Problems analysis by the female rice farmers of Fatick

Plowing for seed production

Paddy field for seed production by row planting

Observation Tour of the Minister of agriculture, and hydraulics (the then Minister) at the seed production site

Observation Tour in the village of Ndiémou by the Governor of Fatick

Training of the technicians of Fatick at ADRAO

Observation tour of the seed production in Ndjwar by the actors concerned in the region of Fatick

Dike against the salinization (Region of Fatick)

Problems Analysis by the agents/technicians of the region of Ziguinchor

Paddy field for the seed production of an NGO in the region of Ziguinchor

Female rice farmers of the region of Ziguinchor

Practice of simple telemeter for the agricultural statistical survey

Practice of paddy yield measurement

Presentation of the results of paddy fields measurement by the statistic agents

Measure of the pH in the azola experiment paddy fields

Azola experiment paddy fields

SUMMARY

1. INTRODUCTION

The rice consumption of Senegal sharply increased in the 1970s. On a per capita basis, rice consumption exceeded that of millet, which was the traditional staple food of the Senegalese, in the 1980s. An average Senegalese consumed 74 kg of rice a year in 2003. Senegal is currently one of the largest rice consumers in West Africa. It is noted, however, that the self-sufficiency rate of rice is as low as 20% of the total demand. Improvement of food security is the most important issue in the country today.

The Government of Senegal (GOS) requested that the Government of Japan (GOJ) extend technical cooperation for preparation of a nation-wide master plan for the rice sector of Senegal. In response to the request by the GOS, the GOJ, through Japan International Cooperation Agency (JICA) agreed with GOS through the Ministry of Agriculture and Hydraulics (MOAH) to carry out the "Study on the Reorganization of the Production of Rice in Senegal" (hereinafter referred to as "the Study"). The Study was commenced in November 2004 and prepared the master plan and the action plan for the major rice producing regions, namely Saint Louis, Matam, Kolda, Ziguinchor and Fatick at completion of the field work in Senegal in July 2006.

Within the framework of the Study, technical transfer programs were also conducted in seven technical fields for capacity building of government staff and rice producers from June 2005 to February 2006.

The Draft Final Report presents all the results of the Study including the background of the Study, the current positions of the rice sector of Senegal, the master plan, the action plan and the performance of the technical transfer programs.

2. BACKGROUND OF THE STUDY

The national territory of Senegal is about 197,000 km² in area, of which, 81,500 km² or 40% is arable land. (FAO, 2002). On the basis of the 1988 population census, the national population was estimated to grow to 10,050,000 in 2004 at the annual growth rate of 2.6 %.

The gross domestic product (GDP) of Senegal was 6.5 billion US dollars in total (World Bank, 2003). The agricultural sector's share in GDP was as high as 21.5 % in 1983 but has been declining, reaching levels of 19.0 % in 1993 and then 15.0 % in 2002. However, the agricultural sector is still a mainstay of the national economy and provided livelihood to 74 % of the total population in 2004.

The cereal production of Senegal has been stagnant since 1995, while cereal imports steadily increased to 800,000 tons in 1998 and one million tons in 2001. As a result, the self-sufficiency ratio of cereals dropped from 58% in 1992 to 40% in 2002. Food security is currently the utmost important issue for the GOS. In June 2004, the GOS adopted the Agricultural Framework Act (LOASP), i.e. the basic principles for agricultural development.

The GOS has formulated various development projects for the agricultural sector in addition to its Annual Agricultural Program for short and middle term periods. Various international aid agencies and bilateral donors have provided funds for the project implementation. The World Bank leads the support for preparing favorable surroundings and strengthening the competitiveness and capacities of the private sector in face of market liberalization. The

European Union (EU) provides assistance for improving the government's capacity in international trade. These assistances can become a new type of cooperation in the era of globalization.

In general, donors' assistance in the agricultural sector can be categorized by their broader objectives such as improving the food security, reducing poverty, increasing the income of the rural population, and improving social services in the rural areas. Donors' assistance in the agricultural sector varies from one region to another. In the Senegal River valley, development of irrigation schemes is a major intervention. In Fatick, the interventions are concentrated in the areas of food security, poverty reduction, and the restoration of soils degraded by salinization. In Casamance, where a 20-year long conflict has recently been settled, donors are providing various forms of assistance under the framework of post-conflict reconstruction, such as increasing food production, rebuilding agricultural activities, and environmental protection and restoration such as construction of dykes to combat salinization.

3. RICE SECTOR OF SENEGAL

(1) Rice Distribution

Senegal is highly dependent upon imported rice, which amounts to 80% of the total consumption. It is noted that over 90% of the rice that is imported is broken rice. Senegal is the largest importer of broken rice in the international rice trade. According to the FAO statistics, Senegal imported 22% of the internationally traded rice in 2002. During the last decade, the amount of rice imported has increased from 400,000 ton to 600,000 ton - 700,000 ton. In 2004, however, due to price escalation, the amount of rice imported by Senegal was significantly reduced from 660,000 ton in previous three years (2001-2003) to 510,000 ton. Recognizing the importance of national food security, the GOS places the highest priority on the earliest possible achievement of self-sufficiency in rice.

Paddy production in Senegal from 1996 to 2004 amounted to 213,900 ton on average. With milling recovery rate of 65%, 139,000ton of rice is obtained from 213,900 ton of paddy, of which 85,000 ton of rice were produced in Saint Louis and Matam. Rice produced in Fatick and Casamance is consumed within the regions. On the other hand, farmers in Saint Louis allocate two-thirds of total paddy harvested to loan repayment and cash generation, while the remaining paddy is reserved for home consumption. This means that some 55,000 ton of rice is for distribution in the domestic markets.

The rice trade in Saint Louis starts in December when paddy harvesting is in full swing and becomes most active at the end of February, i.e. the validity period of the CNCAS loan. Most local rice is purchased by traders by June or July and sold at retail shops by October. From November to January, local rice is rarely available in domestic markets.

Middlemen in Saint Louis often collect paddy from local producers after receiving firm orders from rice traders in Dakar, Kaolack, Doubel and other urban centers. Paddy grains purchased are processed at the rice mills within the Saint Louis region. Milled rice is transported to destinations such as Kaolack and Doubel and locally consumed. The rest is re-distributed to retailers in other regions, especially Casamance and Tambacunda through their distribution channels.

(2) Rice Production

Saint Louis and Matam, which are situated along the Senegal River, are the primary rice

producing zones of Senegal. The average annual rainfall in these areas is limited to 300 mm. In recent years, the regional paddy production has increased and amounts to 72% of the national production. Under irrigated condition, the regions achieve high paddy yield, i.e. over 5 ton/ha on average. The farming system is characterized by intensive use of farm inputs. Herbicides are commonly used. Farm machinery is often hired by farmers for land preparation and harvesting.

Traditional rice farming prevails in Casamance, i.e. Kolda and Ziguinchor. With rather higher rainfalls, i.e. 1,000 mm per annum, both regions together produce 27% of the national paddy production. The average paddy yield ranges between 1 ton/ha and 2 ton/ha. Farmers in Ziguinchor are generally conservative regarding modern farming techniques such as the use of chemical fertilizers, pesticides and even farm machinery. Rice farming in Fatick is practiced to a limited extent mainly by groups of women. Traditional varieties with high drought tolerance are sown selectively in low-lying land along the main rivers and their tributaries. Due to limited (600 mm a year) and erratic rainfall, the average paddy yield varies considerably, but is usually around 1 ton/ha. Farm inputs are rarely used. Farming is done manually with traditional implements. Problem soils with either high salinity or acidity are frequently observed. Paddy fields are often abandoned/fallow due to high salinity. The regional paddy production is limited to 1 % of the national total.

The Senegal River Valley will continue playing a leading role for improvement of the self-sufficiency rate of rice for years to come. In the Valley, basic infrastructure, such as irrigation facilities, major roads and rice milling plants are available as a result of the huge investments made in the past. Additionally, by capitalizing on the suitable soils for agriculture and the abundant water resources, very high yields have been realized by the experienced farmers supported by the various services, including technical extension, input supply, agro-machinery operation, credit, etc. Further increase in rice production could be attained here more easily than in the other areas in the country.

Paddy production in the Valley is stagnant caused by disincentive of the producers to rice production due to low profit, which partly accounts for the increase in the abandoned/fallow paddy area and the change in crops. The cause of the low profit is the relatively high cost of production in comparison with the gross benefit and/or lower actual yield level than the potential. High production cost results from the high cost of inputs, irrigation, harvesting and transportation.

Lower yield is attributed to the inadequate farm management and inadequate maintenance of the facilities. Other constraints to attaining higher yield include the limited use of inputs due to the limited amount of credit that is provided by CNCAS as well as failure in the timely application of inputs according to a cropping calendar due to the delay in arrival of inputs to the supplier. Abandoned/fallow paddy fields are caused by saline/alkaline hazards induced by the low level of irrigation development, especially the lack of drainage facilities and inadequate leveling, and break down of irrigation pumps due to inadequate maintenance. This is particularly true in the private irrigation schemes (PIP) and the village irrigation schemes (PIV).

(3) Post-harvesting and Handling

Medium to large scale rice mills have been installed in the Senegal River Valley. Those mills are only operated for five months a year from December to May. The milling capacity of the currently operational 15 mills is estimated to be 75,000 ton for the five months in total, while the annual paddy production of the valley amounts to 150,000 ton to 170,000 ton. Therefore, the milling capacity is basically short during the peak period from January to

February when producers rush to repay the CNCAS loans. On the other hand, the rice mills are idle for the remaining seven months a year. The annual processing capacity of the existing mills can be expanded by promotion of paddy storage installations. The existing mills would be able to process 180,000 ton of paddy through year-round operation.

Only a few existing rice mill factories are equipped with paddy cleaners, sifters and/or grain sorters. Sorting work is often done manually after milling. Many rice mills are obsolete which lowers the work efficiency. There is excessive competition among rice millers as the total rice milling capacity in the Valley exceeds the paddy production. Rice mill operators are normally seasonal workers. Therefore, they can not accumulate operators' skills.

Inadequate post-harvest handling, including delay in threshing after harvest, the delay in rice mill after threshing, inadequate storage, etc. often makes harvested paddy excessively dry, which brings about a decrease in the milling recovery rate and an increase in broken rice content.

In the rural areas, small rice mills are widely used. There are 463 units in the Senegal River Valley, of which 351 units are operational and geographically concentrated, i.e. 232 units within the Dagana Department of the Saint Louis Region.

(4) Rice Marketing and Consumers' Preference

Local rice faces a difficulty in rice marketing due to limited and irregular supply in comparison with imported rice. Imported rice an advantage in that it keeps regular marketing channels open by its stable supply throughout the year. Expansion of marketing channels for local rice should be promoted more strategically. In this regard, it is crucial to determine consumers' preferences and promote the advantages of local rice.

Within the framework of the Study, a marketing survey was carried out. The Study interviewed 410 consumers about their preferences among 12 samples of rice available in the local markets and their reasons. The respondents were randomly selected among consumers in Dakar and its vicinity, Rufisque, Fatick, Saint Louis and producers cum consumers in the Valley. The survey results are summarized below.

1) Senegalese consumers generally prefer broken rice over whole grain rice. However, consumers make the selection between broken rice and whole grain rice by recipe.
2) Consumers' preference was different between urban and rural areas. Consumers in urban areas pay more attention to the cleanliness of the grains and prefer rice without impurities or bran and value uniformity in the size of broken rice.
3) Consumers in the Senegal River Valley prefer local rice over imported rice. The main reasons are the superior qualities of local rice such as the good aroma after it's milled, freshness and food safety. In addition, consumers appreciate Sahel varieties because of their greater swelling characteristics when cooked.
4) The price of the rice is less important in selection. Consumers generally understand that the cheaper the price is, the worse the quality is.

The market information is regularly collected on a weekly basis under the responsibility of the Ministry of Commerce, but the collected information has not been delivered and utilized fully. For example, information on the consumers' taste in rice has not been transmitted to rice millers and producers. Another problem is the lack of information on paddy harvesting dates, which makes it difficult for the buyer of paddy to access to the producers in a timely manner.

4. THE MASTER PLAN

(1) Objectives of the Master Plan

The objectives for the reorganization of the rice sector in Senegal are defined addressing the major problems identified above.

- To provide a better rice production environment which will allow paddy farmers to obtain more income and sustain paddy cultivation
- To produce higher quality domestic rice corresponding to the consumers' needs.
- To prepare various conditions to assure the smooth marketing of domestic rice.

The above objectives are mutually related. An integrated approach is a must for the successful reorganization of the rice sector.

(2) Developmental Framework

The per capita consumption of rice in Senegal has increased at the pace of 1.56 kg per annum since 1990s and reached 74 kg per annum in 2003. There are prospects for further increase in the years to come. However, an in-depth study will be required to forecast the per capita consumption in 2015. The study to be required will include analyses of the domestic rice market conditions as governed by the production prospects of other grain crops, increased rice consumption caused by urbanization, change of food habits in rural areas, etc. and projection of how the international rice market is affected by the demand-supply balance of the major rice producing countries, fluctuation of prices and their impact on retail prices in the domestic markets.

The Study defined the present per capita consumption of 74 kg as the minimum line of the development target to be sustained under the Master Plan. The population projection on the basis of 1992 census predicts that the national population will reach 13.71 million. This means that the total rice demand in 2015 is to be 1,000,000 ton.

The rice production sector is expected to supply 400,000 ton of milled rice to the domestic markets in 2015, while imported rice will not be increased from the present amount, i.e. 600,000 ton, so as not to allocate further foreign currency to rice import. On the basis of the 2015 population and the per capita consumption, i.e. 74 kg, the expected rice supply in 2015 is targeted as presented below.

Rice yearly Supply Estimations

Unit: 1,000ton

Area	2005		2015	
	Domestic rice	Imported rice	Domestic rice	Imported rice
Urban	50	650	100	400
Rural	100		300	200
Total	150	650	400	600
	800		1,000	

Source: JICA Study Team

Current annual domestic rice production was some 150,000 ton/yr in the last five years. The attainment of 400,000 ton/yr of domestic rice production is a big challenge

(3) Development Scenario

Urgent Support for Rice Millers

A wide range of development efforts will be required to increase the production of local rice as a basic condition for improvement of the self-sufficiency rate of rice toward 2015. Rice producers in the Valley are currently attracted by vegetable production with high profits and stable marketing channels. Under such circumstances, the most crucial issue for the rice sector of Senegal is to prove and demonstrate profitability and marketability of local rice to motivate producers. In this regard, the short-term strategy should be centered on the earliest commencement of the marketing promotion program of local rice under the Master Plan.

The development scenario toward 2015 was drawn with hope and expectation to create a new business environment around the rice sector of Senegal under the concept of a market economy. Rice millers are key actors who will be able to add more value to local rice by immediate improvement of their rice milling technologies. Under the Master Plan, the millers will be encouraged by the provision of several supports. Once they generate reasonable profits from the rice business, they will become more positive to expand their involvement in the rice business. Currently, their income is only from the fixed milling charges paid by either producers or middlemen. In the future, they will embark on more activities such as direct purchase of dry paddy from producers, rice milling and wholesaling of milled rice. Rice millers, as entrepreneurs, will be keen to obtain market information including consumers' preference in rice quality so as to set up and manage their business plans, including further investment.

Supply of High Quality Rice to Dakar and Other Urban Areas

Market promotion will precede all the activities proposed under the Master Plan. The priority will be attached to supply of 100,000 ton of quality rice to the consumers in Dakar and other urban areas. Local rice will penetrate into the domestic markets because of its good reputation due to its advantages such as scent, freshness and food safety. Local rice will be fully appreciated by urban consumers.

To realize the above-mentioned goals, rice millers will have to make the further investments necessary for improvement of the existing milling plants and other additional facilities including cleaners, shifters and separators. Paddy storage will also have to be installed to extend the operation period of the mills from five months to 12 months. All the requirements will be carefully justified from a cost and benefit analysis. Consultation services will be extended to the rice millers.

Urban consumers are keen to see guarantees for the quality of the local rice. The quality standard of milled rice will be studied, authorized and applied by the governmental agencies concerned. Rice quality, including origin, variety, harvested date, broken rice content, etc. will be indicated on the label of rice bags. Various marketing channels will be operated by several stakeholders. Some consumer groups will directly place orders for their preferred rice to either producers or rice millers and make purchases in the future.

Strengthened Government Support

Market promotion in Dakar and urban areas will prove the high value of local rice. Rice producers will convince themselves of the profitability and marketability of local rice. They will be motivated to produce and sell more paddy to rice millers at higher prices. The government support required for the rice sector will be strengthened.

Rice research under the Master Plan will establish appropriate rice farming systems suitable

for local conditions in the Senegal River Valley. The research will focus on cost saving, high yields and double cropping techniques in order to increase the direct benefits from rice farming. Crop diversification with vegetables will be promoted among the rice producers to a certain extent. Cropping intensity of rice will be sustained so as to ensure the development framework of the Master Plan, i.e. 400,000 ton of rice production as a whole.

The irrigation development will prioritize the rehabilitation of the existing irrigation potential at to reach the maximum level. The government's effort will be made to optimize the cost implication for rehabilitation and maximize the number of beneficiaries. Causes of low cropping intensity and abandonment of the irrigation facilities will be determined in detail. Around the concept of participatory development, the government will optimize the construction plans after clear demarcation of responsibilities between the government and the farmers.

Services providers of farm machinery will also be supported in order to ensure working capacity and quality of their services are sufficient to meet the requirements of rice producers. Under the master plan, the government will organize a short-term field research for establishment of optimum mechanized rice farming systems, including selection of suitable machinery and implements for land preparation and harvesting. Capacity building programs will be provided to the service providers and their operators.

The shortage of combine harvesters causes delay of harvesting finally resulting in a low milling recover rate and high broken rice content. Reapers will be developed in Senegal and promoted as an alternative to combine harvesters. Rice millers will purchase paddy of good quality, i.e. optimum moisture content and fewer impurities at higher prices. Producers will pay more attention to quality control of paddy in the future.

The CNCAS agricultural credit subsidized by the government is essential support for rice producers. In the future, interventions of micro-finance institutes will supplement the activities of CNCAS by employing the local work experiences of micro-finance institutes. In addition, medium to long term credit will also be introduced to enable credit users to procure fixed assets such as farm machinery, storage facilities, rice mills, etc. Delay of farm input supply will be solved by introduction of open tender in selection of farm input suppliers.

Food Security and Poverty Reduction in Rural Areas

Rice shortage is observed even in the rice producing regions, especially in the period of July to August. Paddy production will be promoted to increase the food self-sufficiency rate in the rural areas too. The Master Plan targets the supply of 300,000 ton of rice or 60% of the total rice demand in the rural areas, i.e. 500,000 ton by 2015. Food security in the rice producing regions will be significantly improved. In accordance with the expansion of local rice demand, rice that is produced in the rural areas will be properly processed and supplied to urban areas as a cash crop. To realize this scenario, installation of additional rice mills is a prerequisite.

Traditional rice farming is widely practiced in Casamance. Because of the nature of rain fed farming, grain yields are strongly affected by rainfall patterns and amounts in the relevant years. Productivity will be improved to a certain extent by promoting possible measures, such as improvement of seed quality, selection of optimum farming practices, distribution of improved implements, soil management within controlled areas preventing salt water intrusion, new farm pounds and water harvesting techniques, etc. Rice production in the Anambe irrigation scheme is also to be focused on.

Rice demand is low in Groundnut Basin and the Eastern Area, where millet is the main cereal.

However, rice production by women's groups in Natick will be supported by minimum but effective services. The technical assistance will be initiated with seed propagation.

Integrated Approaches

The reorganization of the rice sector will be promoted under coordination of the Ministry of Agriculture and Hydraulics. At the level of the Cabinet of the Ministry a new committee will be organized in order to coordinate and monitor all the activities under the Master Plan. The agencies concerned will be requested to join the forum to exchange their views for development of the rice sector of Senegal for achievement of the targets of the Master Plan.

(4) The Master Plan

The Master Plan has been formulated in accordance with the strategies derived from the problem structure analysis. There are 11programs/projects as shown in the next page, of which, seven are for the Valley (Saint Louis and Matam Regions).

Master Plan Programs

Title of program	Corresponding Development Strategies
Senegal River Valley (Saint Louis and Matam)	
1. Rice Productivity Improvement Program	1.2 Research, development and extension of the technologies for the reduction of production costs, increased yield, and increase in cropping intensity including double cropping
2. Mechanized Rice Farming System Improvement Program	1.3 Improvement of the efficiency of the agro-machinery work
3. Irrigation Development Program	1.1 Improvement of irrigation and drainage facilities and capacity development of water users' associations (especially VIP and PIP)
4. Rice Quality Improvement Program	2.1 Improvement of rice quality through the renovation and improvement of rice mill facilities 2.2 Reduction of post-harvest losses, improvement of milling recovery rate and extension of the rice mill operation period by augmentation of paddy storage capacity 2.3 Development and extension of a timely harvest and threshing work system 2.4 Improvement of the rice pick-up system 2.5 Establishment of quality standards for paddy and milled rice 2.6 Establishment and dissemination of the rules for the indication of rice quality
5. Program for Improvement of Rice Distribution	3.1 Monitoring of imported rice (quality, quantity and price) and stock 3.2 Monitoring of rice market prices at major consumption places 3.3 Monitoring of the quality of marketed rice and consumers' needs 4.1 Improvement of the market road connecting the trunk roads with rice production areas 4.2 Construction of bridges crossing seasonal rivers 4.3 Open information on harvesting time of each production area
6. Program for improving credit access for rice production and marketing	1.5 Assurance of the timely supply of inputs 1.6 Improvement of the agricultural credit system 2.1 Improvement of rice quality through the renovation and improvement of rice milling facilities 2.2 Reduction of post-harvest losses, improvement of the milling recovery rate and extension of the rice milling operation period by augmentation of paddy storage capacity 1.3 Improvement of the efficiency of the agro-machinery work
7. Environmental Management Program in Irrigation Development	7.1 Environmental Management System Development Project in the Lower and Middle reaches of the Senegal River Valley
Traditional rice production areas (Kolda, Ziguinchor and Fatick Regions)	
8. Seed production and distribution program	・Capacity building of the seed production system and increase production
9. Support for the rainfed rice farmers	・Stabilization and improvement of rainfed rice yield ・Collaboration and support for the on-going salinity hazard prevention and restoration of paddy fields
10.Rehabilitation of irrigation areas and capacity development of farmers' groups in the Anambé basin	・Extension of irrigated rice farming under the established natural and social conditions. ・Formation of a nucleus for the rural development of the Casamance
Construction of the Master Plan Implementation Structure	
11.Establishment and operation of a committee for the promotion of the reorganization of rice production in Senegal	・Coordination among stakeholders of the rice sector and institutional development

Three other programs/projects are for the traditional rice cultivation areas of Kolda,

Ziguinchor and Fatick Regions. Rice production in those areas is susceptible to the climactic conditions and constrained by the salinity/alkalinity and acidity of the soils and water. Yield increase under such conditions is a big challenge. Social issues such as gender and development are also to be addressed. In consideration of such current conditions, only those projects which need urgent measures are to be undertaken. Another issue is the program to provide a framework for the sustainable and efficient implementation of the master plan.

Programs for the Senegal River Valley (Saint Louis and Matam)

1) Rice Productivity Improvement Program

This program aims at improvement of rice farmers' income through development of the low cost rice farming technologies and development of the high profit making rice farming technologies. Rice research in the Valley is to be carried out by ISRA, ADRAO and SAED. Under the Master Plan, these organizations will further keep a close linkage to promote agricultural extension. Possible low cost rice farming technologies include reduction of seeding amount through line seeding or transplanting, reduction of fertilizer application amount through improved application techniques, reduction of herbicide use amount through leveling, etc. Possible high profit making rice farming technologies are grain filling rate improvement and grain weight increase through timely fertilizer application, paddy quality improvement through organized harvesting, threshing and storage, production increase through introduction of double cropping of rice, etc. The Program will assess technical feasibility and economic viability of the possible technologies and prioritization for development, taking into consideration opinions of leading farmers and extension workers.

2) Mechanized Rice Farming System Improvement Program

Land preparation (plowing and harrowing) and harvesting are broadly practiced with aid of farm machinery in the Valley in order to overcome the shortage of farm labor. This Program aims at establishment and extension of appropriate farm mechanization from both the cost-saving and yield improvement points of view. The Program is to be initiated by capacity building of government staff, including systematic transfer of knowledge and professional skills, standardization of land preparation for both directly sown and transplanted rice, development and introduction of rice reapers, improvement of service quality by the private service providers, etc. Firstly, the capacity building programs will be provided to SAED, SODAGRI and group leaders of the rice producers. Secondly, the field experiments will be carried out at the representative sites of the Valley which are to be selected on the basis of soil types. Land preparation practices suitable for the Valley will be selected by comparing among several combinations of tractors and implements taking soil characteristics into consideration.

Standardization of mechanized harvesting practices is another key issue. Its work efficiency will be enhanced by a combination of rice reapers and ASI threshers. ISRA, SAED and ADRAO have made every effort to develop rice reapers suitable for the Valley. Under the Program, the existing models of reapers used in the world will be collected and compared on site. Extension services regarding reapers will also be envisaged under the Program.

3) Irrigation Development Program

This program targets irrigation schemes where the actual irrigation rate is decreasing (the rate of actually irrigated area within the developed zone). It also deals with the rehabilitation and partial extension of existing schemes. Target sites include all types of irrigation schemes that are found in the valley, that is, large-scale (GAs), medium-scale (AIs), and small-scale

irrigation areas (PIV and PIPs). Small-scale irrigation areas are generally badly developed and their abandonment rate is very high. At present, PIVs and PIPs represent 2,725 schemes covering a total surface area of 63,983 ha.

SAED is in charge of giving concerned farmers a sense of responsibility so that they can cover the costs needed for operation and maintenance of irrigation infrastructures. So, it is necessary to clearly specify responsibilities of governmental agencies and producers and then revise all concerned rules and regulations. The program also intends to build SAED staff's capacities relating to participatory development. The staff in question will form the basic unit in charge of implementing the program. Furthermore, it is necessary to build the capacities of hydraulic unions and individual farmers as far as organisation and management are concerned so that irrigated rice farming will become sustainable in the rehabilitated schemes. Such capacity building has to be carried out by the program. The program aims at completely developing irrigation.

4) Rice quality improvement program

The purpose of this program is to establish milling techniques that enable local rice to be competitive with imported rice in terms of quality and price and popularize those techniques. In other terms, the program focuses on the creation of an environment where customers can buy high quality local rice at a good price on the one hand, and rice millers can carry out long-term economic activities generating good profit on the other. Regarding milled rice quality, it is necessary to establish an appropriate post harvest management system. This program will also deal with technology transfer. After selecting farmers' groups, the program will show the positive effect of improved management through timely harvest and use of storage facilities to prevent paddy from drying after being harvested. The use of techniques preventing paddy from drying excessively will result in a better recovery rate and better milled rice quality. Then, rice millers will be trained in milling techniques. They will enjoy material support to improve their facilities (distribution of sorters).

Quality standards for paddy (NS03-28) and milled rice (NS-03-29) were established in June 1996 in Senegal. The Ministry of Commerce took control of inspection measures regarding imported rice by enforcing both the above mentioned standards but they are not applied to local rice marketed quantities, which are very limited. Milled rice standards distinguish only three categories (head rice, mixed rice, and broken rice) and indicate the specifications of each category. The findings of this Study have revealed that consumers in urban areas request additional information (rice chemical components, nutritive values, consumption deadlines, etc.). Current standards cannot meet those needs expressed by urban consumers.

The program will re-examine standards in force and make recommendations for their improvement. At the same time, new criteria will be established to meet consumers' needs including information on the product itself. The program will also provide assistance to disseminate those particular criteria and have them enforced.

5) Rice marketing improvement program

Improvement of the rice self-sufficiency rate necessitates a better environment in which local rice can be distributed easily within the national market and be at the disposal of all consumers, even ordinary ones. In this respect, it is important for all concerned parties (producers, rice millers, and traders) to have access to the right information on the rice sector. On the one hand, producers seek information on consumers' needs, including retail price, required quality, etc. On the other hand, rice millers and traders need information from production sites such as available rice varieties, harvest periods, expected production, etc. Providing good information

on paddy production and rice marketing to all actors in the rice sector will help boost their activities and thus increase the value added of the whole sector.

Furthermore, it is important for the Senegalese Government to collect and maintain all information on the rice sector (from rice production to marketing) with a view to making political decisions or preparing a legal framework in order to promote food security. The Ministry of Agriculture and Hydraulics has been in charge of food security since February 2006. So, it would be appropriate to suggest that all information on the rice sector should be centralized.

ONRS, whose secretariat is located in DAPS, has been collecting, analyzing, and disseminating information on rice within and outside of Senegal for many years. However, it will stop its activities at the end of the year 2006. This program enables the continuation of activities carried out by ONRS. It also contributes to facilitating information exchange with SAED (information on varieties, harvest periods, and expected productions) and ARM (information on rice export and import, retail prices, and stock volumes). These exchanges enable the creation of a centralized rice information system within a short period of time.

Some isolated areas located along the Senegal River have been facing an access problem. It is necessary to improve that situation so as to facilitate rice marketing and transport into and out of those isolated sites. The construction of access roads connecting the national road to existing irrigation schemes could be an answer to that problem. That construction must be a sustainable rehabilitation of rural tracks the operation and maintenance of which must be entrusted to a specific body.

6) Agricultural Credit Support Program

This program is to be implemented to reinforce the agricultural financial sector in favor of producers, rice millers, and agricultural machinery service providers. Rice production increase necessitates an appropriate input supply to producers. In this respect, it is advisable that a microfinance sector should be developed to complete the existing agricultural credit system which is currently almost monopolized by CNCAS. First, microfinance institutions must be grouped together in an organisation recognized by the official agricultural credit system. Secondly, import formalities of agricultural inputs must be simplified; there must also be a local financial service for producers and improvement of the repayment rate must be achieved. MEC Delta, located in the Saint-Louis region, is an example of the success of this type of agricultural credit. A new type of financial service answering producers' needs can be developed and promoted by making good use of lessons learnt and know-how acquired by MEC Delta.

Regarding an irrigation development program, high priority zones (small scale irrigation areas) are located in the middle and upper valley of the Senegal River. They are under the administrative authority of Podor prefecture, the Saint-Louis region, and in Matam region. However, few micro-finance institutions deal with agricultural credit in those areas. Even CNCAS has no office there. In this context, it would be efficient for this micro-finance program to cooperate with the irrigation development program.

Extension of credit services to the private sector is also important. The creation of a financial service supporting paddy purchase, operation and maintenance activities and procurement of new sorters will significantly contribute to improving movement of high quality local rice produced by rice millers with a limited amount of capital.

Furthermore, agricultural machinery service providers need a financial system enabling them to renew and get additional agricultural machinery. This program should contribute to the extension of long-term agricultural credit to the private sector that has been trying to get

agricultural equipment such as machinery, storage facilities, rice mills, etc. Moreover, a foundation for local rice consumption was created to encourage purchase of large quantities of milled rice and installation of milled rice storage facilities for consumers' organizations.

7) Program for Environmental Management relating to Irrigation Development

The salt content of the Senegal River Valley soil is generally high and salt naturally appears easily through irrigation development. Sea water intrusion into the River has been controlled since the construction of Diam dam and salt accumulation is well controlled. However, species of aquatic plants grow and multiply quickly as the River water salinization decreases. Consequently, irrigation canals are invaded and cottage-type fishery is disturbed by those plants. Moreover, since rice has been produced for many years, it is feared that the quality of the Senegal River Valley will change a great deal in the future because of large quantities of agricultural inputs used for production. This program includes a management system that allows the environmental changes of the Senegal River Valley that result from irrigation development to be monitored. Measurements required for environmental conservation are specified by the aforementioned system and are to be carried out continuously.

Programs of the Master Plan for the Regions Producing Traditional Rice

1) Support Program for the Production of Seeds

This program is to be implemented, taking into account the lessons and experiences drawn from the technology transfer programs within the same framework, carried out during the present study in the regions of Kolda, Ziguinchor (Casamance) and Fatick.

The present program produces high quality seeds and distributes them in the target areas of Fatick and Casamance where people practice traditional rice growing. In the first phase, the following will be examined and realized : a suitable system for the production and distribution of rice seed, the clarification of the responsibilities of actors concerned (public organs, NGOs, farmers organizations, etc.), the elaboration of the expansion plan for the seed production facilities and the plan for their management and maintenance, the training of specialists for the production and control of seed and also the training of farmers producing seed. Then, the program continues to install seed production facilities, ensuring their good operation and makes the production and distribution of seed progress in the regions.

2) Support Program for the Production of Rainfed Paddy Cultivation

This program targets Casamance (the regions of Ziguinchor and Kolda) and the region of Fatick where growing rainfed rice is widely practiced in a traditional way. This program aims at improving rice growing yields as much as possible by valuing the results and the activities of the projects/programs already realized and/or on going.

Using the rainfall of over 1,000 mm and the plentiful water of the river Casamance, this rainfed cultivation is the main activity of the people of Casamance. The harvested area is of more than 50,000 ha and exceeds that of the Senegal river valley, in spite of its low yield of about one ton/ha. Since the severe drought of 1968, the paddy fields of the region have been affected by problems of salinity and acidity, which consequently caused a generalized degradation of the soils in the region. As a consequence, the rice growing areas have continued to decrease since then.

In the region of Fatick where the rainfall is limited to 600 mm, rice growing is practiced in the valleys of the Sine-Saloum River and the bas-fonds of its tributaries. There, rice is the second most important foodstuff after millet. However, the harvest area is limited to only 1,000 ha.

Rice growing is considered to be an agricultural work for women and in most of cases, they work in groups.

Due to the deforestation in the upstream area of the river, the expansion of crop fields has not included rice growing for a long time, and because of the reduced rainfall, the area was affected by the intrusion of sea water in the river; this lead to the generalization of the problems of salinity and/or acidity in the rice growing areas. Now, several farmlands formerly used for rice growing are abandoned.

The present program aims at establishing a suitable rainfed rice growing system in the target regions by valuing the results of the past and present projects and programs. For example, the following are concrete activities: Proposing rational measures for the prevention of acidity/salinity, introduction of salt tolerant varieties, development of simple agricultural tools, leveling of paddy fields, etc.

3) Program for the rehabilitation of the irrigation schemes of the Anambé basin and the development of farmers' cooperatives

The present program contributes to the improvement of rice productivity in the Anambé basin, in the region of Kolda and consists of two elements: the rehabilitation of part of the irrigation schemes and the development of farmers' cooperatives. In the first phase, a development study was carried out in order to select the constituents of the project to be realized, which will bring effective and sustainable development.

The program has undertaken a general study and an analysis of the current situation of the irrigation program in the Anambé basin. Surveys have been carried out properly on the following issues: the natural and socio-cultural conditions, the agro-pastoral situation, the hydraulic resources, the irrigation and drainage facilities, the rice growing practice as a whole, the post-harvest activities and the processing of farm products, the storage infrastructures, the provision of farm machinery services, the marketing of farm products and an inventory survey of existing facilities, etc. The program also carried out the following activities: The analysis of the causes inhibiting development, the inspection of the development potential, the determination of the relevant organization for the execution of the program, the elaboration of the organizational and human resources training programs, the planning of the rehabilitation projects for the developments, the economic and financial analyses, etc.

There are already several on going projects in the Anambé basin, such as PADERBA [a support for the producers (women) of the region] financed by the African Development Bank (ADB) and a program for expansion of the cultivated areas by the Islamic Development Bank (IsDB) and it is necessary to harmonize the present program with these precursor projects and programs.

Implementation organization for the Master plan

For smooth and proper management of the Master Plan, it is proposed to establish a new Promotion Committee for the Reorganization of the Production of Rice in Senegal in MAHRSA during the second half 2006.

5. ACTION PLAN

The Master Plan consists of 19 programs as presented in following table. Eleven projects were selected as priority programs and projects from the viewpoint of their urgent necessity.

An Action Plan was preprared for each of the 11 projects.

Action Plan List

Master Plan Program	Program・Project	Action Plan Number
Senegal River Valley (St. Louis Region, Matam Region)		
1. Rice Productivity Improvement Program	1.1 Adaptive Research and Extension Project for Rice Productivity Enhancement	01
	1.2 Project for the Preventing Salt Accumulation Problem in the Delta	
2. Mechanized Rice Farming System Improvement Program	2.1 Research and Extension Program for Effective Land Preparation for Rice	02
	2.2 Rice Reaper Development and Extension Project	03
3. Irrigation Development Program	3.1 Small-scale Irrigation (PIV and PIP) Rehabilitation and Extension Program	04
	3.2 Large-scale Irrigation Area (GA) and Middle-scale Irrigation Area (AI) Development Program	
4. Rice Quality Improvement Program	4.1 Rice Processing Technology Improvement and Extension Program	05
	4.2 Rice Quality Standard Extension Program	
5. Program for Improvement of Rice Distribution	5.1 Program for support of establishment of a rice marketing information system	06
	5.2 Farm Village Access Improvement Program	
6. Program of improving credit access for rice production and marketing	6.1 Program to support the establishment of micro-finance institutions for rice producers	07
	6.2 Financial Support Program for Rice Millers	
	6.3 Financial Support Program for Agricultural Machinery leasing	
7. Environmental Management Program in Irrigation	7.1 Environmental Management System Development Project in the Lower and Middle reaches of the Senegal River valley	08
Traditional Rice Cultivation Area (Kolda Region, Ziguinchor Region, Fatick Region)		
8. Seed production and Distribution Program	8.1 Seed Production and Distribution Support Program in Casamance	
	8.2 Seed Production and Distribution Support Program in the Fatick	
9. Rainfed Rice Production Support Program	9.1 Rice Production Support Project in the Casamance Region	09
	9.2 Rice Production Support Project in the Fatick Region	10
10. Anambe Irrigation Development Program	10.1 Anambe Irrigation Rice Production Promotion Project	11
	10.2 Anambe Farmers' Cooperative Support Program	
Election of the Organization for Enforcement of Master Plan		
11. Establishment and Management of a Promotion Committee for the Reorganization of the Production of Rice in Senegal		

6. TECHNOLOGY TRANSFER PROGRAMS

The Technology Transfer Programs, which constitute a part of the proposed projects/programs in the master plan, have been implemented with the main objective of building the capacity of the government staff who will be the main players of the implementation of the master plan in the future. At the same time the implementation of the Technology Transfer Programs as a development activity will be expected to bring about some benefit. The lessons learned will be reflected in the master plan. Through this process, the master plan and action plans will be matured in consideration of environmental impact, social risks, etc.

The objectives, activities and participating agencies in each program are summarized in the following table.

Objectives and Progress of Technology Transfer Programs

Program	Objectives	Activities	Participating agencies
1. Improvement of rice cultivation techniques for increasing yield	Improvement of rice cultivation techniques of low yielding rice farmers in Dagana and Podor through participative training methods	A series of theoretical guidance presentations on rice cultivation techniques and their demonstration at farmers' fields in four irrigation schemes.	ISRA Saint Louis and SAED
2. Utilization of azolla for reducing production cost of paddy under irrigated field conditions	Trial for examining the effect of azolla on the paddy yield and applied nitrogen recovery rate for pursuing low input paddy cultivation	Field trial at ISRA Fanay station by establishing eight treatments combining four nitrogen levels and azolla inoculation. Yield analysis was conducted.	ISRA Saint Louis
3. Seed propagation by women's groups in Fatick	Seed propagation and motivation to use quality seeds for improving productivity of the traditional rice cultivation	Seed production (12ha) and paddy cultivation at 11 sites with 56 ha in total using certified seeds	DRDR Fatick, ANCAR Fatick, PBA and ISRA Saint Louis
4. Rice Quality Improvement	Examination of the possibility of quality improvement of domestic rice, and transfer of technology of rice processing techniques	Demonstration of rice milling techniques and importance of the management of paddy moisture content on high milling recovery and head rice rate	SAED, Union of Debi-Tiguette
5. Marketing Promotion of Senegalese Rice	Examination of possibility of adding value to high quality domestic rice, and market development	Market development through the sale of 50 tons of domestic rice, and hand over to the farmers of Debi-Tiguette	SAED and Union of Debi-Tiguette
6. Capacity building for rice yield sampling surveys	Transfer of techniques of rice yield survey and methods of data analysis.	Introduction of measurement devices and instruments for rice yield surveys and training of relevant people on the survey by using them	DAPS, DRDR and SDDRs Saint Louis
7. Re-construction of seed propagation system in Casamance	Preservation of foundation seed and technical guidance to farmers on seed production as the basis for the re-construction of the seed production system	Preservation of 17 varieties of seeds and seed production at two sites in Casamance	ISRA, DRDR, SODAGRI, IDECOM, ANCAR, PROCAS, NGOs

7. RECOMMENDATIONS

From a viewpoint of food security, it is apparent that increased rice production is a basic condition for improvement of the self-sufficiency ratio of rice in Senegal. It is recommended to direct more effort to enhance post-harvest and marketing techniques in order to produce and distribute local rice of higher competitiveness against imported rice.

Simultaneously, the government is expected to take the responsibility to create a healthy business environment through the promotion of (1) Encouragement of rice millers, (2) Region-wise development strategy, (3) Crop credit and distribution of farm inputs, (4) Analysis of import taxes and (5) Coordination of the rice sector in the fields of politics and creation of a legal system to achieve the relevant goals.

The Study
On
The Reorganization of the Production of Rice in Senegal

Final Report

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ABBREVIATIONS

ACEP	Alliance de Crédit et d'Epargne pour la Production	Credit and Saving Alliance for Production
AFD	Agence française de développement	French Development Agency
AFDS	Agence du fonds de développement social	Social Development Fund Agency
AI	Aménagement Intermédiare	Intermediate Irrigation Scheme
ANCAR	Agence Nationale de Conseil Agricole et Rural	National Agricultural and Rural Advisory Agency
ARM	Agence de Régulation des Marchés	Market Regulation Agency
ASC	Association Sportive et Culturelle	Sports and Cultural Association
AVD	Association villageoise de Développement	Village Development Association
BCEAO	Banque Centrale des Etats de l'Afrique de l'Ouest	Central Bank of West African States
BHS	Banque de l'Habitat du Sénégal	Housing Bank of Senegal
CDI	Charte du Domaine Irrigué	Irrigation Development Charter
CGIAR	Groupe consultatif pour la recherche agricole internationale	Consultative Group for International Agricultural Research
CIDA	Agence de coopération et de développement international (ACDI)	Canadian International Development Agency
CILSS	Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel	Permanent Inter-State Committee for the Prevention of Drought in the Sahel
CIRAD	Centre de Coopération International en Recherche Agronomique pour le Développement	French Agricultural Research Centre for International Development
CIRIZ	Comité Interprofessionnel du Riz	Inter-professional Committee on Rice
CMS	Crédit Mutuel du Sénégal	Senegal Mutual Credit Bank
CNCAS	Caisse Nationale de Crédit Agricole du Sénégal	National Bank for Agricultural Credit in Senegal
CNCR	Conseil National de Concertation et de Coopération des Ruraux	National Council for Discussion and Cooperation with Farmers
CONCOFIR	Comité National de Concertation sur la Filière Rizicole	National Committee for Discussion on the Rice Sector
CPSP	Caisse de Péréquation et de Stabilisation des Prix	Price Adjustment and Stabilization Agency
CSA	Commissariat à la Sécurité Alimentaire	Food Security Commission
DAP	Diamoniaque de phosphate	Di-ammonium phosphate
DAPS	Direction de l'Analyse, de la Prévision et des Statistiques	Department of Analysis, Prediction and Statistics of MARHSA
DIAPER	Diagnostic Permanent	Permanent Diagnosis
DPDA	Déclaration de Politique de Développement Agricole	Agricultural Development Policy Declaration
DRDR	Direction Régionale du Développment Rural	Regional Department of Rural Development of MARHSA
FAIV	Fonds d'appui aux initiatives villageoise	Village Initiatives Support Fund
FAC	Fonds d'Aide et de Coopération	Assistance and Cooperation Fund
FAO	Organisation des Nations Unies pour l'Alimentation et l'Agriculture	Food and Agriculture Organization of the United Nations
FDL	Fonds de développement local	Local Development Fund
FEPROBA	Fédération des Producteurs du Bassin de l'Anambé	Anambe Basin Producers' Federation
FEWSNET	Réseau d'alerte rapide sur la famine	Famine Early Warning Network
FNPRS	Fédération Nationale des Producteurs de Riz au Sénégal	Senegal National Federation of Rice Producers
FPA	Fédération des Périmètres Autogérés	Federation of Self-management Irrigation Scheme
FPE	Fonds de promotion économique	Economic Promotion Fund
FSP	Fonds de solidarité prioritaire	Prioritized Solidarity Fund
GA	Grand Aménagement	Large-scale Irrigation Scheme
GDP/ PIB	Produit intérieur brut	Gross Domestic Products

GEC	Groupement d'Epargne et de Crédit	Saving and Credit Group
GIE	Groupement d'Intérêt Économique	Economic Interest Group
GMP	Groupe Motopompe	Diesel Water Pump
GPF	Groupement de Promotion Féminine	Women Promotion Group
GPH	Groupement de Professionnels de l'Horticulture	Vegetable Growing Professional Group
GTZ	Deutche Gesellschaft für Technische Zusammenarbeit GmbH (Coopération technique allemande)	German Agency for Technical Cooperation
HIPC	Pays pauvres très endettés (PPTE)	Heavily Indebted Poor Countries
ICS	Industries Chimiques du Sénégal	Chemical Industry of Senegal
IDECOM	Initiative pour le Développement Communautaire Intégré	Integrated Community Development Initiative
IMF	Fonds monétaire international (FMI)	International Monetary Fund
IRRI	Institut International de Recherche Rizicole	International Rice Research Institute
ISE	Institut des Sciences de l'Environnement	Institute of Environmental Sciences
ISN	Institut Sénégalais de Normalisation	Senegal Standarlization Institute
ISRA	Institut Sénégalais de Recherche Agricole	Senegalese Institute for Agricultural Research
ITA	Institut de Technologie Alimentaire	Food Technology Institute
JICA	Agence japonaise de la cooperation internationale	Japan International Cooperation Agency
LOASP	La Loi d' Orientation Agro-Sylvo-pastorale	Agricultural Frame Act
MAHRSA	Ministère de l'Agriculture, de l'Hydraulique Rurale et de la Sécurité Alimentaire	Ministry of Agriculture, Rural Hydraulic and Food Security
MEC	Mutuelle d'Epargne et de Crédit	Saving and Credit Mutual Association
MFIs	Institutions de microfinance (IMF)	Micro Financing Institutions
MECA	Mutuelle d'Epargne et de Crédit des producteurs de l'Anambé	Saving and Credit Mutual Association of Anambe Farmers
MIA	Ministère de l'Industrie et de l'Artisanat	Ministry of Industry and Local Crafts
FNRAA	Fonds national de recherche agricole et agro-alimentaire	National Agricultural and Agro-processing Research Fund (NARF)
NGOs	Organisations Non-Gouvernementales (ONG)	Non-governmental organizations
NPA	Nouvelle Politique Agricole	New Agricultural Policy
OAD	Organisation autonome de la Delta	Autonomous Organization of Delta area
OJT	Formation à l'extérieur	On the Job Training
ONRS	Observatoire National du Riz au Sénégal	National Observatory of Rice in Senegal
PACD	Promotion d'une agriculture compétitive et durable	Promotion of competitive and sustainable agriculture
PADERBA	Projet d'Appui au Développement Rural dans le Bassin de l'Anambé	Rural Development Support Project in the Anambe Basin
PAGERNA	Projet d'auto-promotion et de gestion des resources naturelles au Sine-Saloum	Natural Resource Management Self-Promotion Project
PAMECAS	Programme d'Appui aux Mutuelles d'Epargne et de Crédit du Sénégal	Saving and Credit Mutual Association Support Programme in Senegal
PAPIL	Projet d'appui à la petite irrigation locale	Project To Support Local Small-Scale Irrigation Support
PAOA	Projet d'appui aux opérateurs/trices de l'agroalimentaire	Agri-Food Operators Support Project
PASA	Programme d'Ajustement du Secteur Agricole	Agricultural Sector Adjustment Programme
PASR	Programme d'Ajustement Structurel de la Filière Riz	Structural Adjustment Programme of Rice Sector
PBA	Programme Senegalo-Allemand de Lutte contre la Pauvrete en Milieu Rural dans le Bassin Arachidier	Programme for Poverty Reduction in the Peanut Basin
PDRG	Plan Directeur de Développement Intégré de la Rive Gauche du Fleuve Sénégal	Master Plan for the Left Bank of Senegal River
PDMAS	Programme de développement des marchés agricoles du Sénégal	Agricultural Markets and Agribusiness Development Project

PHSC	Programme hors secteurs de concentration	Non-Focal Sector Programme
PIP	Périmètres Irrigués Privés	Private Irrigation scheme
PIV	Périmètres Irrigués Villageois	Village Irrigation scheme
PNDL	Programme national de développement local	National Local Development Programme (NLDP)
PDLP	Programme national de développement local participatif	Participatory Local Development Project （PLDP）
POAS	Plan d'occupation et d'affectation des sols	Land Occupation and Allotment Plan
POGV II	Projet d'organisation et de gestion villageoise (phase II)	Village Organization and Management Project (Phase II)
PRAESC	Programme de relance des activités économiques et sociales en Casamance	Programme for the Revival of Economic and Social Activities in Casamance
PRIAF	Projet de Renforcement de l'Information des Acteurs des Filières Rizicoles en Matière de Marchés et de Politiques	Market and Policy Information Reinforcement Project for Rice Sector
PROCAS	Programme d'Appui au Developpement Socio-economique pour la Paix en Casamance	Programme to promote economic and social development for peace in Casamance
PRODAM-II	Projet de développement agricole de Matam Phase-II	Agricultural Development Project in Matam phase II
PRSP	Document de stratégie de réduction de la pauvreté (DSRP)	Poverty Reduction Strategy Paper
PSOAP	Programme des Services Agricoles et Organisations de Producteurs	Agricultural Services and Producer Organizations Programme
PSSA	Programme spécial pour la sécurité alimentaire	Food Security Special Programme
SAED	Société d'Aménagement et d'Exploitation des Terres du Delta du fleuve Sénégal et des Vallées du fleuve Sénégal et de la Falémé	National Company for Development and Exploitation of the Senegal River Delta Lands and of the Senegal River Valley and Faleme
SAP	Programme d'ajustement structurel (PAS)	Structural Adjustment Programme
SCAC	Service de coopération et d'action culturelle (de l'Ambassade de la France)	Department of Cooperation and Cultural Activities
SDDR	Service Départemental du Développement Rural	Rural Development Departmental Service
SENCHIM	Société nationale des produits chimiques	National Chemical Products Company
SODAGRI	Société de Développement Agricole et Industrielle du Sénégal	National Company for Agricultural and Industrial Development
SODEFITEX	Société de Développement des Fibres Textiles	National Textile Fiber Development Company
SONACOS	Société Nationale des Oléagineux du Sénégal	National Groundnut Oil Company
SONADIS	Société National de Distribution	National Distribution Company
SUMA	Section d'utilisation en commun de matérial agricole	Common Farm Implements Users' Group
SV	Section Villageoise	Village Branch of Farmers' Cooperative
TEC	Tarif Extérieur Commun	Common External Tarrif
TOT	Formation de formateurs	Training of Trainers
UEMOA	Union Économique et Monétaire Ouest-Africaine	West African Economic and Monetary Union (WAEMU)
UNEP	Programme des Nations Unies pour l'Environnement (PNUE)	United Nations Environment Programme
UNIS	Union Nationale Interprofessionnelle des Semences	National Inter-professional Union of Seeds
UPA	Unité de politique agricole	Agricultural Policy Unit
WARDA	Association pour le Développement de la Riziculture en Afrique de l'Ouest (ADRAO)	West Africa Rice Development Association
WFP	Programme alimentataire mondial (PAM)	World Food Programme

Unit

Extent

cm^2	=	Square-centimetres (1.0 cm x 1.0 cm)
m^2	=	Square-meters (1.0 m x 1.0 m)
Km^2	=	Square-kilometres (1.0 Km x 1.0 Km)
a.	=	Are or Ares (100 m2 or 0.01 ha.)
ha.	=	Hectares (10,000 m^2)
ac	=	Acres (4,046.8 m2 or 0.40468 ha.)

Volume

cm^3	=	Cubic-centimetres (1.0 cm x 1.0 cm x 1.0 cm or 1.0 m-lit.)
m^3	=	Cubic-meters (1.0 m x 1.0 m x 1.0 m or 1.0 K-lit.)
lit.	=	Litre (1,000 cm^3)

Length

mm	=	Millimetres
cm	=	Centimetres (cm = 10 mm)
m	=	Meters (m= 100 cm)
Km	=	Kilometres (Km = 1,000 m)
Inch	=	2.54 cm
ft	=	foot (0.3048 m)
mile	=	1,609.34 m

Weight

gr.	=	Grams
Kg	=	Kilograms (1,000 gr.)
ton	=	Metric tonne (1,000 Kg)
MCM	=	1,000,000 cu-m

Currency

US$	=	United State Dollars
¥	=	Japanese Yen
FCFA	=	le Franc de la Communaut Financire Africaine

Time and Others

sec.	=	Seconds
min.	=	Minutes (60 sec.)
hr.	=	Hours (60 min.)

Exchange Rate

As of October, 2006

US $ 1.00 = ¥ 117.70

1.00 FCFA = ¥ 0.19249

CHAPTER 1 INTRODUCTION

1.1 Introduction

Rice consumption in Senegal has sharply increased in 1970s. In 1980s rice exceeded millet which was traditionally the staple food of Senegalese on per capita consumption basis. In 2003, rice consumption of Senegalese reached 74 kg per capita. Senegal is currently one of the largest rice consumers in West Africa. It is noted, however, that the self-sufficiency rate of rice is significantly low. Imported rice occupies some 80% of the national rice demand.

In view of food security, the Government of Senegal (GOS) requested to the Government of Japan (GOJ) to extend the technical cooperation to prepare the nation-wide master plan for the rice sector of Senegal. In response to the request by the GOS, the GOJ through Japan International Cooperation Agency (JICA) agreed with GOS through Ministry of Agriculture, Rural Hydraulic and Food Security (MARHFS) to carry out the Study on the Reorganization of the Production of Rice in Senegal (hereinafter referred to as "the Study"). The Study will be carried out in accordance with the Scope of Work (S/W) and the Minutes of Meeting (M/M) agreed upon between MARHFS H and JICA.

In accordance with the S/W, JICA dispatched the Study Team in November 2004 for implementation of the first field work for 3.5 months. The second field work was carried out from May 2005 to November 2005 for 6.5 months. At the completion of the second field work, the draft of Master Plan was submitted as a form of Interim Report. On 14th November, the Steering Committee Meeting was held to discuss the draft of Master Plan as per stipulated in the minutes of meeting of Attachment-1.

1.2 Objectives

The objectives of the Study are mentioned below.

i) To conduct the Master Plan Study for the reorganization of the production of rice in order to improve the competitiveness of rice produced in Senegal;

ii) To carry out technology transfer to Senegalese counterpart personnel in the course of the Study.

1.3 Study Area

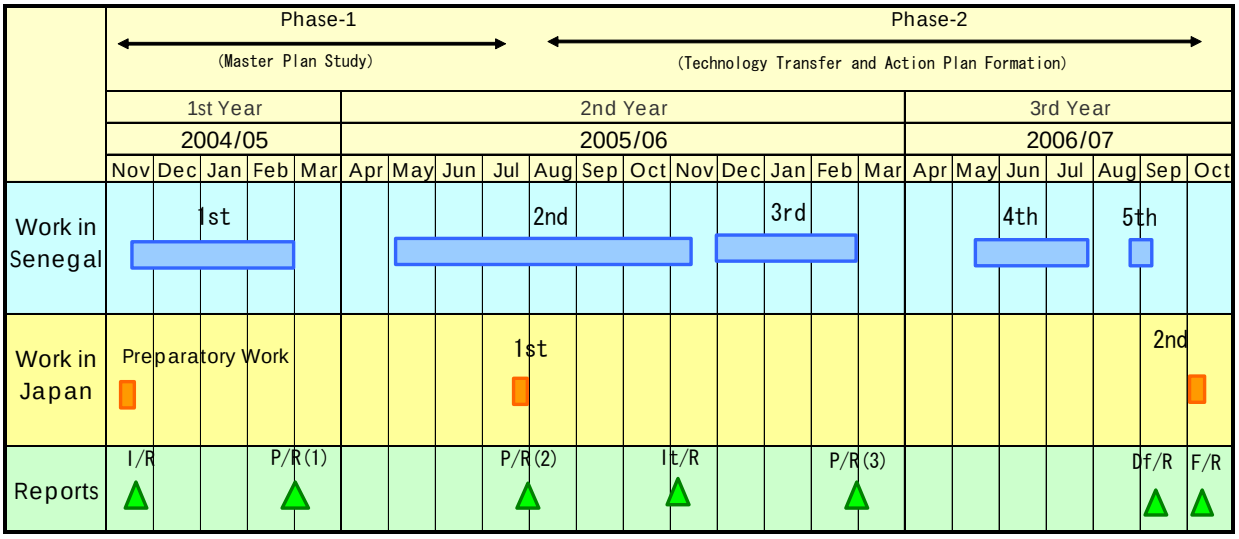
The Study will cover the whole area of the country and prepare the Master Plan. The Action Plan will be prepared for five regions comprising Saint-Louis, Matam, Fatick, Kolda, and Ziguinchor.

1.4 Study Schedule

The Study will be carried out over 24 months from November 2004 to October 2006 including home office work in Japan. The Study consists of two (2) Phases described below.

Phase 1 : Master Plan Study and Implementation of Technology Transfer Programs

Phase 2 : Technology Transfer Programs (Continued) and Preparation of Action Plans



I/R:Inception Report, P/R:Progress Report, It/R:Interim Report, Df/R:Draft Final Report, F/R:Final Report

Fig. 1.1.1 Overall Schedule of the Study

In accordance with the S/W, JICA dispatched the Study Team in November 2004 for implementation of the first field work. The Study Team explained the Steering Committee the contents of Inception Report in respect with objectives of the Study, the approach to the Study, work schedule, undertaking by the Senegalese government as presented in the minutes of meeting of Attachment-2.

The first field work was carried out for 3.5 months according to Inception Report. The present conditions including development constraints and potentials of the rice sector of Senegal were studied. All the study results were compiled into Progress Report (1) in February 2005 and explained to the Steering Committee on 21st February 2005 as per Attachment-3.

The second field work was carried out for 6.5 months from May 2005 to November 2005. The technology transfer programs were commenced for seven (7) technical fields of the rice sector. At the completion of the second field work, the draft of Master Plan was submitted as a form of Interim Report. On 14th November, the Steering Committee Meeting was held to discuss the draft of Master Plan as per stipulated in the minutes of meeting of Attachment-4.

The third field work was carried out for 3.0 months from December 2005 to February 2006. The additional study was made to supplement the Master Plan and the technical transfer programs were continued. The results of the Study were compiled into Progress report (3).

The fourth field work was carried out for 2.5 months from May 2006 to July 2006. The Study concentrated on elaboration of Master Plan and preparation of Action Plan. All the results obtained throughout the Study were compiled as Draft Final Report in August 2006 and explained to the Steering Committee in September 2006. This final report was prepared based on the results of study conducted over the 24-month period in October, 2006.

1.5 Steering Committee

The counterpart agency of the Study is Department of Analysis, Prediction, and Statistics (DAPS) of MARHFS. For smooth and efficient implementation of the Study, the Steering Committee will be established. DAPS would chair and take responsibilities to convene the

committee prior to the commencement of the Study.

Senegalese Side

1) Department of Analysis, Prediction and Statistics (DAPS) of MARHFS
2) National Company for Development and Exploitation of the Senegal River Delta Lands and of the Senegal River Valley and Faleme (SAED)
3) Regional Department of Rural Development (DRDR) of MARHFS
4) National Company for Agricultural and Industrial Development (SODAGRI)
5) National Bank for Agricultural Credit in Senegal (CNCAS)

Japanese Side

1) JICA Study Team
2) Advisory Study Team
3) JICA Senegal Office

In May 2005, DAPS requested the following agencies to participate in the study activities as observers in order to reflect more opinions to the Study.

1) National Agricultural and Rural Advisory Agency (ANCAR)
2) Market Regulation Agency (ARM)
3) Senegalese Institute for Agricultural Research (ISRA)
4) Food Technology Institute (ITA)
5) Inter-professional Committee on Rice (CIRITZ)
6) Anambe Basin Producers' Federation (FEPROBA)

CHAPTER 2 BACKGROUND OF THE STUDY

2.1 Outlines of Socio-economy of Senegal

2.1.1 Population and Economic Indicators

The area of the country is about 197,000 km² and the cultivable areas is about forty percent of the total area, 81,500 km² (FAO, 2002). On the basis of the census of 1988, the growth rate of population is calculated as 2.6 % and the estimated population of 2004 is 10,050,000 of which 74 % is agricultural population.

The Senegalese GDP (World Bank, 2003) is counted for 6.5 billion US dollars in total. The economic growth rate was recorded as low as 1.1 % in 2002 which rose up to 6.5 % in 2003. The growth rate of agricultural sector in particular, was 2.4 % on average for the ten years of 1993 – 2003, but the sector's growth rate also recorded significant fluctuations during that time. For example, the rate in 2002 dropped largely (19.9 %) from that of its previous year and in turn, the next year 2003 recorded 19.2 % increase compared to 2002. The proportion of the agricultural sector in GDP was as high as 21.5 % in 1983; however since then it has been declining such as 19.0 % in 1993 and then 15.0 % in 2002.

2.1.2 National Development Programs and Agriculture Policies

The Government of Senegal has started formulating the Program by the first Development Program of 4 years (1960 - 1963). Since the 8th Development Program (1989 - 1995), the program has covered for six years and the Government is operated under the 10th Program for the years of 2002 – 2007. The 1st – 4th Structural adjustment programs have been applied to Senegal since 1980 and could bring about some fruits in the country's economy. And the government finally accepted the devaluation of CFA Francs in January 1994, in view of a further economic growth and of reinforcement of competitiveness of export.

Having suffered from the accumulated external debt, Senegal has reached the decision point of expanded HIPC initiatives in June 2000. After that, the Poverty Reduction Strategic Paper (PRSP) was finalized in June 2002 and the country achieved to the HIPCs' completion point in April 2004 to be eligible for debt relief of some multilateral financial institutions, namely the World Bank and the International Monetary Fund (IMF). The resource which becomes available under the HIPCs initiatives amounts to 488 millions US dollars and is set to be used for the poverty reduction. The G8 Summit of July 2005 decided that Senegal was also a target country for the debt cancellation of multilateral financial institutions.1

The country's Agricultural Policies have been changing from the period of the State's interventions (1960 - 1984), and then a period after having adopted the New Agricultural Policy (NPA) (1984 - 1994) and the period of the Agricultural Development Policy Declaration (DPDA) since 1994. Following the period of NPA, the principles were shifted from the government's direct intervention for agricultural development to promoting responsibilization of farmers, restructuring and privatization of national agricultural agencies. Moreover, since the devaluation in 1994, in order to achieve sustainable production growth, improvement of food security, increase of employment and income in rural areas, under the Agricultural Sector Adjustment Program (PASA), the government has been implementing the liberalization of pricing and marketing of agricultural products in addition to the privatization of production, transformation and distribution of agricultural products.

[1] Senegal benefits from debt cancellation of over 2 billions US dollars (more than 1,040 billions CFAF), the amount equivalent to the total debt amount to IDA, including already cancelled under HIPCs initiatives (168 millions US dollars). In addition, the debt to AFD (African Development Fund) (268 billions CFAF) was cancelled in 2006.

In June 2004, the Government of Senegal adopted the Agricultural Frame Act (LOASP) which is the basic guiding principles for agricultural development for the next twenty years. It says the importance is put on various aspects of agricultural sector, such as promoting Food Security, improving living standard and conditions, creating social welfare in rural areas, establishing a system for sustainable natural resource management, encouraging private sector activities, improving quality of agricultural products and restoring natural environment in rural areas.

The Government of Senegal recognizes the importance of the agricultural sector from three major viewpoints in the National Development Policy. In the rural areas in which about half of the population of Senegal lives, many of residents make their livelihoods depending on agricultural sector. The importance of the agricultural sector from a viewpoint of improvement of living standard in the rural areas, what is called "poverty alleviation" is the first one. The 2nd one is the importance as a sector which produces an overseas export-oriented product and reinforces a national income. Peanuts and cotton have been the main national income sources until now. From now on, fruit, such as a mango besides vegetables and legumes, such as asparagus and a cowpea, is also expected as a means of acquisition of foreign currency. The 3rd is the importance from a viewpoint of a food security. Public investments aiming at diversification of products or the increase in production of cereals have been made. The government of Senegal plans to decrease the amount of food import through ensuring the food security and increasing a food self sufficiency ratio and to attain a sound national finance as the result.

2.2 Production of Rice and Other Cereals in Senegal

Cereals import has steadily increased since 1995. Their total amount reached to 800,000 ton in 1993 and one million ton in 2001. In contrast, domestic cereal production has been stagnant in the same period resulting in sharp drop of self-sufficiency in demand and supply balance of cereals from 58% in 1992 to 40% in 2002. In 1999 to 2003, the average annual production of cereals was one million ton, of which 65% was covered by millet, 14% by rice, 14% by sorghum and 8% by maize.

Rice is the second diet following millet in terms of production although large differences are recognized by region. The rice producing zones of Senegal consist of seven (7) regions, namely Saint Louis, Matam, Tambacounda, Fatick, Kaolack, Kolda and Ziguinchor. In particular, as seen in Figure 2.2.1, rice production occupies from 50% to 80% of the total cereal production in main four (4) regions, namely Saint Louis, Matam, Kolda and Ziguinchor.

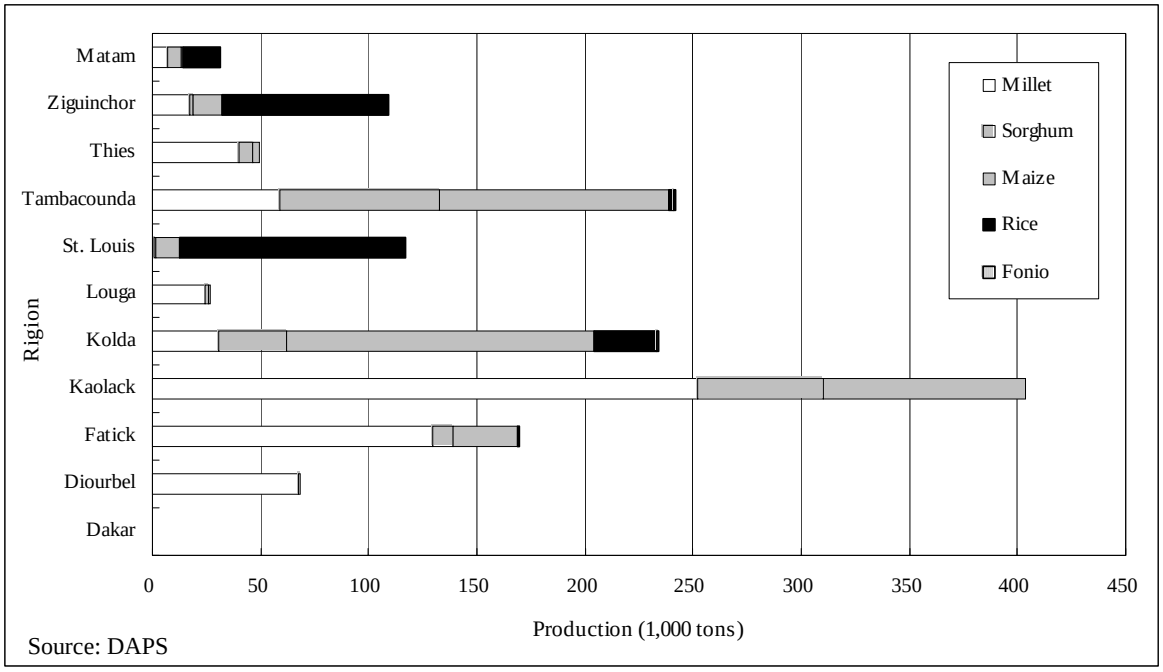


Fig. 2.2.1 Cereal Production by Region（2003/04）

Availability of cereals per capita was calculated for each o region on the basis of cereals production and regional population. The results are presented in Figure 2.2.2. One for Tambacounda amounts to 430 kg followed by Kaolack (341 kg), Kolda (261 kg) and Fatick (257 kg). In these regions, cereals is considered to be surplus. On the other hand, cereals production on per capita basis is lower than its national average (134 kg) in such regions as Saint Louis (137 kg), Ziguinchor (140 kg) and Matam (85 kg).

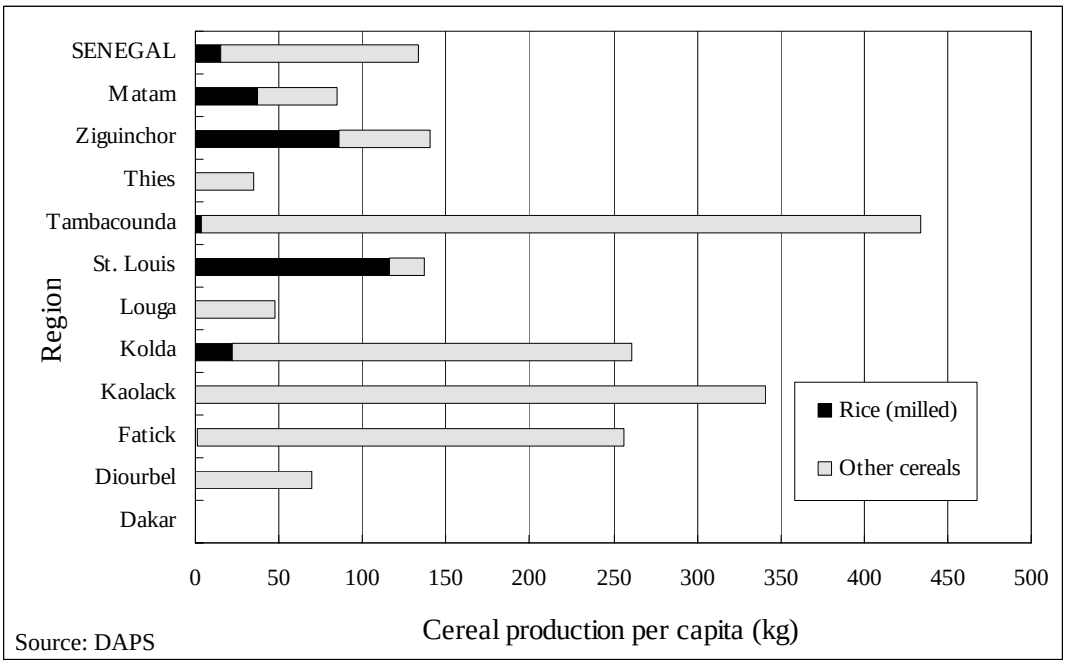


Fig. 2.2.2 Availability of Cereals Per Capita（2003/04）

The fluctuation of annual production of rice and millet during the past 20 years is illustrated in Figure 2.2.3.

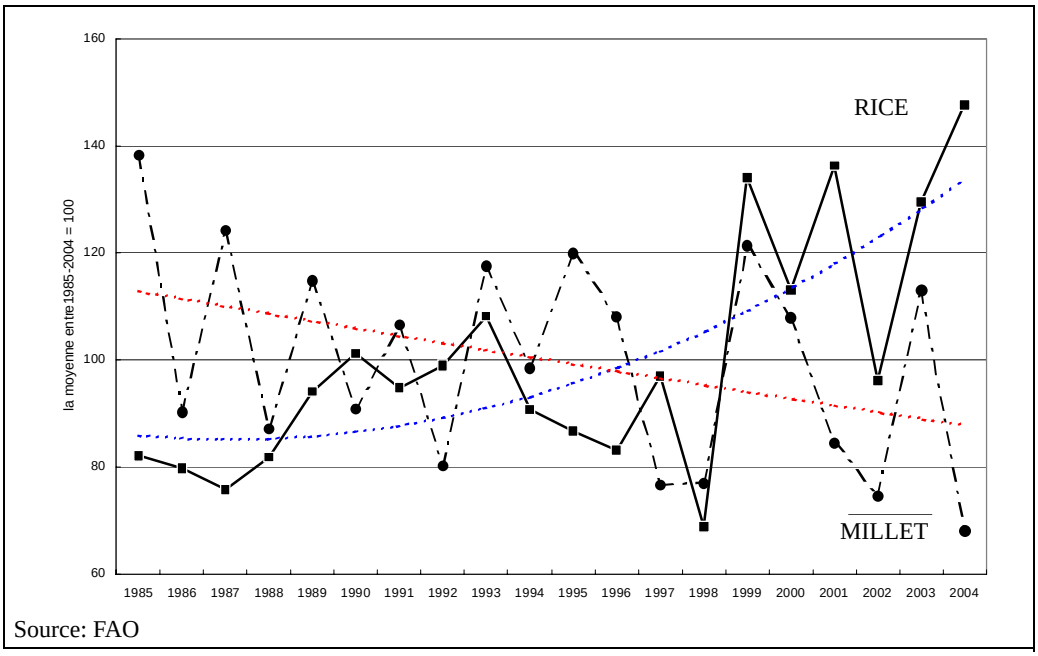


Fig. 2.2.3 Fluctuation of Annual Production of Rice and Millet (FAO)

Although large fluctuation is recognized, the figure shows that millet production has been gradually reduced, while rice has increased during the last 20 years. Millet is competitive with groundnuts in agricultural land use. The trade off for more groundnuts is usually less millet. The planed area of groundnuts is strongly affected by coverage of government subsidy in farm inputs supply for groundnuts. Therefore, not only climatic changes but also the budgetary arrangement for groundnuts indirectly affects production of millet.

On the other hand, rice is planted selectively on low-lying lands, which are generally endowed with ample water and fertile soils. Consequently stable grain yields are expected in comparison with other cereals. However, low-lying lands are less suitable for upland crops due to poor drainage conditions. Rice is advantageous and rational in terms of use of low-lying land.

It is projected that demand and supply of rice in the international markets will become critical in near future. To promote foreign currency saving, food security and poverty reduction, it is advisable to embark on reorganization of production of rice.

2.3 Interventions of International Organizations and Bilateral Donors

2.3.1 Overview: Donors' Assistances to the Agricultural Sector

Although Food Security is presented as an important sector in the Agricultural and Rural Development Policy in Senegal, there has not been any clear long-term vision presented for nation-wide agriculture of the country until the Agriculture Frame Act (LOASP) adopted in June 2004. The Government has formulated various projects or programs in the agricultural sector in addition to an Annual Agricultural Program for a short or middle term[2] period and international aid agencies and bilateral donors have provided funds for their implementation for the development of Senegalese agriculture sector.

The World Bank is leading in the support for preparing a favorable surroundings and strengthening the competitiveness and capacities of private sectors in face of market liberalization.

EU also provides assistance for enforcing the government's capacity in terms of international trade. These assistances can be a new type of cooperation in the era of globalization. In general, donors' assistances in

[2] PNDA, a mid-term agricultural development program (2006 - 2010) has been drafted and is waiting for a budget to conduct validation workshops at regional and central levels.

the agricultural sector are set under a couple of broader objectives such as improving the country's Food Security, reducing the poverty (increase income of rural populations, improving social services in the rural area). The other types of assistances closely related to agricultural sector are programs covering the agricultural sector as a whole, development of irrigation scheme, emergency aid and food aid in response to the invasion of desert locust and drought.

Donors' assistances in agricultural sector vary from one region to another. In the Senegal River Valley (SRV), development of irrigation scheme is a major intervention. For the region of Fatick, the interventions are concentrated on the area of food security, poverty reduction, and the restoration of soils degraded with salinisation. In Casamance where has settled a 20-year long conflict, donors are providing various assistances under the framework of post-conflict reconstruction such as increasing food production, rebuilding agricultural activities, and environmental protection and restoration like anti-salinisation dyke construction. Germany being on the top of the list, many donors such as France, Canada, United States of America, EU, Taiwan (assistances suspended) provide assistance to the post-conflict Casamance especially to the region of Ziguinchor. The projects or programs assisted by donors include different supports in the rice sector depending on importance and characteristics of rice culture in each region. PROCAS (Germany) gives an example with supplying rice seeds to local population and rebuilding seed stock. Another example in Fatick region is technical assistance to women rice producers' groups. The assistances of main donors in the rice sector can be summarized as below.

Table 2.3.1 Areas of interventions in the rice sector by major donors

donors/ sub-sectors	Production	Transformation	Irrigation	Agricultural machinery	Research	Producers organization	Agricultural . Credit	Institutional support	Market info.	Target Region		
										SRV	Fatick	Casamance
World Bank					+	+			+	+	+	
EU								+				
AfDB			+			+	+					+
FAO/IFAD	+	+			+	+	+			+	+	
France						+		+		+		
Germany	+	+	+	+/-		+				+	+	+
India				+						+		+
Arab countries			+	+								+
Taiwan (suspended)	+	+							+/-	+		+

2.3.2 International Aid Agencies

(1) World Bank and International Development Association (IDA)

The World Bank is mainly financing the projects and programs in the areas of rural development in view of the poverty reduction, infrastructure development of market and market information, and strengthening capacities of producers for the promotion of economic liberalization.

Agricultural Markets and Agribusiness Development Program in Senegal[3] (PDMAS) is composed of Component A "Improving domestic marketing conditions", Component B "Development of Agricultural Exports", Component C "Development of Private Irrigation" and Component D "Project Coordination and M&E" (one of the program's regional offices is based in SAED). The first five-year (2005 – 2009) phase's cost is estimated at US$57.3 million.

Component A includes domestic supply chain consolidation for agricultural products, upgrade of rural market infrastructure including post-harvest facilities, access improvement to

[3] http://www.pdmas.org/

domestic market knowledge and information. Component C consists of three sub-components which are (1) Support to crop diversification and give incentive for the investment to private irrigation schemes (including PIP) for their rehabilitation and new development (Delta, Lac of Guiers), (2) Promoting small-scale irrigation by using water from existing village boreholes and small water-catchments dams (basins de retention) (the Groundnut Basin), and (3) introduction and adjustment of new irrigation technologies and production model (Niayes areas, Lac de Guiers area, Senegal upper-middle valley and Casamance).

Agricultural Services and Producer Organizations Program phase 2 (PSOAP 2) puts the emphasis on improving the capacities of producer organizations and on strengthening agricultural services which are presently in the process of privatization. The program cost of US$ 47 millions was approved in June 2006. ANCAR, which was created by PSOAP phase 1, is one of the project's five executing agencies and is in charge of agricultural advisory and dissemination services. ISRA and ITA also take part in the execution of the project. The National Agricultural and Agro-processing Research Fund (NARF) is a sub-component under the Component "Support to the Agricultural Research System".

National Rural Infrastructure Program (PNIR) which is co-financed by International Fund for Agricultural Development (IFAD) had its objective to support to Local Districts (*Communautés rurales*) in the process of decentralization. Its phase 1 was executed from 2001 to 2005 and cost US$ 42.9 millions. After the completion of the phase 1, PNIR and Social Development Fund Agency (AFDS) merged into one program, National Local Development Program (PNDL). The objective of PNDL continues to be the improvement of social economic infrastructures at the level of local district. Storage house for crops and local market facilities were built under PNIR. In April 2006, the World Bank approved PLDP (Participatory Local Development Project, US$ 505 millions), a project to support PNDL.

(2) European Union (EU)

There exists a particular convention between EU and ACP (African, Caribbean and Pacific) countries to determine the frame of trade, development aid and political cooperation among the concerned parties. On the basis of the Cotonou Agreement signed in June 2000, development aid is executed. The budget to the 77 signatory ACP countries is about 13.5 billion Euros for the period of first five years.

EU assistance to Senegal is administered under the 9th EDF (European Development Fund: 2000-2005, 282 million Euros) and executed in the line of the Country Strategy Paper and Indicative Programme (2002-2007). The "focal sectors" are: Good political, economic and social governance; road transportation; sanitary facilities; and macro-economic support. Agriculture is not a part of it. However, EDF budget allocated for "non-focal areas" can be utilized for various sectors such as food security, support to NGOs, emergency assistance, support for democratization, for environment protection, etc.

In the Senegal River Valley, PIVs (small-scale village irrigation schemes) were supported for their development with the 5th – 7th FED (1985 - 1995). SAED was the executing agency.

(3) African Development Bank (AfDB)

Since 2000, AfDB provides financial support to producers in the Anambe Basin through Anambe Basin Rural Development Support Project (PADERBA), which established a microfinance institution (MECA) and also supports a producers' organization, the Federation of Producers of the Anambe Basin (FEPROBA). The project also provides assistance to women producers by developing 200 ha of irrigated areas.

AfDB has just started Project to Support Local Small-Scale Irrigation Support (PAPIL) in the region of Fatick. PAPIL's objective is to restore degraded soils of 3000 ha in the region. Concrete activities include the construction of anti-salinisation dyke, execution of program for improving people's capacities, promotion of decentralization process and improvement of social economic infrastructures using Local Development Fund (FDL) of the project. The budget is estimated at 14 billions FCFA for five year period.

(4) Food and Agriculture Organization (FAO)/ International Fund for Agricultural Development (IFAD)

FAO executes a Special Program for Food Security (SPFS) emphasizing on the rice production in twelve African countries including Senegal. SPFS in Senegal started in 1995 in Casamance and then the project expanded its activities in Tambacounda, Kédougou, Sédhiou, Matam and Kolda. After 1996, a program of south-south cooperation among three parties, namely FAO, Vietnam and Senegal, was implemented and 250 experts in total from Vietnam were deployed during the period of 1997 - 1999. At the sites of rain-fed agriculture, the experts introduced simple land development methods (earth dyke, deep plowing, etc.) together with improved water control technique and improved largely the rice yields in Fatick region as well as at Oussouye and Sédhiou in Casamance. The yield was almost doubled also at Matam where irrigated agriculture is practiced. The beneficiary villages totaled up to more than 300 by 2001. At present, FAO is preparing a Regional Programme of Food Security for 8 member countries of West African Economic and Monetary Union (WAEMU). The JICA Study Team was interviewed by the concerned FAO mission in terms of the Selegalese rice sector. In addition, FAO provides technical assistance to formulate a five-year National Agricultural Development Programme (PNDA) as institutional support for agricultural policy, following LOASP.

IFAD gives assistance to Village Organization and Management Project phase II (POGV II) in the area of Groundnut Basin, namely Fatick, Kaolack and Thiès regions. Following POGV phase I (1994 - 1999), POGV II started in 2001. There are three pillars in the project: (1) strengthening producers' organizations, (2) improving village infrastructures, and (3) establishing a sustainable system for diversification of agricultural production and income sources of producers. The budget for seven years is estimated at 15 billions FCFA in total. Under the project, the Village Initiative Support Fund (FAIV) can be used to develop small scale irrigation scheme and to purchase agricultural input (improved variety seeds in particular) to women rice producers.

In the region of Matam, there is an integrated program for the agricultural sector. Agricultural Development Project in Matam phase II (PRODAM-II) started after the completion of its phase I period (1994 – 1999). In order to strengthen agricultural production in the region, the project carries out activities for improving social infrastructures, strengthening producers' organizations, establishing a local microfinance institution (available capital is about 100 millions FCFA) in favor of small and medium scale enterprises. The project budget amounts up to 16 billions FCFA for 7 years. In addition, a piece of developed land (1 ha) is provided to target producers in view of achieving food security at family level. The project target includes also the pastoral sector.

The above two interventions are both integrated program in order to improve the living conditions of producers in rural area and do not target at the rice sector in particular. But, they are both very important because rice producers in the regions can benefit a lot from them.

2.3.3 Bilateral Assistance

(1) France

The French Government, with its difficult financial situation of the post war period, lanched a program of increasing crop production of its colonial territory of Senegal in order to reduce the crop import into the territory. However, because of very low profitability vis-à-vis the large scale of irrigation development demanded by the program, the French Government at the time could carry out only two development works in the basin of the Senegal river, one at Richard-Toll and the other at Guédé.[4] Since the independence of Senegal, France has continued its financial assistance (in the form of loan or subsidy), through the FAC (Fund for Aid and Cooperation), to OAD (Autonomous Organization of the Delta) and its successor organization, SAED. France was also one of the main donors for the construction of a key infrastructure of OMVS (Senegal River Development Organization), namely Manantali multi-purpose dam. But, on the contrary to the previous commitment, France and other European donors wished certain revision of interventions to the development of the Senegal river in 1997.[5] It is said that the crisis of rice sector in Senegal was the direct reason for that and since then eventual and further assistance by European donors has been considered with the following three conditions:

- need to clarify land tenure situation
- need to define a policy for the maintenance of developed areas and infrastructure
- need to define the conditions of intensification and diversification of production system

SAED took the above into account and prepared its 6th Mission Letter. After the joint evaluation with the World Bank on the execution of the 6th Mission Letter, the Government of France decided to provide support to the development of Land Management and Tenure Plan (POAS) and Irrigation Development Charter (CDI) (760,000 Euro for five years). Under POAS, France also supports to promote the process of decentralization through improving the institutional surroundings and strengthening the capacities of Local districts (communauté rurale). SAED is a key partner of POAS implementation.

The project “Promotion of Competitive and Sustainable Agriculture (PACD)”, signed in June 2005, is to provide assistance for a smooth transition of Senegal into emerging liberalization circumstances in and out of the country. They can already be observed on numerous scenes such as WTO negotiations, implementation of the Cotonou Agreement (the latest ACP-EC convention), disengagement of the Government from various agricultural sectors and privatization of governmental agencies, etc. For example, PACD sends experts to the related governmental structures, enhances the capacities of producers and peasant organizations for encouraging exports, organizational support for negotiations of agricultural trade through the Export Promotion Agency of Senegal (ASEPEX). The budget is estimated at 2.3 millions Euros for three years.

The French Government’s assistance to Senegal is made mainly through Prioritized Solidarity Fund (FSP) and French Agency of Development (AFD) in the form of subsidy. It has a wide range of target areas such as development of infrastructures, urban development, rural development and environment, health, education, modernization of local financial sectors, assistance to private sector, etc. They are in general transversal and the agricultural sector is not considered as an independent particular sector of intervention. Having decided its strategic framework and considering recent needs change in international cooperation and

[4] *Le Bassin du fleuve Sénégal* (Mamadou MAIGA, 1995), 80 page

[5] Fiche Projet « Appui à la réalisation des objectifs institutionnels de la 6ème Lettre de Mission de la SAED », AFD/ Agence de Dakar, novembre 2004

shrinking aid budget, Department of Cooperation and Cultural Activities (SCAC) of the French Embassy does not apply any more its assistance to agricultural production nor to marketing sectors.

(2) Germany

Germany has been giving assistance to the development of the basin of the Senegalese river since 1970's and financially contributed, for example, the construction of Manantali and Diama multi-purpose dams executed by OMVS. German Bank of Reconstruction (KfW) has executed various big projects for irrigation development in cooperation with SAED. One of such projects is the Irrigation Program phase IV (1992 - 1996), which aimed at rehabilitating the large-scale irrigation areas of Boundoum before transferring the management responsibilities to using producers' organizations. Germany was one of the principal donors. Germany provided financial resources also to another project, Great Drainage Construction Project. In addition, about a thousand ha of irrigable area for 40 PIV was created around Podor City under N'Galenka Irrigation Development Project (until 2002, 1.7 millions Euros). The project constructed also drinking water facilities in some of the beneficiary villages. In 2005, the German Government sent an evaluation mission in order to assess its past irrigation projects from the view point of poverty reduction. The mission reported that double-cropping was not widely practiced and people tended to produce vegetables (okra, tomato, onion) and banana rather than rice.

It is noteworthy to look at the details of on-going German project in Casamance. PROCAS (Socio-economic Development Support Program for Peace in Casamance) has its activities in various sectors, agriculture at the centre, health, education and environment. PROCAS was formulated in 2003 on the basis of last 20 year of German experiences and lessons learnt in the two regions of Casamance. When the regional security was severely deteriorated in 1997, most of the aid agencies had decided to temporarily withdraw from Casamance, German did not move and continued its activities. This period helped to consolidate the confidence of local populations to German engagement.

The concrete activities include a wide range of actions, always in view of peace consolidation in the region, such as food aid, seed distribution (rice[6], maize, groundnut, etc.), rebuilding seed production system in Casamance, construction of anti-salinisation dykes (covering 1,500 ha of land in total), provision of motorized cultivators to local service providers (private enterprises), development of vegetable gardens, construction of transformation unit of palm oil and water supply facilities in villages and so on. The project is characterized also by using local resources in the public and private sectors in the region. PROCAS has brought about concrete results that displaced people have started regaining their lives in the region, the food production has increased with the introduction of improved seeds. Such outcome helps reducing tensions existed in this post-conflict region. PROCAS is now bringing contribution into the Program for the Revival of Economic and Social Activities in Casamance (PRAESC) through its Food security component.

In the region of Fatick, on the other hand, the Project for self-promotion and management of natural resources in the area of Sine-Saloum (PAGERNA) has assisted restoring degraded soils of abandoned areas because of salinisation and Senegal-German Project of Promoting Communautés Rurales in the Regions of Kaolack and Fatick (ProCR) has been on the execution in view of enhancing capacities of Local districts in the process of decentralization.[7]

[6] a producers' union in Podor, Ujak, received an order for paddy grains in 2004 from the German aid agency
[7] PAGERNA, ProCR and a women alphabetisation programme have been merged into another intervention, Programme of the Groundnut

(3) India

During the period of 1999 – 2000, the Government of India implemented the Indo-Senegal agricultural development project 1999 – 2000 (US$ 2 millions) in the basin of the Senegal River for reviving rice and cotton production. The project donated tractors, irrigation pumps and others in addition to sending Indian expert in maize production. In 2003, India provided a loan of US$15 millions in order to support micro and small enterprises and to help purchase agricultural implements and machines in rural area.

India considers the West African region as strategically important area and concluded a convention of technical and economic cooperation with eight West African countries, "TEAM-9 initiatives."[8] Under the initiatives, the Senegal Government benefited US$ 27 millions for improvement of irrigation schemes existing in the Basin of the Senegal River. The assistance is that an Indian company which won a package deal supplies existing irrigation schemes with necessary equipments such as pumps. SAED is the executing agency of the project. The Indian company has already opened its representatives at Saint-Louis and other cities. In addition, at the beginning of 2006, the Senegalese Government has procured, with a loan of the same initiatives, agricultural machineries worth 8 billions FCFA, more than 2,500 items including tractors, rice milling machine, irrigation pumps. These machineries are to be at the disposal of potential users with government's subsidy, namely 40% of its market price for the tractors and 75% for the irrigation pumps.

(4) Arab nations

The Islamic Development Bank (IsDB) approved, in March 2002, a loan of US$ 9 millions for further development of the Anambe Basin of which project SODAGRI is the executing agency. This project, Anambe Basin Hydro-Agricultural Development Project Phase-III, has just invited for a tender in January 2006. The project includes the development of irrigation schemes, provision of agricultural machineries such as tractors and rice milling machines for the execution of three years period. In the past, IsDB had financed for its phase II project together with other Arab banks including BADEA[9], OPEC Fund and Soudi Fund.

In 1976, Kuwait started its assistance to Senegal through the Kuwaiti Fund for Development. The fund has provided since then 40 billions FCFA in total mainly for the agricultural sector, concretely for the construction of dams of OMVS, development of the Anambe Basin, construction of crop storehouses at Guédé Mbantou (Podor department) and access road to remote villages as well.

BADEA has financed in various regions of Senegal, for large-scale development works of irrigation. Principal projects include Hydro-agricultural Development Project of Ndierba and Dagana C (8.1 millions Euros), Agricultural Development Project of Anambe (9.6 millions Euros), Anti-salinisation Dyke Construction Project in Casamance (3.6 millions Euros), Kobilo Basin Development Project in the region of Matam (7.5 millions Euros), and so on.

(5) Taiwan

Since Taiwan reentered into diplomatic relations with Senegal in 1996, Taiwan had realized various projects such as road construction and technical assistance to rice production. The latter was named as Local Rice Promotion Project and its technical supports have targeted mainly large scale irrigated areas in the Dagana Department. It covered a wide range of activities including introduction of a Taiwanese improved variety (TCS-10), technical

Basin (PBA, 2004 – December 2010).

[8] Techno-Economic Approach for Africa India Movement

[9] Arab Bank for Economic Development in Africa

assistance to rice production and seed multiplication (Anambe Basin of Kolda region), facilitation of purchase of agricultural machines. In addition, the project had activities in transformation (rice milling) and marketing sub-sectors. In terms of transformation sub-sector, the project has facilitated producers' access to credits (230 millions FCFA in total) for procuring a rice milling machine through the Economic Promotion Fund (FPE).

After several years of endeavors, project's significant results have been very much appreciated. The locally produced rice by the project helped people to recognize the quality of local rice and its marketing promotion has even reached an exportation of the product to South Africa or the Republic of Slovakia. However, all the project activities have been suddenly suspended since the Government of Senegal reestablished the diplomatic relations with the People's Republic of China in October 2005. Besides, Taiwan continues to implement similar project of rice promotion (TCS-10) in the Gambia, Chad and Burkina Faso.

On the other hand, the Chinese Government resumed its aid to Senegal shortly after the reestablishment of diplomatic ties. The both governments have signed a cooperation convention at the beginning of 2006, of which the mount is up to 2 billions FCFA. In agricultural sector, crop exportation will be supported.

(6) The United States of America

The principal executing agency of USA's public assistance, USAID, concentrates its assistance in Senegal on the support of private sector, the efforts for promoting democracy and good governance, health sector especially in terms of HIV/AIDS prevention, education and support of community-led peace initiatives in Casamance. Agricultural sector is not included as a particular focal sector of intervention. So as to support to rebuild peace in Casamance, USAID provides assistance for organizing conferences to promote dialogues among the concerned parties, executing development activities at the community level and promoting organization of groups such as ACS (Sport and Culture Association of the youth) with the assistance of local NGOs. Concrete activities related to agricultural sector are in the form of various income generating activities, for example, cashew nut processing, poultry and pig raising, sesame culture and so on.

Besides, although it is not direct assistance to Senegal, in view of securing food security in vulnerable regions, USAID is funding FEWSNET（Famine Early Warning System Network）and publishes monthly country reports on food security and posts other related information on its web site.[10]

In the past, USA provided assistance to the Adjustment program of rice sector from1996 to 1999 in order to accelerate privatization and liberalization of rice sector in Senegal. One of the activities was to enhance the capacities of UPA (policy analysis structure of agricultural sector previous to DAPS) through conducting a study on competitiveness and profitability of the rice sector (1997 - 1998).

(7) Other donors

Canada executes the Agri-Food Operators Support Project (2002 - 2007) which aims at supporting food processing sector and promoting small and medium scale enterprises in the sector, for example, by establishing a revolving fund. The target sectors are Cereals, fisheries, fruits, vegetables and dairy products. The counterpart structures are ITA and Ministry of Industry and Artisan. The total project budget is up to 1.7 billions CFAF.

[10] http://www.fews.net/

Israel is preparing for a pilot project in the Fatick region to reinforce the region's anti-salinisation efforts, to examine possibility of drip irrigation at small vegetable gardens and to give opportunities for agriculture technical training. Its partners would be the regional structures of agricultural sector. In addition, a research project named Techno-agricultural innovation project to fight against the poverty, is planned to be launched in the course of 2006.

Switzerland started an information service project "Xam mares" (to know the market) in May 2005. The project provides daily market information to the users through the network of mobile phone and internet. The information there includes prices of agricultural products, everyday situation of stocks, etc. at various markets in Dakar City. The project partners are the Ministry of Commerce, Sonatel, CNCAS and a private company, Manobi-sonatel is executing the project.

CHAPTER 3 PRESENT CONDITIONS OF RICE SECTOR OF SENEGAL

3.1 Rice Distribution

3.1.1 Demand and Supply Balance of Rice in Senegal

(1) Per capita consumption of rice

Official information about rice demand and supply in Senegal is limited. In 1980s, Ministry of Rural Development estimated the per capita consumption of rice to be 71 kg. However, it seemed to be overestimated by taking account of sharp increase in rice demand in late 1970s. The estimate by Ministry was revised later on. FAO estimated the per capita consumption to be 59.7 kg in 1995 and 74.1 kg on an average in 2000 to 2002.

ISE and UNEP studied the demand-supply balance of rice in and after 1995. They estimated the per capita consumption of rice to be 74 kg in 2003 with annual increase of 1.56 kg since 1995. The study results are summarized in Table 3.1.1.

Table 3.1.1 Demand-Supply Balance of Rice in Senegal (1995-2003)

	1995	1996	1997	1998	1999	2000	2001	2002	2003
Population (1,000)	6,484	6,659	6,838	7,023	7,213	7,407	7,607	7,813	8,024
Per capita consumption (kg)	60	62	63	65	67	69	70	72	74
Demand (1,000ton)	389	410	433	456	481	508	536	565	596
Supply (1,000ton)	544	729	583	667	822	632	812	865	821
Local rice (1,000ton)	102	97	123	130	155	124	174	141	168
Proportional extent (%)	19	13	21	19	19	20	21	16	20
Imported rice (1,000ton)	436	627	452	535	658	502	632	710	641
Proportional extent (%)	80	86	78	80	80	79	79	82	78
Donated (1,000ton)	7	5	8	2	9	6*	6*	14	12
Proportional extent (%)	1	1	1	1	1	1	1	2	2
Stock (1,000ton)	154	319	151	211	341	124	277	300	225

Remark：* Since no data are available for 2000 and 2001, average in 1995-1999, i.e. 6,000 tons, is applied for both years.
Source：ISE/UNEP, 2003

(2) Self-sufficiency ratio of rice

The rice sector of Senegal is characterized firstly by its significantly low self-sufficient ratio, i.e. 20%. As seen in Table 3.1.1, imported rice has increased from 400,000 tons to 600,000 tons - 700,000 tons during the last nine years. In contrast, local rice production has been stagnant in the range between 100,000 tons and 200,000 tons.

The Senegal rice sector envisages keeping the stock of 200,000 tons to 300,000 tons. It is noted that the rice stock stipulated in Table 3.1.1 is not actual figures but theoretical ones, which were calculated by deducting estimated rice demand from the total rice supply on relevant years. ARM unofficially estimated that some 20% to 30% of rice in Senegal seems to be exported to neighboring countries through border trade.

3.1.2 Rice Import

(1) International rice market

According to the FAO statistics, Senegal was the largest importer of broken rice in the

international rice trade with a share of 22% in 2002. On the other hand, Thailand was the largest exporter of broken rice with a share of 75%. The details are presented below.

Table 3.1.2 International Trade of Broken Rice (FAO 2002)

Broken Rice Import(ton)			Broken Rice Export(ton)		
Senegal	791,699	22.4%	Thailand	1,241,745	74.5%
Indonesia	717,337	20.3%	USA	85,231	5.1%
Cuba	499,395	14.1%	India	75,826	4.6%
Sierra Leone	240,505	6.4%	Italy	38,789	2.3%
Guinea	205,578	5.8%	Ulgai	31,794	1.9%
Ivory Coast	133,333	3.8%	Spain	27,219	1.6%
Ghana	117,000	3.3%	Niger	26,585	1.4%
Burkina Faso	105,505	3.0%	Netherlands	23,885	1.4%
Japan	98,504	2.8%	Brasil	15,569	0.9%
France	77,562	2.2%	Egypt	11,686	0.7%

(2) Annual Fluctuation of Rice Import

The amount of rice import in 1989 to 2004 is presented in Table 3.1.3.

Table 3.1.3 Rice Import by Senegal (1989-2004)

Year	Imported Rice (ton)	Index (1989=100)
1989	374,268	100
1990	359,496	96
1991	397,827	106
1992	340,978	91
1993	362,752	97
1994	327,814	88
1995	387,516	104
1996	627,247	168
1997	452,072	121
1998	535,272	143
1999	658,078	176
2000	501,658	134
2001	632,253	169
2002	709,575	190
2003	640,739	171
2004	518,198	138
2005	605,648	162
Average (89-95)	364,379	
Average (96-05)	588,074	

Source:ARM

The annual rice import in 1989 to 1995 ranged between 300,000 tons and 400,000 tons. After the liberalization of the rice sector in 1996, the rice import is significantly increased by 500,000 tons to 700,000 tons. The import amount was also increased from 88 billion FCFA to 110 billion FCFA in 2002 at maximum.

In 2004, the rice import by Senegal was signifincantly reduced from 660,000 tons in last three years (2001-2003) to 510,000 tons. ONRS analyzed the background of this sharp decrease. The main reason was understood to be shortage of rice available in international market due to unfavourable harvest in some important rice producing countries such as Thailand resulting in price escarlation. In addition, cost increase of seacargo also adversely affected rice traders of

Senegal. In view of unstable conditions of international market, the Government of Senegal recognizes to improve the nation's food security urgently by achieving self-sufficiency of rice as early as possbile.

(3) Origins of imported rice

Imported rice in Senegal is originated from some 10 countries. In 1985 to 1995, i.e. before liberalization, rice was imported mainly from Thailand (51%), Pakistan (20%) and USA (19%) followed by Vietnam, China, Myanmar, India, etc. In 1995, rice import from Myanmar and Pakistan was stopped and one from China and USA was drastically reduced. In contrast, rice from India and Vietnam became more prevailing in the local market.

In 1996, when the liberalization was started, Indian rice occupied 52% of the total import rice, while Thai rice occupied only 19%. In and after 1997, Thai rice expanded its share and attained 73% in 2004. In 1999 to 2003, the rice exporters to Senegal are represented by Thailand, India and Vietnam, which occupied 94% to 96% of the total imported rice.

(4) Seasonal fluctuation of rice import

The monthly rice import in 2004 and 2005 are presented below.

Table 3.1.4 Monthly Rice Import in 2004 and 2005

Month	2004		2005	
	Import(ton)	Proportion (%)	Import(ton)	Proportion (%)
Jan	32,590	6.3	50,274	8.3
Feb	47,892	9.2	38,911	6.4
Mar	52,948	10.2	35,649	5.9
Apr	23,826	4.6	123,470	20.4
May	41,207	8.0	43,292	7.1
Jun	41,476	8.0	53,810	8.9
Jul	65,552	12.6	85,988	14.2
Aug	51,069	9.9	18,591	3.1
Sep	38,383	7.4	25,668	4.2
Oct	37,898	7.3	73,387	12.1
Nov	39,288	7.6	22,293	3.7
Dec	46,124	8.9	34,314	5.7
Total	518,198	100.0	605,648	100.0

Source: ARM

Although imported amount fluctuated by month, rice is regularly imported resulting in its constant supply and price conditions with little fluctuation. This is one of advantages of imported rice compared with local rice of which supply is seasonal.

3.1.3 Distribution Channels

(1) Before liberalization in 1996

Import of broken rice was .fully under the control of sole agency, namely CPSP. SONADIS and private traders were allowed to import only limited amounts of whole grains. Local rice as well as imported rice was purchased by CPSP directly from SAED, SODAGRI and SODEFITEX.

The major distribution channels of rice before its liberalization in 1996 are illustrated below.

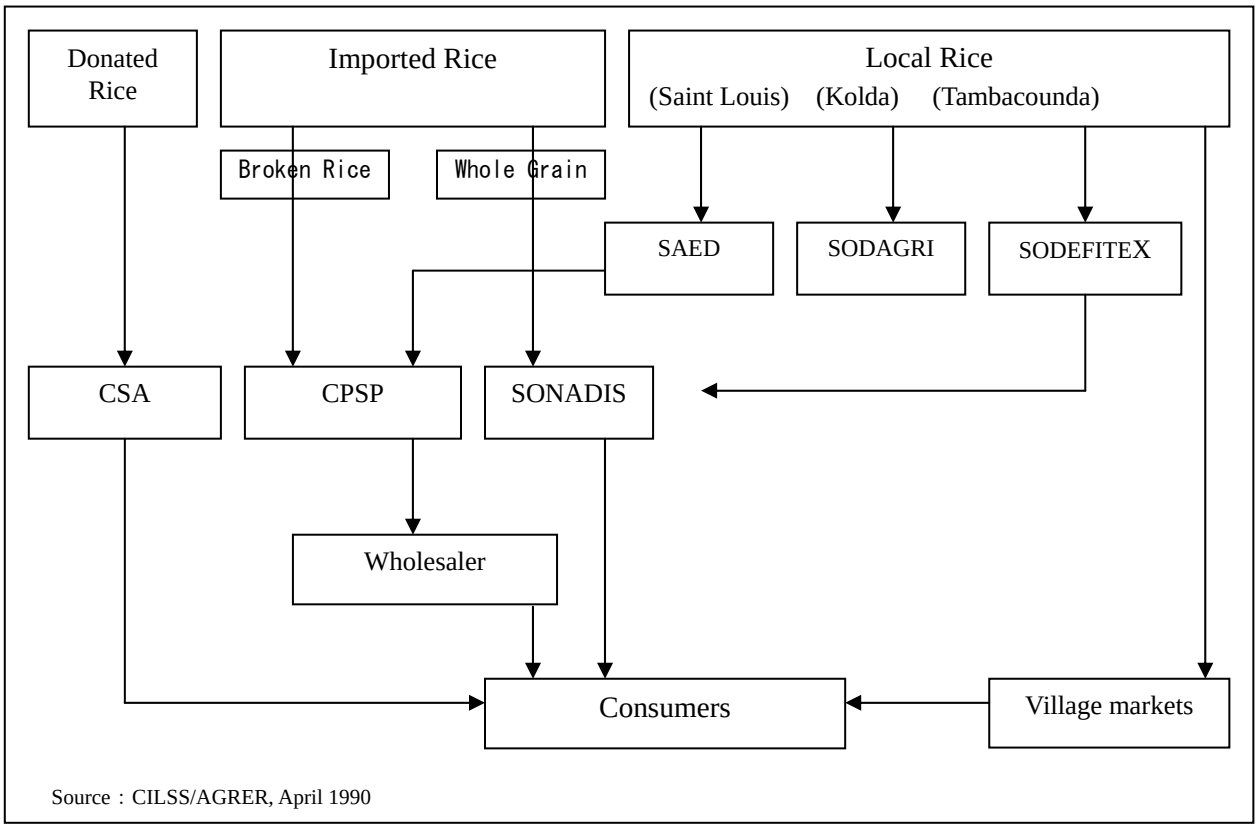
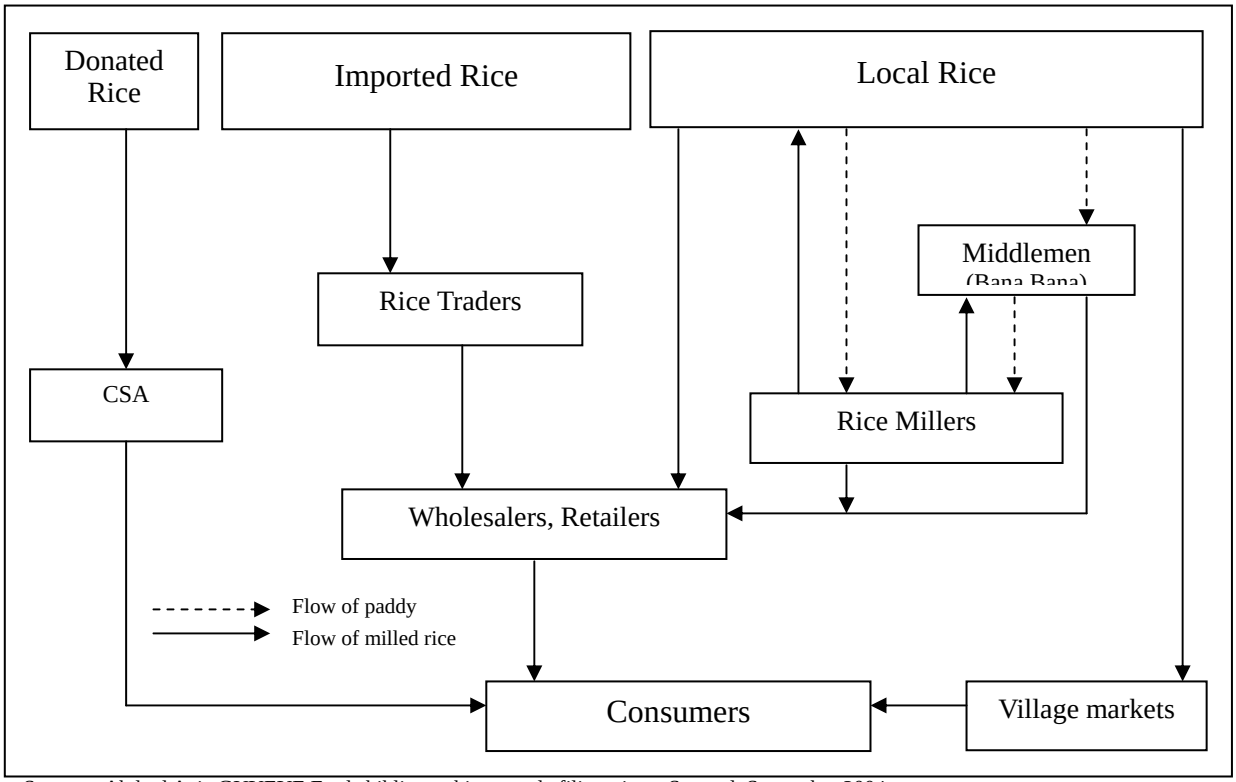


Figure 3.1.1 Distribution Channels of Rice before Liberalization in 1996

(2) After liberalization in 1996

In line with PASR, government intervention was officially withdrawn from distribution and marketing of rice by dissolution of CPSP in 1995. In and after 1996, rice milling sections of SAED, SODAGRI and SODIFTEX was privatelized. Within a few months after dissolution of CPSP, rice import was operated fully under the private rice traders.

The major distribution channels of rice after its liberalization in 1996 are illustrated below.



Source：Abdoul Aziz GUYEYE,Etude bibliographique sur la filiere riz au Senegal, September 2004

Figure 3.1.2 Distribution Channels of Rice after Liberalization in 1996

In most cases rice imported to Senegal is firstly purchased by traders in Europe from rice producing countries and resell to Senegalese traders. In recent years Senegalese traders tend to leave their rice business due to its lower profit as a result of oversupply of imported rice in local markets. In fact, the rice traders were decreased from 43 in 1996 to only eight. The largest trader currently deals with nearly 40% of the total imported rice. ONRS pointed out unstable food security of Senegal taking such condition of rice import into consideration.

3.1.4 Distribution of Local Rice

Paddy production in Senegal amounts to 213,900 tons on an average from 1996 to 2004, of which 61% were produced in Saint Louis and Matam. According to SAED, farmers in Saint Luois often reserve 30% of total paddy harvested, while the remaining paddy is allocated for loan repayment and cash generation. With milling recovery rate of 65%, 139,000ton of milled rice is obtained from 213,900 of paddy.

Table 3.1.5 Distribution of Local Rice

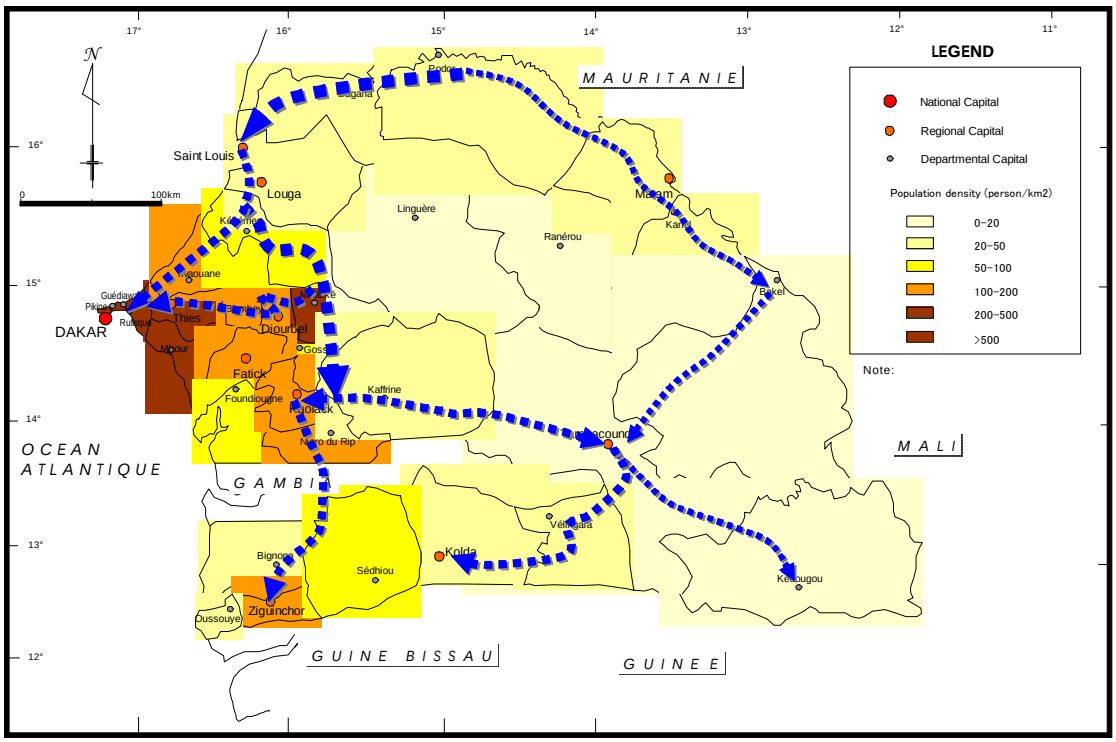
Region	Paddy Production (ton)	For Home Consumtion (ton)	For Marketing (ton)
Saint Luois and Matam combined	84,700	29,600	55,100
Kolda	24,900	24,900	0
Ziguinchor	26,300	26,300	0
Others	3,100	3,100	0
Total	139,000	83,900	55,100
Proportion (%)	100	60	40

Soirce: JICA Study Team

Out of 139,000 tons, 54,200 tons produced in Casamance, i.e. Kolda and Ziguinchor,and other regions deems to be locally consumed. Rice distribuited through marketing channels is limited only to 55,100 tons or two thirds out of 84,700 tons produced in Saint Luois and Matam.

The rice trade in Saint Louis is started in December when paddy harvesting is in fuill swing and most active at the end of February, i.e. varidity of the CNCAS loan. Most of local rice is purchased by traders by June to July and sold at retailer shops by October. From November to January, local rice is rarely available in domesticmarkets.

The Study carried out the interview to farmers, traders abd rice millers in Saint Louis in June to Jul 2005 in order to vaeiry the distributing channels of local rice. The distribution channels verified are illustrated below.



Source：JICA Study Team

Figure 3.1.3 Distribution Channels of Local Rice

In general, rice traders in other regions purchase paddy from famers through middleme for several hundred tons per order. Paddy is then processed within the Saint Louis region and transported after milled to other regions. Most of rice millers do not purchase paddy due to lack of funds but provide service only of custom milling. This is one of major reasons why their incentive for quality control of milled rice is low.

The city of Touba in the region of Diourbel constitutes in Senegal an unprecedented pole of economic development, where a good part of the production of the regions of Saint-Louis and Matam is sold. With the dynamism of the carriers from Touba in the rice sector, this city asserts itself more and more as the place of transit and distribution of local rice in Senegal. Very important quantities of rice are transported from Saint-Louis via Touba, towards the center and the south of the country. The survey which was carried out in July, 2005 showed that 15 340 tons, representing 25 to 30 % of the production of local rice was bought by 14 traders from Touba during the last 2004/05campaign.

3.1.5 Price Mechanizm

(1) Histrical background

The monthly fluctuation of milled rice prices is illustrated in Figure 3.1.4 for the period of January 1990 to September 2003. These are the prices for imported broken rice and for local rice.

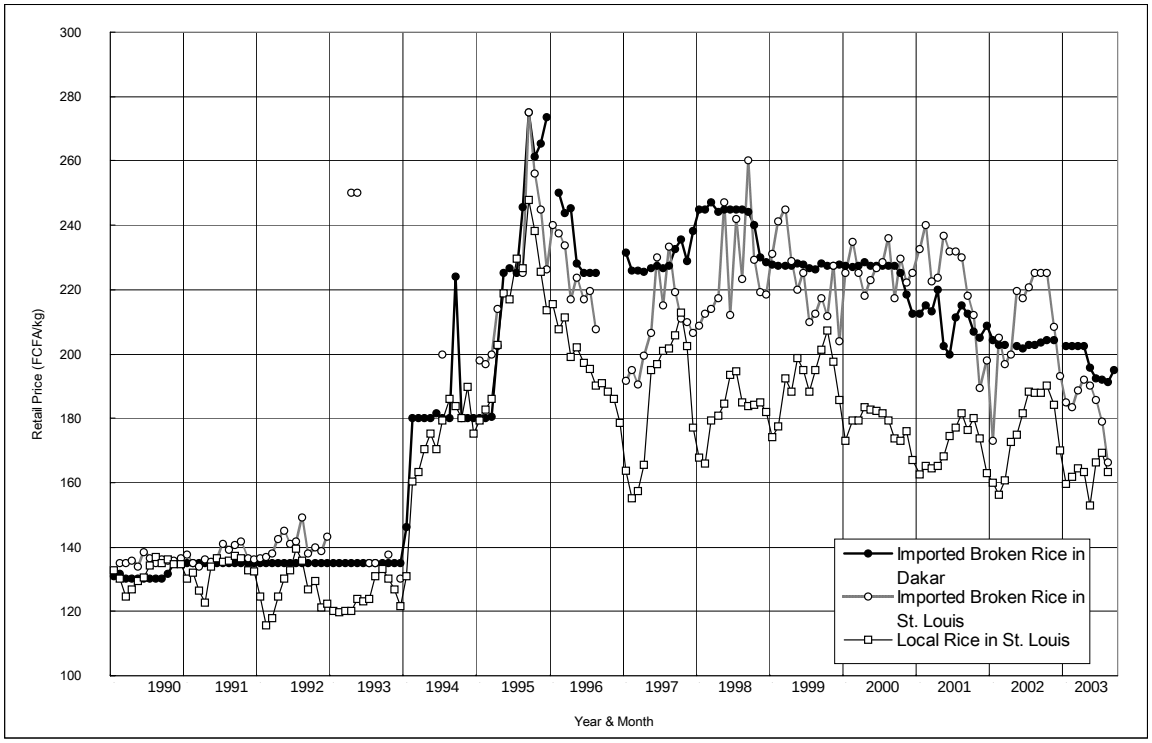


Figure 3.1.4 Price Fluctuation of Imported Rice and Local Rice in Dakar and Saint Louis (SIM/CSA)

The price of rice in Senegal evolved considerably with the devaluation and the commercial liberalization of rice in the middle of 1990's. These evolutions in the Senegalese market include 3 very distinct stages.

The first stage : the period previous to the devaluation of the FCFA in January, 1994

The second stage : Between the devaluation of the FCFA in 1994 and the end of 1995

The third stage : after 1996, period of liberalization of the rice market

The liberalization of the price of rice brought about a mechanism of synchronization between the prices of imported rice and the prices of local rice. The retail price of local rice is always fixed below that of imported rice because of its quality considered to be lower and its weak competitiveness. In Saint-Louis, local rice is less expensive than imported broken rice of about 30 to 50 FCFA / KG. Regarding the monthly fluctuations in prices, the prices of local rice fall at their lower level in February, at the end of the period of repayment of the CNCAS credit. It is in this period that rice producers, without any other alternative, are obliged to sell their production at very low prices. These fluctuations are not felt in the market in Dakar. On the other hand, one observes more and more that the prices of local rice in Saint-Louis start to strongly influence the prices of imported rice.

(2) Price Structure of Imported Rice

The West African countries of UEMOA and ECOWAS generally impose Common External Tariff (TEC) to the products imported from outside the communities. The details of TEC are

as below:

A. Revenue to the National Treasury

CR (Customs Rate), e.g. 10 % for products of category 2 such as “broken rice”

LS (Statistics Levy), 1%

B. Contribution to UEMOA and ECOWAS

SCL (Solidarity Community Levy): 1% of the value of imports coming from outside UEMOA

CL (Community Levy /ECOWAS): 0.5% of the value of imports coming from out of ECOWAS

CET is planned to be applied within WAEMU space by the end of the year 2007. Discussions concerning enforcement of that measure are ongoing.

Furthermore, it would be difficult to conclude a consensus about ECOWAS’s TEC among 15 ECOWAS member states, including Nigeria which imposes a custom duty of 100% onto imported rice. There is an opinion to establish new categories which allow the member states to impose higher custom duties in order to protect national industries including agriculture.

Table 3.1.6 Structure of Imported Rice Price (FCFA/ton)

Description	A1 Super (non perfumed)		A1 Super broken (perfumed)	
FOB	96,570	(185 US $)	127,890	(245 US $)
Fret	33,930	(65 US $)	33,930	(65 US $)
Insurance	1,500		1,500	
CIF Dakar	132,000		163,320	
Trader Margin	2,610	(5 US $)	2,610	(5 US $)
Trader Financial Cost	1,827	(3.5 US $)	1,827	(3.5 US $)
Trader Selling Price	136,437		167,757	
Import Tax	20,500		20,500	
Warehouse	7,000		7,000	
Importer Financial Cost	1,500		1,500	
Importer Cost Price	165,437		196,257	
Importer Margin	5,000		5,000	
Importer Selling Price	170,437		201,257	

Source: ARM Homepage, Exchange rate: 1 US $ = 522 CFAF

It is obvious that an increase of custom duty on imports is efficient and would bring about an immediate impact for the protection of national rice production. However, this requires high level political decision. Such a decision also needs to be accepted in the economic communities to which Senegal allies. In addition, enormous research and works will be needed to make decision on an appropriate level of import tax. For the moment, no movement for touching import tax to protect national rice production is observed. The Study does not include such a protective measure as a part of the Master Plan.

The price structure and cost implication of imported rice during the period of May 30 – June 6 2006 are presented in Table 3.1.6.

In terms of imported rice, a fixed amount of 20,500 FCFA is applied as custom duty regardless of its quality and variety. This amount is equivalent to 12.6% and 15.5% of CIF Dakar price of perfumed and non-perfumed imported rice respectively. These rates are more than the TEC rate described above, i.e. 12.5%.

PCS and PCC are to be paid to respective sub-regional Community from the national treasury. In addition, Value added Tax (TVA) is exempt for rice as it is categorized as food of first

necessity.

(3) Regional difference of rice price

The monthly fluctuation of retail price of imported broken rice from January 2001 to September 2003 is shown in Figure 3.1.5. The figure shows the ±20 FCFA difference between the prices in Dakar and one in the other regions.

Imported rice is unloaded at the Dakar port and transported to the regions. Therefore, the prices of imported rice should be higher in the regions than in Dakar. In fact, the prices in Tambacounda, Kolda and Ziguinchor are higher than ones in Dakar. However, the retail prices in Dakar from 2001 to 2002 were significantly high. The prices in Fatick, Thies, Diourbel, etc. are often lower than ones in Dakar although transportation cost to these urban centres is additionally born. One of the reasons is quality difference. Imported rice sold in Dakar are generally newer, while ones in other regions are often older (Study on Rice ISE/PNUE, 2003).

Sharp price down was recorded in January 2002, when substantial amounts of donated rice were released after rice farmers suffered from severe flooding.

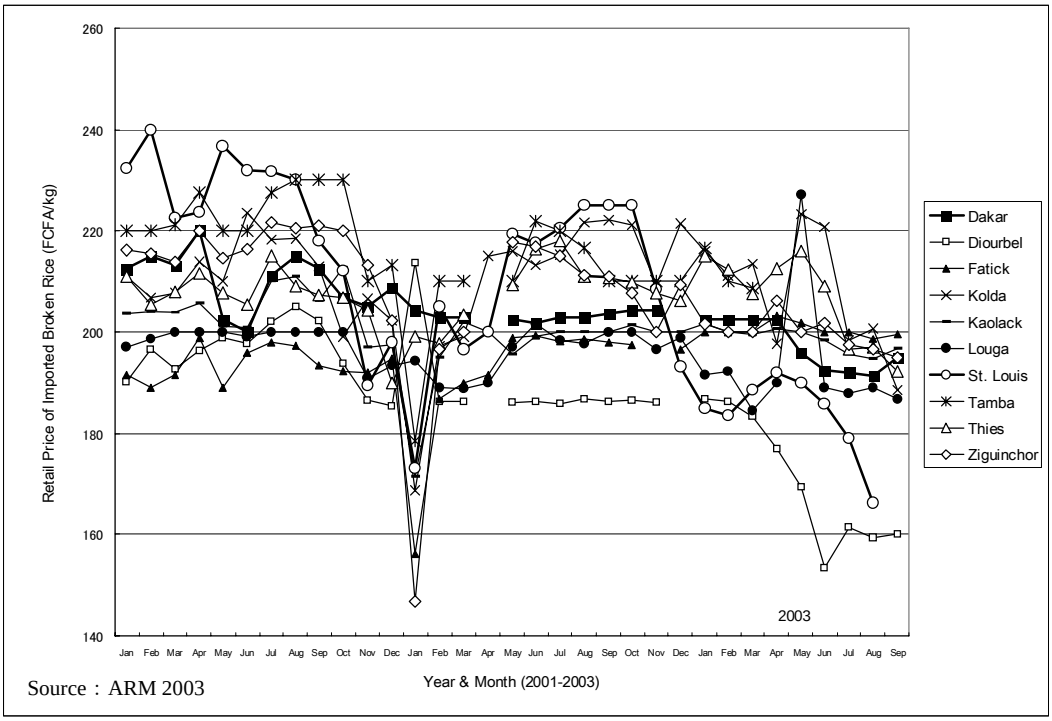


Figure 3.1.5 Monthly Price Fluctuation of Imported Broken Rice（2002-2003)

3.1.6 Retail Price of Milled Rice

The table below indicates retail prices of different rice varieties.

Table 3.1.7 Feature of the 12 samples of rice

Initial	Origin	Shape	Fragrance	Price (FCFA/kg)	Remarks
A	Thai	Broken	Perfumed	275	Mino
B	Senegal	Broken	non	225	Richard Toll
C	Thai	Broken	a little	240-250	Solo, Baobab
D	Vietnam	Broken	non	225	
E	Senegal	Mix	non	350	Valley, new rice
F	Senegal	Mix	non	260	Valley, new rice
G	Guinea-Bissau	Mix	non	600	Brown、manual milling
H	Thai	Whole grain	Perfumed	700	Caroline
I	Pakistan	Whole grain	Perfumed	1800-1950	Basmati
J	Thai	Whole grain	non	400-450	
K	USA (Japan)	Whole grain	non	300	Tyson
L	USA	Whole grain	non	500	parboiled

Source: JICA Study Team 2004 - 2005

Local rice average procurement price was 175 CFAF/kg in January 2005 and selling price of rice importers (non-selling price n perfumed Thai A1 Super, head rice) was 202 CFAF/kg. So, local rice was competitive to imported one. However, perfumed broken rice price can reach very low levels as it was for instance the case in 2003. It was 144 CFAF/kg; it is then difficult to assert that local rice price advantage will be maintained in the future. That advantage may be due to a purely temporary situation.

3.2 Rice Production

3.2.1 Present Situation of Rice Production in Senegal

(1) Study method

Present situation of rice production in Senegal was studied through various surveys, such as literature survey, periodical field observation survey to major rice production areas, interview survey to leaders of the farmers and various official agencies related to the rice sector, and questionnaire survey to the rice producers and key informants in the selected rice production areas.

Literature survey was made to grasp the regional variation of the rice cultivation in Senegal, including the position of rice as staple food, farming practice, production, supporting system, etc.

Interview survey to various agencies including SAED (Société d'Aménagement et d'Exploitation des Terres du Delta du fleuve Sénégal et des Vallées du fleuve Sénégal et de la Falémé), Headquarters and each delegation, ISRA (Institut Sénégalais de Recherche Agricole), Saint Louis, ADRAO (Association pour le Développement de la Riziculture en Afrique de l'Ouest), Saint Louis, ANCAR (Agence Nationale de Conseil Agricole et Rural), Saint Louis and Fatick, and DRDR (Direction Régionale du Développment Rural), Saint Louis and Fatick, was conducted to clarify their roles and activities in relation to rice production and obtain relevant data.

Field observation surveys to the rice cultivation areas were made in December, 2004, June, October and November 2005 for Saint Louis and Fatick, and January 2005 for Matam,

respectively to observe the rice growing, harvesting and threshing work, and rice growing environment. In Fatick, valuable information was obtained through the interviews to the experts of the on-going projects such as German assisted project, PBA (Programme senegalo-allemand de lutte contre la pauvrete en milieu rural dans le bassin arachidier), and FAO-PSSA (le Programme Spécial de Sécurité Alimentaire).

Surveys on paddy farming practice[1] were carried out in January 2005 for the Senegal river valley and in February, 2005 for Casamance area, respectively, to obtain the farmers' perception on rice cultivation. In the Senegal river valley, in cooperation with SAED and DRDR, 220 rice producers were selected from 11 villages (20 producers per village) located in the Senegal river valley, and interviewed using a prepared questionnaire. Interviewed items included family size, farming scale, cultivated crops, irrigation type, farm management practice from land preparation to post harvest, destination of products, position of paddy as staple in the household, facing problems, etc. As for the Casamance Area (Kolda and Ziguinchor regions), 100 farmers from 10 villages where rice is cultivated were interviewed in each region, using the similar questionnaire as the survey in the Senegal river valley. The Casamance study was entrusted to a local consultant through a bid.

Through the above surveys, features of the rice production environment were clarified by region, and constraints, issues as well as potential on rice production increase were identified.

(2) Rice production environment

1) Climate

Senegal as a whole has two seasons: the wet season and the dry season. The wet season starts with the monsoon rain in April in the south-eastern part, and moves towards north-west. The monthly rainfall increases to reach the maximum in August and decreases sharply until October/November when the dry season starts. It rains more in the south and less in the north. The annual rainfall reaches more than 1,000 mm in the Ziguinchor and the southern Kolda regions, while less than 400 mm in the northern Saint Louis. The average annual rainfall in the last 30 years has decreased by several hundred millimeters as compared with that of the previous 30 years, which has accelerated sea water intrusion into river nearby rice fields, resulting in the abandonment of the farm land by salinization and/or acidification of soils, especially in Ziguinchor and Fatick.

Unlike the rainfall, the temperature varies east to west. Annual average temperature varies from below 25^{o}C in the coastal area including Dakar, to over 29^{o}C in the eastern part of the Country including Matam. The hottest months are April and May, just before the onset of wet season. In the northern part like Podor and Matam, the maximum temperature goes up above 40^{o}C in these months. On the contrary, the coldest month is January. The minimum temperature goes down below 15^{o}C in this month. In the Senegal River valley, the minimum temperature of lower than 18^{o}C sometimes lasts for two weeks in November and December, which will induce the sterilization in flowering of rice plants.

2) Soils

Rice in Senegal is mainly grown on deltaic soils formed by marine and alluvial deposits and on the lowland where the hydromorphic soils develop. Deltaic soils are affected by sea water, which induces salinity problem due to its high salt contents with high osmotic pressure and/or low pH problem which brings about iron and aluminum toxicity, by forming hydro-sulfuric acid through oxidation process of pyrite. This problem has been aggravated by decreased annual

[1] Detailed results of the surveys were shown as annexes in this document.

rainfall over the years, especially in Fatick and Ziguinchor regions.

The hydromorphic soils with high clay contents (vertisols) are difficult to manage. It becomes very hard when dry, and very muddy when wet. The soils sometimes cause saline problem due to its high cation holding capacity. On the other hand, these soils are suitable for rice cultivation.

(3) Characteristics of the paddy farming by areas

1) Senegal river valley

Development history and evolution of paddy production in the Senegal river valley[2]

The distinct feature of rice cultivation in this area is the adoption of high input – high output type agriculture under the irrigation condition. Due to insufficient rainfall, rice is grown under irrigation utilizing the abundant water resources of the Senegal river.

Actually, the irrigated rice cultivation was introduced in 1950s, during the colonial period. Since 1960s, large scale irrigation development projects have been planned and implemented in the Delta area (Departments of Saint Louis and Dagana) for commercial rice production, due to the suitability of soil (clayey and saline) for rice cultivation. The development activities as well as technical extension and marketing have been lead by the State Company, SAED (Société d'Aménagement et d'Exploitation des Terres du Delta du fleuve Sénégal et des Vallées du fleuve Sénégal et de la Falémé) at that period of time.

There are three types of development, each corresponding to the type of development:

- The large irrigation schemes (GPs: Grands Périmètres) with an area of over 1,000 ha, and the Intermediate Development (AIs: Aménagements Intermédiaires) with an area between 500 and 1,000 ha, both developed by the public funds. The GPs are generally composed of enclosure dike for the basins, pump stations and sometimes drainage stations, a network of irrigation and drainage canals. The majority have recently been constructed or rehabilitated and their management has been transferred to the farmers' organizations. They are characterized by their reliability and their efficiency. They represent 25,600 ha exploitable area, that is 39% of total exploitable surfaces.
- The private irrigation schemes (PIP: Périmètres Irrigués Privés) set up by private initiatives and financing between 1989 and 1993. The PIPs are characterized by a rough and inadequate development (imperfect planning, lack of drainage) which does not assure the sustainability of the system due to the high costs of irrigation, difficult weed control and the salt accumulation in the surface soils. They constitute 25,800 exploitable ha, that is 39% of total exploitable area, essentially in the delegation of Dagana. But given their rapid degradation, only about 20 % of such developed surfaces offer normal conditions today. Besides, 78 % of them are located in the zone of the Delta of the Senegal river.
- The village irrigation schemes (PIV: Périmètres Irrigués Villageois) with an area between 15 and 50 ha set up in the middle valley of the Podor and Matam Departments during the 70s and 80s, by public fund, with the objective of compensating the effects of the drought. They constitute a very heterogeneous group but are often characterized by a lack of reliability and functionality, which resulted in the under-utilization and progressive abandonment of the schemes. The pump with a diesel engine is the most fragile installed element. The PIV constitute 22% of exploitable area, with 14,500 ha.

[2] Most of the description in this sub-section is cited from the report entitled "*Etude Bibliographique sur la Filiere Riz au Senegal*" prepared by Abdoul Aziz Gueye, September 2004.

The variants concerning the farming practice depend on the schedule, the mode of land preparation (mechanical and manual labor), the mode of weeding (chemical or manual), the type of nursery (transplanting[3] or direct seeding), and the mode of harvest and threshing (combine-harvester, mechanical or totally manual threshing). The mechanization rate is high in the large perimeters particularly in the Delta area (Department of Dagana) where the farming scale per household is larger (sometimes larger than 10 ha), while in the upstream, where farming scale is smaller (one household sometimes has as small as 0.25 ha), the farming practices are much more labor intensive. In this regards, the farmers in the Department of Dagana have been seriously affected by the decrease in the number of operational combine harvester after the disengagement of SAED from the agro-machinery operation and the devaluation of FCFA.

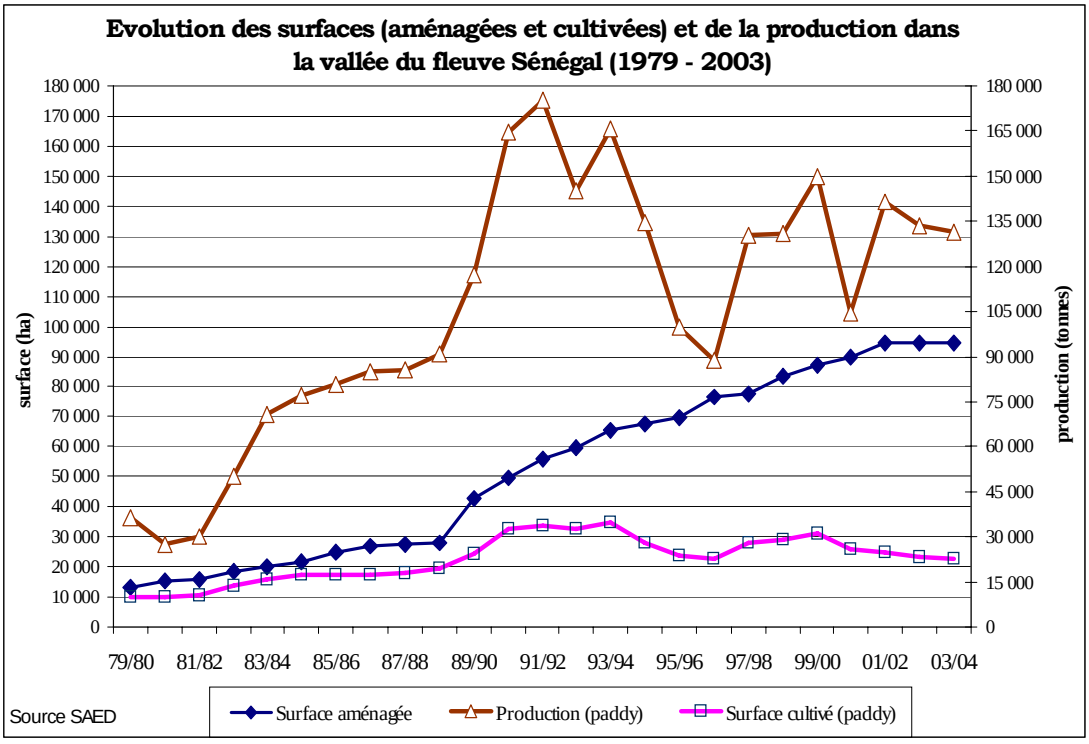


Figure 3.2.1 Evolution of Cultivated Area and Rice Production in the Senegal River Valley

From 1989 through 1991, the production of paddy rice in the Senegal river valley has increased drastically by 80%, from 90,000 tons to 163,000 tons. It has been attributed, among other things, to the development of PIP thanks to the provision of production credit by CNCAS. However, the private sector developed the irrigation system in a very rough manner, without drainage system or compaction of the canals. The combination of many factors like the unsustainable facilities, with the decrease in the production, the debt, the devaluation of the FCFA, has lead to the abandonment of many plots.

It should be noted that most of the PIPs, the surfaces of which continue to be counted among the developed surfaces of the zone, do not exist anymore. So, the developed area shown in the above table has been over-counted. Nevertheless, cultivated area of paddy is far less than the actual irrigable area.

While the cultivated area under paddy has been stagnated or even decrease, the production seems to be maintained in recent years. This is due to the yield increase over the years as shown

[3] Transplanting method has been introduced by international organization and donor countries through the technical cooperation projects.

in Table 3.2.1. The average yield of paddy in the area increased from 5.0 ton/ha in 2000 to 5.7 ton/ha in 2004.

Table 3.2.1 Change in the Yield of Paddy in the Senegal River Valley

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Yield (ton/ha)	5.3	4.8	4.4	4.5	5.0	4.5	5.3	4.5	5.1	5.0	5.2	5.3	5.4	5.7

Source: DAPS

However, in order to realize a high yield, many farmers apply, through their belonging groups, credit to cover the high cost items including irrigation, machinery service, purchase of inputs such as certified seeds, fertilizers and agro-chemicals, etc.

Before, SAED has assisted farmers in maintaining irrigation facilities, operating farm machinery services including land preparation and harvesting, and marketing the products. However, after the adoption of structural adjustment policy and liberalization of rice sector, SAED has withdrawn from these businesses, and the farmers have had to be responsible for all these costs. Agro-machinery including tractor and combine harvesters are all imported, but the renewal of the machinery has become very difficult after the devaluation of local currency.

2) Fatick region

In the Fatick region, rice cultivation is practiced under rainfed condition, only in Fatick and Foundiougne Departments, especially in the lowlands along the Sine and Saloum rivers and their tributaries. The rice cultivation in Fatick is done by women traditionally. The rice farming starts in June and July when the soil become wet after the onset of rainy season. They sow seeds directly on the ground and hoe to mix the seeds with soils. The hoe they use is of triangular palm size with a wooden stick curved with an acute angle, in order for them to hoe rhythmically making most of the wood's elasticity. The varieties used include local ones such as Momo and Dohbi, both of which are salt-tolerant and short duration.

The main constraint to the rice cultivation is weed. Usually women who cultivate rice also help men to cultivate upland crops including millet and groundnuts. In the rainy season, they are busy in taking care of all crops, and not able to allocate enough time for rice. They work in the rice field for three to four hours a day at most.

The change in the cultivation area, yield and production of paddy rice in the past 16 years is presented in Figure 3.2.2.

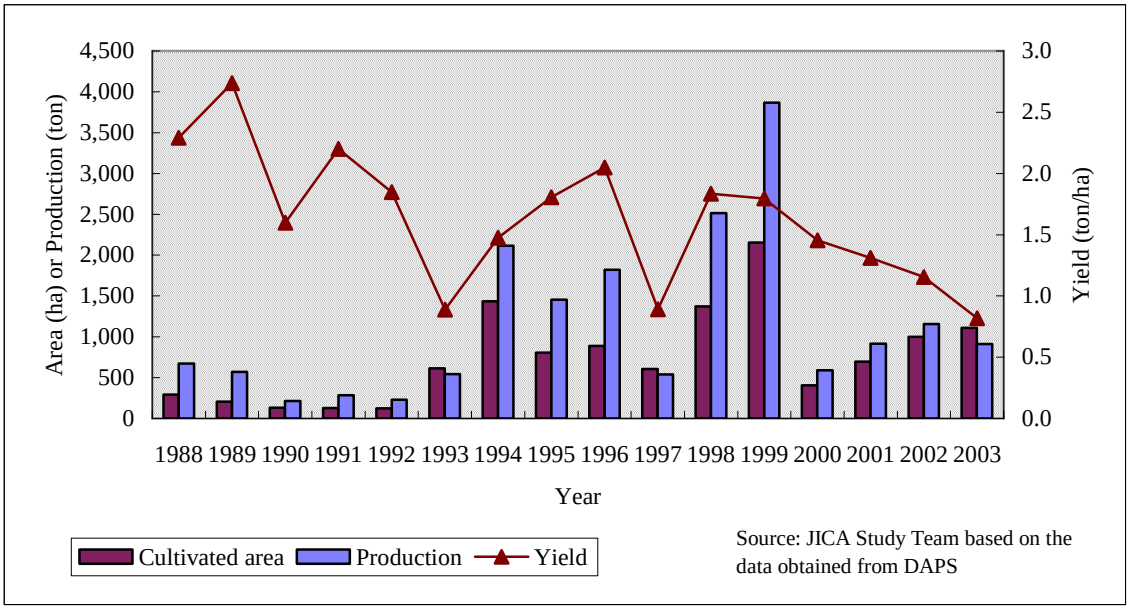


Figure 3.2.2 Change in the Area, Yield and Production of Paddy Rice in Fatick Region

Total cultivated area of rice fluctuates very much ranging from 125 ha to 2,150 ha. The yield of rice also varies very much, ranging from 0.7 ton/ha to 2.7 ton/ha, showing the decreasing tendency. As a result, production varied from 200 ton to nearly 4,000 tons.

This large fluctuation of area and yield is owing to the rainfall and associated salinity problem. The decreased rainfall allow the sea water to intrude into inner land where rice cultivation has been in practice, causing saline problem. The area where pyrite is found in the subsoil suffers from aluminum toxicity as a result of oxidation of pyrite to form sulfuric acid.

In order to prevent the saline and acid problem, many dams have been constructed in the delta area[4], to protect agricultural land from sea water intrusion. According to the German assisted project, PAGERNA (Projet Autopromotion et Gestion des Ressources Naturelles au Sine-Saloum), the mechanism of the reduction of salts in the soil by the dam construction is explained as shown in Figure 3.2.3.

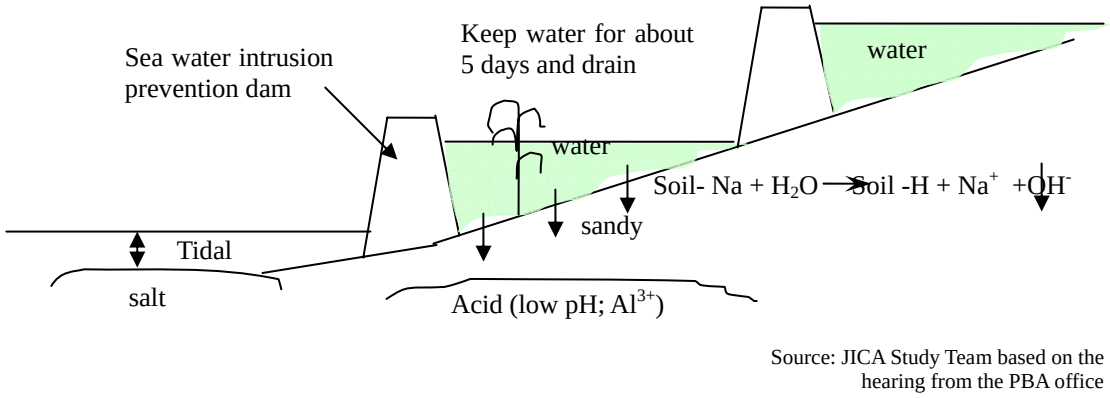


Figure 3.2.3 Schematic of the mechanism of salt reduction in the soil by constructing dams in the deltaic area

[4] According to the Technical Advisor of the "Programme senegalo-allemand de lutte contre la pauvrete en milieu rural dans le bassin arachidier (PBA)", which is the continuation of PAGERNA under German Cooperation, so far 12 dams have been constructed in Fatick by PAGERNA, and others have been constructed by other agencies such as FEE, CARITAS, PGIES, IUCN, etc.

Rainwater is trapped by a dam and kept for about 5 days. Part of the kept water is percolated through sandy soil to suppress the acidity deep in the soil. While accumulated sodium in the soil is dissolved in the water[5] and leached out. As a result, soil pH in the root zone becomes almost neutral. After some five days, the kept water is drained to wash salts out. In doing so, salinity in the soil is reduced to allow crops to grow.

In 2001 and 2002, Vietnamese team under FAO-SPFS (Special Programme for Food Security) came to introduce seeder, line planting, and the use of fertilizer. They also introduced High Yielding Variety, Sahel 108. They tried to improve the livelihood conditions of the area by enhancing the productivity of paddy. However, according to the technical advisor of the Vietnamese team, it was very difficult to fulfill their objective due mainly to salt problem in the area.

3) Casamance (Ziguinchor and Kolda regions) area[6]

The Casamance consists administratively of Ziguinchor and Kolda Regions. It can be divided into three areas in terms of agro-ecology: Lower Casamance, Middle Casamance and Upper Casamance.

The Lower Casamance corresponds to the administrative region of Ziguinchor.

The Casamance river, the main river flowing through the Lower Casamance, originates from some 50 km north-east of Kolda, and flows into the sea at about 50 km downstream from the Ziguinchor city. The western part of the Lower Casamance presents a vast marshy low land (marigot) system. The main tributary is the Soungrougou that takes its source in the forest of PATA and joins the Casamance river at some 50 km east of the Ziguinchor city.

Rice cultivation has been practiced there, traditionally in the low lands. However, the area has been facing serious problem of decrease in annual rainfall over the two decades (1,800 mm in 1960 to 1,200 mm in 1995), which resulted in the regression of the mangrove swamp, and the degradation of soils (decrease in fertility, erosion, salinization, acidification, etc.)[7].

Lower Casamance also has many valleys that got shaped following marine transgression and regression. These valleys were very favorable to lowland rice cultivation, but with the decrease in rainfall, which allowed sea water to intrude into these valleys, large rice growing areas have been abandoned.

To cope with the above phenomena, various programs of construction of dikes or anti-salt dams, combined with the retention of rain waters have been implemented first through the Integrated Project for Agricultural Development in Casamance (PIDAC; Projet Intégré de Développement Agricole de la Casamance) and through the Society for the Development of Casamance (SOMIVAC; Société de Mise en Valeur de la Casamance), both of which were dissolved in 1985, then through the Project for the Management of Water in the South (PROGES; Projet de Gestion de l'Eau zone Sud) and the Project for the Rural Development of Low Casamance (DERBAC; Projet de Développement Rural de la Basse Casamance), which both ended in 1999. In the same way and on personal initiative, some farmer's organizations tried their own experience, thus realizing dikes with traditional means that unfortunately gave way after a few

[5] This mechanism is explained by the Technical Advisor. However, the formation of sodium hydroxide will not happen in the field. Sodium may be leached out associated with other anion like chloride and sulfate.

[6] Most of the description in this sub-section is cited from the report entitled "Etude Bibliographique sur la Filiere Riz au Senegal" prepared by Abdoul Aziz Gueye, September 2004.

[7] In the Annex 3, one could see various soil-related problems on rice cultivation in Ziguinchor, based on the observation and experiment of a late ex-Japan Overseas Cooperation Volunteer.

years of existence.

Other types of facilities have been realized by the PROGES inside the protected valleys like for instance, the retention dikes, the stone rows on the contour lines, the anti-erosion banks, etc. These facilities serve to ensure the good repartition of the water and to fight against erosion and siltation.

The Diola is currently dominant in the Lower Casamance. The spatial repartition of two ethnic groups has an influence on the systems of rice production. They are: the original Diola system and the Mandingo system.

- In the original Diola system, the division of work between sexes is clearly defined in the agricultural tasks: men are responsible for the land preparation work in the paddy fields and the work in the upland fields, whereas women take care of sowing, transplanting, and harvest of the paddy rice;
- In the Mandingo system, the division of work is made according to the toposequence – men take care of the cultivation of upland crops, whereas women are in charge of the rice growing. This system prevails in the "Kalounayes" and in the district of Sindian.

Agriculture in the area is characterized by under-equipment in material and a lower level of agricultural inputs which are unavailable most of the time. Land preparation works are still done by men using traditional instruments[8].

The fertility of soils is maintained through the use of organic manure. This practice is more popular than the use of chemical fertilizer which is seldom or not used at all due to high cost.

There are two types of rice growing in the zone:

- the **upland rice growing,** with the following main varieties: Manganafà, Bilkissa, Chinois, Yaya, Bassite, Koutouthie, Kassa, Barafita (tolerant to drought), Adama DIALLO, Coumba NDama (70 days), and Farsé. However, upland rice cultivation is constrained by the water erosion due to the runoff of rain waters, the excessive weeds, the lack of improved varieties, the delay in the start of cultivations and the insect problems (stem borer and midge);
- the **lowland rice growing** is predominant. However, due to the drought, there is a clear regression for the benefit of the upland rice growing. Despite the inexistence of a well-structured seed sector, some of the seeds used are the improved varieties essentially produced by the ISRA Station of Djibélor. The local varieties, traditionally used by the local people in the lowland are progressively replaced by the improved varieties introduced mainly by ISRA and extended by the development projects. The following constraints have been noticed: the salinisation and the acidification of the soils, the iron and aluminum toxicity, the siltation of paddy fields (water erosion), insufficiency of facilities (dikes) for a good control of water and attacks by herbivore fishes.

The practice of rice growing in the Ziguinchor region has a strong cultural and traditional dimension. During village ceremonies, the Diola glory in presenting their rice produced by the sweat of their brows, over twenty years before. In these conditions, marketing of the rice was really unknown to them, and the processing of paddy rice was carried out by women using a mortar and a pestle.

Times having changed and due to the insecurity, which prevailed in the area since about 20 years before, the natural equilibrium, the familial structure and certain cultural values have

[8] The Diola use a long wooden hoe with iron blade called 'Kadiandou', while the Mandingo use other types of hoe called 'Daba' or 'Baro'.

been profoundly perturbed. For this reason, today, self-sufficiency is not guaranteed although the production tends to recover in recent years. A small breakthrough of imported rice to contribute to cover the food needs is even noticed.

The change in the cultivated area, yield and production of paddy rice in the Lower Casamance in the past is presented in Figure 3.2.4.

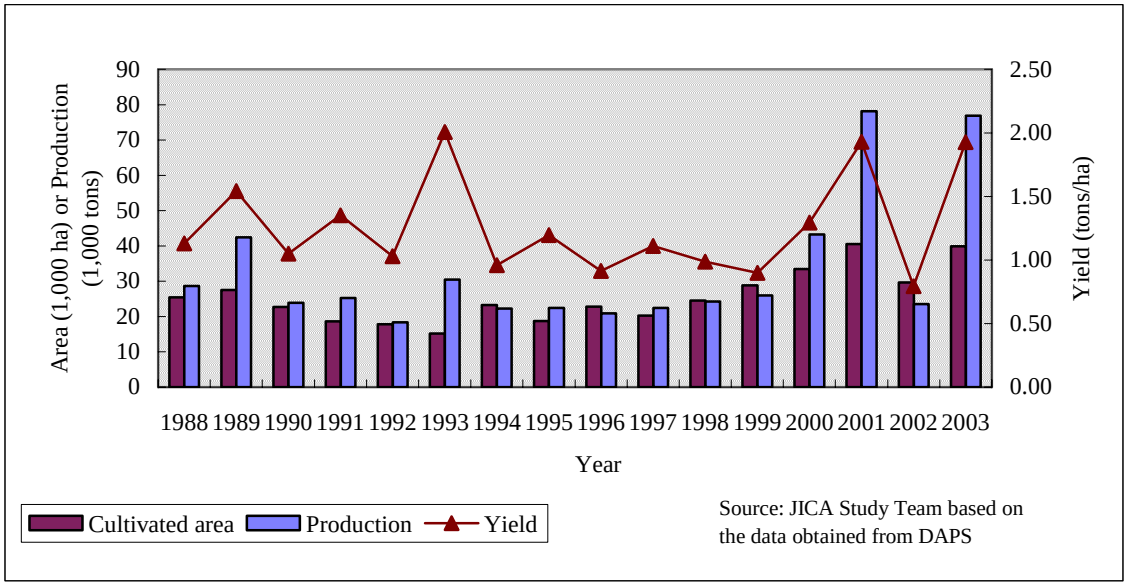


Figure 3.2.4 Change in the Cultivated Area, Yield and Production of Paddy Rice in the Lower Casamance

The Upper Casamance corresponds to the eastern part of the Kolda Region. The different rice cultivation zones are composed of the Anambé Basin that is a zone of intervention of the SODAGRI (Société de Développement Agricole et Industrielle du Sénégal), spanning the departments of Vélingara and Kolda and all along the Casamance River. **The Middle Casamance** corresponds to the western part of the Kolda Region. There are many valleys developed for women by the Integrated Project of Middle Casamance (PRIMOCA) on a total area of some 5,000 ha. In the Sédhiou Department, the Taiwanese Cooperation has allowed women to reach remarkable performances largely exceeding 2 to 2.5 tones/ha they used to obtain. This was done through the introduction of a technological package and the construction of bands for controlling submergence.

Likewise, with the Special Program for Food Security (PSSA; Programme Spécial de Sécurité Alimentaire), the Vietnamese cooperation has allowed to set up test areas of 5 – 8 ha all along the Casamance river, with a whole technological package (seeds, fertilizers, pair of draft ox and animal traction equipment, introduction of line sowing, hoeing, etc.). A yield of 7 tones/ha was attained compared to the 2 tons/ha usually obtained.

In **the Anambé Basin**, there are two systems of rice cultivation. The traditional cultivation in a few valleys and lowlands commonly known as Non Developed Zones (PNA; Périmètres Non Aménagés) where the people practice a traditional rice cultivation without fertilizers nor intensification, just utilizing the temporary inundated depressions. The rice is destined to home consumption, and between 1992 and 1999, productivity fluctuated between 1.1 and 2.5 tons/ha with the production of 5,100 and 10,000 tons.

The development of the Anambé basin was formed with the creation of the SODAGRI in 1974. The SODAGRI had a farm of about 100 ha where rice-growing tests started in 1978 during the feasibility studies carried out by the Swiss Consultants. Today, the SODAGRI has developed

about 5,000 ha of land which is shared by several sectors with 500 to 1,000 ha supplied by pumping stations autonomous from one another.

The irrigation water is stored and controlled by the two dams: Anambé and Niandouba. The total effective storage capacity of these two dams is over 150 millions m^3. The irrigation water is drawn into the fields through a distribution canal network (primary, secondary, tertiary, and quaternary in some perimeters) and is drained through a drainage network (primary, secondary, tertiary, and collector). Since the setting up of the first phase in 1985, the performances recorded in the rice-growing sector are very moderate with an average yield of 3 to 4 tones of paddy per ha, despite the collaboration between SODAGRI and ISRA in terms of research and development.

Irrigated cultivation in the area was a new technique that had hardly been introduced. In addition to that, this zone is an area populated with livestock raisers (Peuls from the Fouladou) whose main activity is livestock farming.

Traditionally, agriculture is practiced in the parcels of households; the appropriate zones for rice-growing were not exploited. The liberalization of the sector took place at a time when the adaptation of the local people to this new system of production had not at all been completed, and the performances recorded were modest.

In the recent years, the area has been choked by the non-refunded loans from the CNCAS that amounted to about 500 millions of FCFA. This situation leads to a total blockage of the system, as shown in Table 3.2.2.

Table 3.2.2 Change in Developed and Utilized Areas in the Anambé Basin (1993 – 2002)

	Developed area (ha)	Total utilized area (ha)		Share of rice (ha)	
93/94	1,665	876	53%	771	88%
94/95	1,665	1,064	64%	883	83%
95/96	1,665	740	44%	610	82%
96/97	1,665	1,296	78%	1,126	87%
97/98	2,230	2,230	100%	1,268	57%
98/99	2,630	1,525	58%	1,378	90%
99/00	4,220	2,961	70%	2,836	96%
00/01	4,220	2,392	57%	2,273	95%
01/02	4,220	1,655	39%	1,517	92%
02/03	4,220	515	12%	255	50%

Source: SODAGRI, 2002.

Moreover, the Rural Development Support Project in the Anambé Basin (PADERBA; Projet d'appui au développement rural dans le basin de l'Anambé) that is financed by the BAD sees to the research of sustainable solutions in relation with all the partners involved like the CNCAS, the SODAGRI and the producers' organization through the National Federation for the Rice Producers in Senegal (FEPROBA; Federation National des Producteurs de Riz au Senegal).

The change in the cultivated area, yield and production of paddy rice in the Middle and Upper Casamance in the past is presented in Figure 3.2.5.

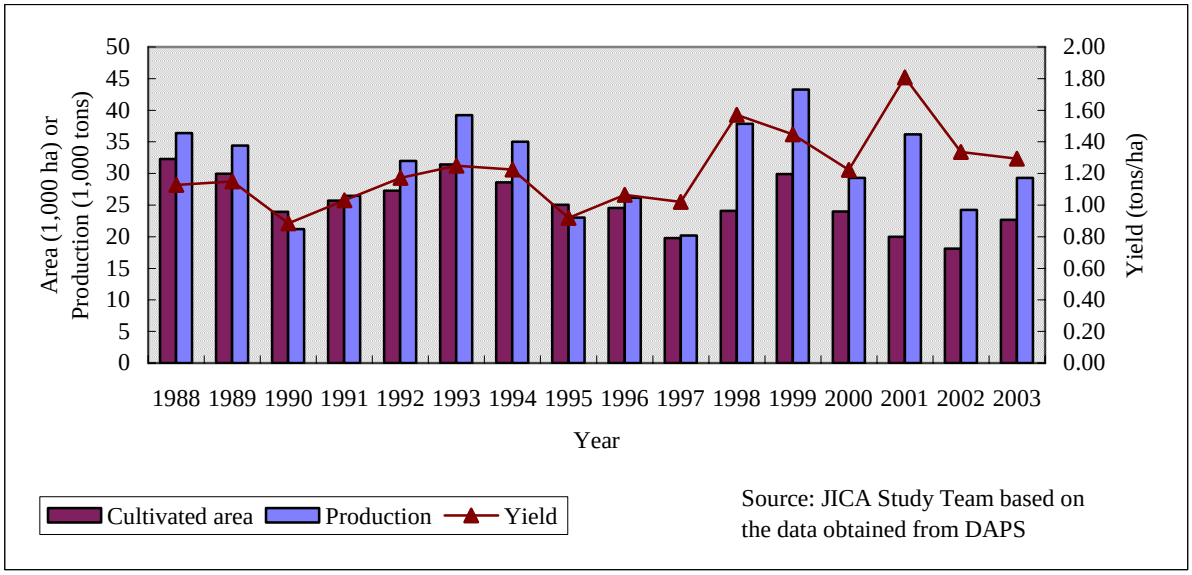


Figure 3.2.5 Change in the Cultivated Area, Yield and Production of Paddy Rice in Middle and Upper Casamance

The cultivated area of paddy in the Middle and Upper Casamance fluctuates between 20,000 ha and 30,000 ha. Having tended to increase, the yield also fluctuates between 1.0 and 1.8 ton/ha. As a result, the production fluctuates between 20,000 and 40,000 ton.

(4) Comparison of Rice Production by Areas

Harvested area, yield and production of paddy rice in Senegal as of 2004/2005 rainy season cropping is shown by region in the Table 3.2.3.

Table 3.2.3 Paddy Production Record by Region (2004/2005)

Region	Harvested area (ha)	yield (kg/ha)	Production (T)
Saint-Louis	24,559	5,784	142,045
Matam	4,676	5,647	26,404
Tambacounda	1,625	1,048	1,704
Fatick	501	200	100
Kaolack	221	1,300	287
Kolda	17,442	1,396	24,351
Ziguinchor	33,825	1,118	37,800
Total 2004/2005	**82,849**	**2,809**	**232,692**
Result in 2003/2004	87,814	2,640	231,805
Average of last five years	93,464	2,485	235,496

Source : ONRS-Bulletin D'Informations sur La Filiere Riz No.11, August 2005

As seen in the previous sub-section, the rice production in Senegal varies much among the regions. The Saint Louis and Matam regions where intensive irrigated rice cultivation is practiced produce more than 70% of the nation's total production. On the other hand, the Kolda and Ziguinchor regions where traditional rainfed manual farming has long been practiced account for some 27% of the national production. The rest were produced in Fatick, Kaolack and Tambacounda where women are the main players of the paddy cultivation under rainfed condition.

Table 3.2.4 shows the characteristics of the rice farming of each of the five regions.

Table 3.2.4 Comparison of the Farming Practices among Rice Production Regions

Region / Items	Saint Louis (St. Louis and Dagana)	Saint Louis (Podor) and Matam	Fatick	Kolda (Traditionelle/ Anambé)	Ziguinchor
Position of rice as staple food	First	First	Secondary	Secondary	First
Cropping season	Jun./Aug.– Oct./Dec. Jan./Feb. – Apr./May	Jun./Aug.– Oct./Dec.	Jul./Aug.– Sep./Oct.	July - October	July - October
Varieties used	High yielding varieties (improved)	High yielding varieties (improved)	Local varieties (partly improved)	Local varieties/High yielding improved	Local varieties
Farming environment	Irrigated lowland	Irrigated lowland	Rainfed lowland	Rainfed lowland /irrigated lowland	Rainfed lowland and upland
Parcel size	Large (>1 ha)	Medium (>0.25 ha)	Small (<0.1 ha)	Small/large	Small
Major player	Men	Men and women	Women	Women/Men	Men and women
Nursery	Direct sowing under submerged condition	Direct sowing (submerged), nursery (transplanting)	Direct sowing (dry condition)	Direct sowing (dry condition/ submerged)	Direct sowing, nursery (transplanting)
Land preparation	Mechanized	Mechanized	Manual	Manual/ mechanized	Manual
Fertilizer dosage	High	High	None to minimum	Low/High	None to minimum
Use of herbicides	Common	Common (partly not used)	None (manual weeding)	None/Common	None (manual weeding)
Harvesting	Combine harvester, manual	Manual, combine harvester	Manual	Manual/Combine harvester, manual	Manual (partly panicle cut)
Threshing	Power thresher	Manual threshing, power thresher	Manual threshing	Manual threshing/ Power thresher	Manual threshing
Average yield (ton/ha)	> 5	> 4	1 - 2	1 - 2 /unknown	1 - 2
Destination	Self-consumption, selling	Self-consumption, selling	Self- consumption	Self-consumption/ self-consumption, selling	Self-consumption
Problem, constraints	Unavailable machinery, high cost of production, difficult marketing, delay in repaying credit, untimely supply of inputs	Unavailable machinery, high cost production, difficult marketing, delay in repaying credit, untimely supply of inputs	Saline/alkaline/ acid, lack of manpower, lack of good seeds	Traditional: saline toxicity, low yield, pest and diseases; Anambé: difficult marketing, lack of machinery, high cost of production, bad debt	Saline/acid toxicity, siltation, water shortage, pest and diseases, effect of civil war

Source: Prepared by the JICA Study Team based on the results of the Agricultural survey in Senegal river valley, socio-economic survey in Casamance area, problem analysis workshops for respective areas, etc.

The cultivation of paddy rice in the Saint Louis and Matam regions along the Senegal river is characterized by the high input – high out put agriculture under irrigation, attaining as high yield as over 5 ton/ha on average. Rather heavy dosage of fertilizer (DAP with 100kg/ha and urea with 250 to 300 kg/ha) and use of herbicides (propanil and 2,4-D) are common in the area. On the other hand, harvest and threshing works varies within the regions. In the downstream area of the Senegal river (the Delta area), where paddy holding area per farmer is large, farmers use combine harvester or combination of manual harvest and power thresher for harvesting and threshing. In the middle and upstream of the river (the Podor department and the Matam region), harvesting and threshing are generally done manually. Among the problems the farmers in the Senegal river valley face, delay in the start of farming due to the lack of tractor for land preparation, high cost of production (including inputs, irrigation water charge, machinery services, etc.), difficult marketing leading to the delay in the repayment of loan, delay in the supply of inputs and harmful birds are major ones.

In the Fatick region, the rice farming has been considered women's work, and most rice farming works are done by the women's groups. In sowing, paddy seeds are sown on the ground where

are cultivated by women with hoes to cover the seeds with soils. In general, paddy seeds they use are those harvested in the previous season. They are usually local varieties of short growth duration with salinity tolerant. In most cases, fertilizer is not used, and the use of herbicides is also limited. So weeding work becomes much burden on women. Further, harvest and threshing works are also done manually. The reduction of annual rainfall over the decades had induced the serious saline and/or acid problems in the soils through sea water intrusion, resulted in the abandonement of paddy cultivated area. Besides, there are other problems including lack of manpower caused by the competition with upland crops cultivation and degraded quality of seed rice.

Rice in the Kolda region is produced by two types of farming practice: the traditional rainfed farming and modern irrigated farming. The traditional rainfed rice cultivation is done mainly by women. This is practiced in the lowland, called « faro » in local language, which are inundated in rainy season. The rainfed rice cultivation is exclusively for home consumption, although the position of rice as staple is secondary after millet and maize. The constraints to rice production include low yield, salinization of paddy field and insect attack. Another rice cultivation, irrigated paddy procuction is practiced in the Anambé catchment developed by SODAGRI. The rice cultivation employs modern mechanized farming technique for commercial production, and is mainly done by men. Rice is not the first staple in this area either. Rice farmers in the Anambé area face various problems such as difficult marketing of the products, lack of agricultural inputs, high cost of production, bad debt, etc.

Rice cultivation has been practiced since long before in the Ziguinchor region. For Diolas, in particular, the rice and the farm land are closely related with their life and religious beliefs. The rice, considered sacred objects and symbol of richness and social status, is hence rarely marketed. Also, chemical products such as fertilizer and agro-chemicals, and agro-machinery of certain types are often avoided because the use of them is considered sacrelege. So, the traditional way of rice farming is done manually from land preparation until harvest. Land preparation is men's work, while women are responsible principally for other works. Rice cultivation in the region is constrained by salinity/acidity toxicity induced by the sea water intrusion and insufficient amount of rainfall, resulting in the low yield. There exist other problems such as insufficient man power and existence of land mines both of which were related to the civil war which has lasted for more than 20 years.

3.2.2 The Irrigation Schemes in the Senegal River Valley

(1) Classification of Irrigation Schemes

The potential irrigable surface in the left bank of the Senegal River Valley is estimated at 240,000 ha, 38 % of which, meaning 90,200 ha, have already been developed. The Government of Senegal has prepared the Master Plan of Integrated Development for the Left Bank of the Senegal River (PDRG) and has fixed the development area of the target irrigation at 88,000 ha by 2015. The developed surface has already exceeded forecasts, and the cultivable area has reached about 84,000 ha. It means that the possibility of a new development for the expansion of irrigated lands is limited.

Rice production in the Senegal River Valley are classified in various types of management and development (Large-scale Irrigation Schemes (GA), Villagers' Irrigated Perimeters (PIV) and Private Irrigated Perimeters (PIP)) according to the main development actor, the area size of the development, the types of works for the development, management types, etc.

Table 3.2.5 Comparing irrigated perimeters according to the type of management

	Large-scale Irrigation Scheme (GA)	Village Irrigation Scheme (PIV)	Private Irrigation Scheme (PIP)
Funding sources	Government	Government	Private Sector
Zone of Development	Lower reach of the Senegal River (Zone of Delta)	Middle and Upper Valley (Podor, Matam)	Zone of Delta
Period of Development	Since 1960's (now became Intermediate scale Irrigation Scheme (AI))	1970's-1980's	Concentrated during the period of 1989-1993
Scale of Development	> 1,000 ha (AIs: 500-1,000 ha)	15-50 ha	Not more than 500 ha
Level of Development	High	Low	Low
Facilities	Electric Motor-pumps, Canal and Drainage Networks	Mainly Diesel Motor-pumps, Canal Network	Mainly Diesel Motor-pumps, Canal Network
Management	UNION	GIE, SV	GIE
Problems	Ageing of the facilities	Salinization, Ageing of facilities	Salinization, difficult management of facilities

Source: JICA Study Team based on "Etude Bibliographique sur la Filière Riz au Sénégal" by Abdoul Aziz Gueye, Sept. 2004

The GAs were developed predominantly in the area of the Delta mainly by the Senegalese government. At the basis of detailed plans, track dikes are built around basins and pump stations with canal network are also established. The surface of a piece of GA is more than 1,000 ha generally. As for a plot, which is intended for mechanized cultivation, it is rather large and measures more than 0.5 ha. Through the implementation of the Structural Adjustment Program, the responsibility in terms of management of the irrigation schemes is transferred from the government to users' groups that is to say the Hydraulic Union (Union), from the second part of the 1980's. The Union collects irrigation toll charges from its members and entrusts to an external organization the maintenance of pumps and canals. However, maintenance or repair works are often too costly for a farmers' organization to cover by itself.

The PIV is a type of small size irrigation scheme with rather simple facilities which was introduced in the 1970's and 1980's as a relief activity for the farmers suffered from the drought at the expense of the government. The facilities are constituted of diesel motor-pumps and canal networks. The surface varies between 15 and 50 ha and the level of development is not very suitable. There are constraints related to the salinization, the ageing of facilities, and to the high costs of operation and maintenance of pumps, which consequently result in the high production cost.

The development of PIPs started during the second half of 1980's with a private initiative, principally in the zone of the Delta. It is developed with pump and canal network facilities, but the leveling was not done properly and the system is not endowed with drainage network. Many PIP plots have been abandoned because of the salinization. Besides, PIP farmers, like the PIV ones, complain about problems related to the high production cost including expenses for the operation of pump.

Smaller size irrigation schemes such as PIV and PIP are very numerous and represent 98 % of the total number of perimeters developed in the valley and the total surface of these two types of irrigated perimeters covers 71 % of the developed areas. However, on the totality of the developed areas, about 7.2 %, i.e. 6,500 ha, have been abandoned for some reasons. The abandoned surface is particularly large in the PIV and PIP which represents 81 % of the totality of abandoned schemes. The abandonment rate was particularly high for PIV, representing 12.9 % of the PIV's total area.

Many PIV were developed at the expenses of the Government, as a compensation for the drought. The initial investment was only about 800 to 1,600 US dollars per ha. The high rate of abandonment of developed perimeters can be related to this low investment. The farmers of

PIV often complain about difficulties that they encounter in the drainage of water and the inadequate leveling. The general situation of irrigation schemes in the Senegal River Valley is illustrated in table 3.2.6.

Table 3.2.6 Inventory of Irrigation Schemes (2003/04)

Category	Number of schemes	Total Surface Developped (ha)	Surface abandoned (ha)	Rate of abandonment (%)	Exploitable Area (ha)	Cultivated Area (ha)	Proportion of cultivated areas (%)
Large-scale scheme (GA)	103 (4)	26,200 (29)	1,261 (19)	4.8	24,941 (30)	19,133	77
GA Non Transferred (GANT)	13 (1)	5,087 (6)	280 (4)	5.5	4,808 (6)	2,789	58
GA Transferred (GAT)	22 (1)	15,472 (17)	615 (9)	4.0	14,858 (18)	12,059	81
Intermediate-scale scheme (AI)	68 (2)	5,641 (6)	366 (6)	6.5	5.275 (6)	4,285	81
Village Irrigation Scheme (PIV)	803 (28)	21,613 (24)	2,780 (43)	12.9	18,833 (23)	12,686	67
Private Irrigation Scheme (PIP)	1,922 (68)	42,370 (47)	2,491 (38)	5.9	39,879 (47)	10,093	25
Total	2,828 (100)	90,183 (100)	6,532 (100)	7.2	83,653 (100)	41,912	50

Source: JICA Study Team, according to the SAED's Data Base

(2) Cropping Intensity and Crop Selection

The total surface cultivated all through the 2003/04 campaign, makes only 41,912 ha, representing 50 % of the exploitable areas in the River Valley. The PIP influenced most with its low rate of sown areas of only 25 %. That of PIV was of 67 % and 77 % for the GA. It is very likely that the unfavorable sown area rates are related to bad development of plots, which should be improved in the short run.

The total surface cultivated during the 2003/04 rainy season, was 27,776 ha, of which 83 % representing 23,015 ha constituted paddy. Paddy is also cultivated in the hot dry season on a surface of 3,191 ha (14 % compared to the surface of rainy season). Besides, various vegetables and cereals are produced. During the 2003/04 campaign, maize was planted for 4,000 ha, tomato on 3,262 ha, followed by onion with 3,048 ha. These are followed then by sorghum, okra, sweet potato and groundnut. The cultivation of tomato is practiced in the cold dry season which starts as early as the end of rice cultivation of rainy season; thus the two crops compete.

On the other hand, these vegetables benefit from several advantages such as reliable marketing path for the case of tomato (for processing) and the import limitations during the harvest period for onion. These two products are far more profitable than rice. Given that the agricultural campaign of these vegetables coincides with the harvest of paddy, producers tend to replace the cultivation of paddy with that of vegetables. It is difficult to imagine in the near future that the production of rice will be rapidly replaced by that of vegetables given the quality of soils of current paddy fields, and the problem of stock and transport of vegetable. But it is necessary to increase the net profitability of rice production in order to improve farmers' income.

3.2.3 Recommended Farming Practices and Actual Cropping Pattern of Paddy Rice in the Senegal River Valley

In the Senegal River valley, a recommended cropping calendar with farming practice under

irrigation condition has been prepared by ADRAO, SAED and ISRA, and it is widely disseminated and practiced by the farmers in the area. The major points of recommended farming practices of paddy[9] are shown on the Table 3.2.7.

Table 3.2.7 Major Points of Recommended Farming Practices of Paddy in the Senegal River Valley

Farming practice	Recommendations
Varieties to be uses	Dry season : IR108, Ikong Pao (growth duration: 105 days) to be sown between February 15 and March 15. Wet season: Jaya, IR1529, Sahel 201 and Sahel 202 (growth duration: 120-130 days), to be sown by August 1. Late wet season: Sahel 108 and Ikong Pao to be sown by August 15.
Sowing	Direct sowing: after soaking 24 hrs and incubating 24 hrs, sow in the submerged condition with the water depth of 3 to 5cm. Uniform sowing with 80-120kg/ha. Nursery preparation: leveled. 200g to 300g of seed per m^2. 10g of urea per m^2. Grow 20 to 25 days before transplanting in wet season, and 25 to 35 days in dry season. Seed rate: 30 to 40 kg/ha. Transplanting spacing: 15 to 20cm apart.
Use of herbicides	Direct sowing: spray between 15 to 21 days after sowing under drained condition. Early in the morning. Uniform spray. Propanyl/2,4-D (8/1 l/ha), Basagran PL2 (7 l/ha)
Fertilizer application	DAP or TSP at land preparation stage, or three weeks after sowing/two weeks after transplanting at latest. Optimum dosage: 100kg/ha Urea to apply at splitted stages: 40% at tillering, 40% at panicle initiation and 20% at booting; or 50% at tillering and 50% at panicle initiation. Optimum dosage: 300kg/ha

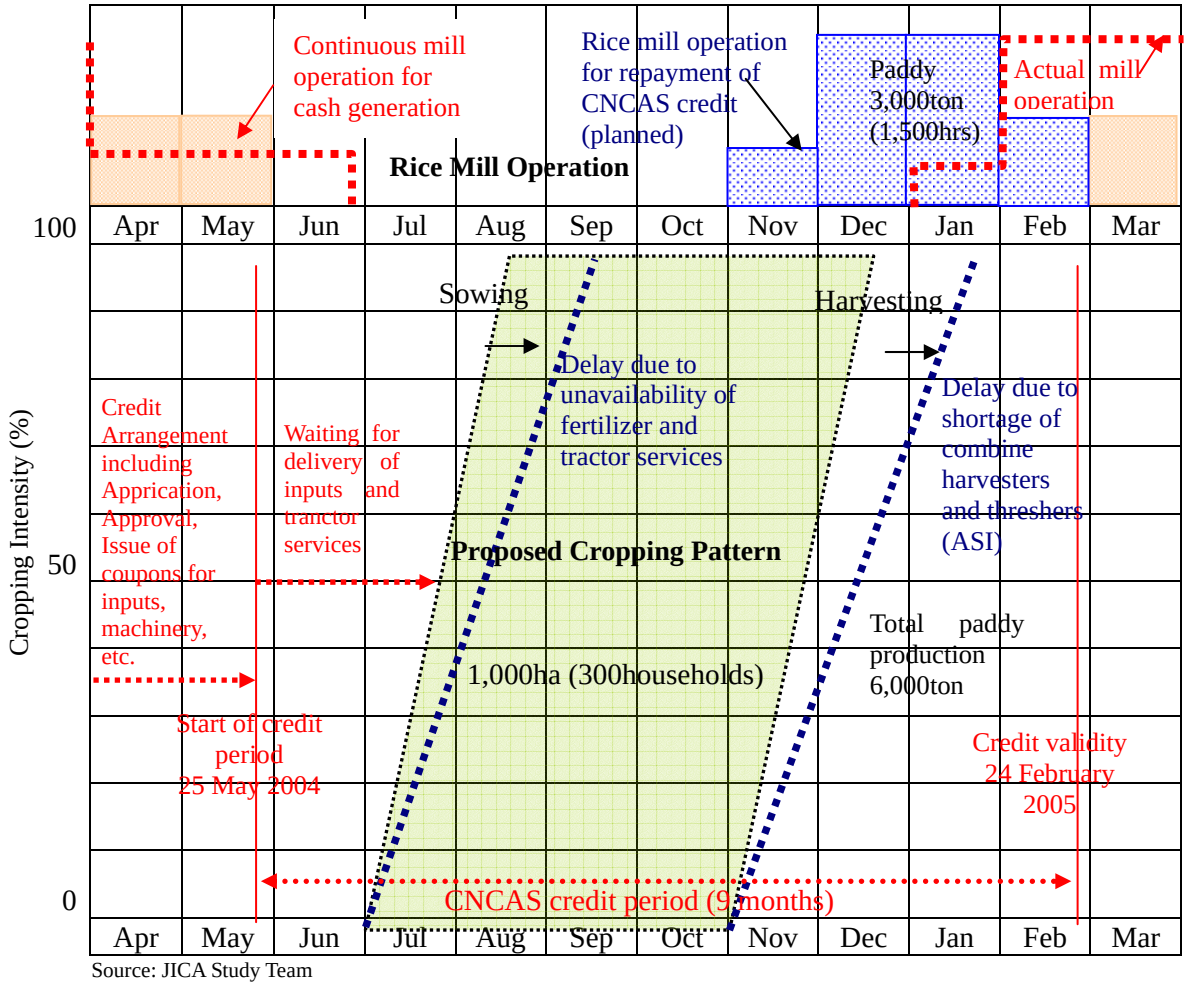
Source: JICA Study Team extracted from 'Gestion intégrée pour la riziculture irriguée dans la vallée du fleuve Sénégal (St-Louis – Bokhol)', ADRAO/SAED/ISRA

The recommended cropping pattern is determined considering the three critical seasons. One is April and May when the maximum temperature is very high, often exceed 40°C, another is July and August when occasional heavy rain falls, and the other is November and December when the minimum temperature often goes down to below 18°C. All these three seasons adversely affect fertilization process. Flowering stage should avoid these seasons.

However, due to the external factors such as the unavailability of farm machinery and inputs, and to the long procedure of the loan transfer, which delays the procurement of farm inputs, the farmers often find difficulty in following the cropping calendar as recommended.

As an example, the cropping calendar experienced by the Débi-Tiguette farmers in 2004/2005 farming season is shown in Figure 3.13.

[9] ADRAO developed a simulation model called "RIDEV", which, based on the past climate record, can estimate the growth duration, timing of fertilizer application, timing of draining out water and possible sterilization rate by varieties, locations and sowing dates.



Source: JICA Study Team

Figure 3.2.6 Schematic of Cropping Calendar of Débi-Tiguette Village in 2004/2005 with the Rice Mill Operation and CNCAS Loan Schedule

The delay in the commencement of the cultivation results in the yield decrease because of the decrease in fertility due to the low temperature at the time of flowering. Besides, the delay in the harvesting and threshing because of the difficulty in hiring combine harvester and power thresher (ASI) accelerate the decrease in the moisture content of paddy.

The delay in harvesting not only lowers the grain quality but also delay in the commencement of rice mill operation, which brings about the difficulty in reimbursing the loan amount to CNCAS.

3.2.4 Farm Economy

A farm economy survey[10] has been conducted for the rice producers in the Senegal river valley jointly by ISRA, ITA, ADRAO, SAED and CIRIZ. Crop budget of 120 farmers with different type of management (large irrigation development (GP), village irrigation (VIP) and private irrigation (PIP)) in the whole valley was surveyed.

The yield of paddy also varies from 4.3 tons/ha on average under the VIP to 5.5 tons/ha under the GP. While, the cost of production varies from FCFA300,00/ha for those under the VIP to

[10] Amadou Abdoulaye Fall: "Analyse des Marges au Stade de la Production", Amelioration de la Qualité et Valorization du Riz Produit dans la Valée du Fleuve Senegal, FNRAA-Riz de Qualite: Projet de Recherche en Partenariat ISRA-ITA-ADRAO-SAED-CIRIZ; June 2004

FCFA386,000/ha under the PIP. Assuming that each kg of paddy is sold at FCFA100, the net benefit per hectare basis is the highest under the GP with FCFA192,000, followed by the VIP (FCFA127,000) and the PIP (FCFA64,000).

Of the total cost, cost of inputs including seeds, fertilizer and agro-chemicals account for the most significant share with 26% to 35%, depending on the development type. In particular, fertilizer costs shares more than half of input costs. Other significant cost items include irrigation and harvest and transportation. These top three cost items account for 65% to 73% of the total cost. Cost per one kilogram of paddy is FCFA65 for GA, FCFA70 for VIP and FCFA86 for PIP, respectively, compared to the present farmgate price of paddy with FCFA90/kg.

Table 3.2.8 Benefit-Cost Analysis of Paddy in the Senegal River Valley by Type of Irrigation

	Irrigation Scheme (Development Type)					
	Large Development（GA）		Village Irrigation（PIV）		Private Irrigation（PIP）	
Gross Benefit (FCFA/ha)	550,900		428,700		449,700	
Yield (kg/ha)	5,509		4,287		4,497	
Farm gate price (FCFA/kg)	100		100		100	
Total Cost of Production	359,188	(100.0)	300,456	100.0	386,148	100.0
1) Land preparation	23,500	(6.5)	23,500	7.8	48,000	12.4
2) Inputs	112,672	(31.4)	106,500	35.4	99,895	25.9
3) Irrigation	64,167	(17.9)	41,143	13.7	78,232	20.3
4) Man power	62,000	(17.3)	51,000	17.0	57,000	14.8
5) Harvest, threshing, transport	84,428	(23.5)	58,130	19.3	71,792	18.5
6) Loan	10,955	(3.0)	6,485	2.2	16,254	4.2
7) Other costs	1,467	(0.4)	13,700	4.6	14,975	3.9
Net Benefit	191,712		127,171		63,552	
Unit cost (FCFA/kg)	65		70		86	
Unit benefit (FCFA/kg)	35		30		14	

Note: The number of samples is 80 for GA, 20 for PIV, and 10 for PIP, respectively.
Source: ISRA/ITA/SAED/CIRIZ

3.3 The Post-Harvest

3.3.1 The Big and Medium sized Rice-Mills

SAED has identified 41 big and medium sized rice mill units in the Senegal River Valley in 2003. The results of this survey have been revised and updated through the Study presented in Table 3.3.1.

Table 3.3.1 Milling quantity and recovery rate in the large and average capacity rice mills in the Senegal River Valley.

Situation of rice mills		Number of rice-mills	Total capacity of rice-mills (in paddy)	
			Capacity per hour	Daily capacity (16 hours of activity/day)
1	Estimated Number of rice-mills in 2003	41	-	-
2	Rice-mills in service.	15	33.0 tons/h	528 tons/day
3	Operational rice-mills but not in service	4	10.5 tons/h	168 tons/day
4	Non-existent or shutdown	22	-	-

Source : SAED 2003, JICA Study Team 2004-2005

Rice farmers start their activity from July/August to November/December. They get a campaign credit from the CNCAS with a nine months refund period (from May to February of the next year). Then, most of the paddy is harvested and delivered for its processing at the rice-mills within the period going from December to February. Thus, most of the production has to be processed during this short period. That is the reason why the total capacity of rice-mills seems insufficient.

Of the 41 rice-mills, only 19 are operational with a total capacity of 43.5 tons/hour, that is to say 696 tons/day. The activity of rice-mills in the area lasts five months (108 weekdays). The total quantity of paddy which must be processed is of 75.000 tons/year. However, the existing rice-mills can process 180.000 tons/year at most if the activity period is extended from 5 to 12 months.

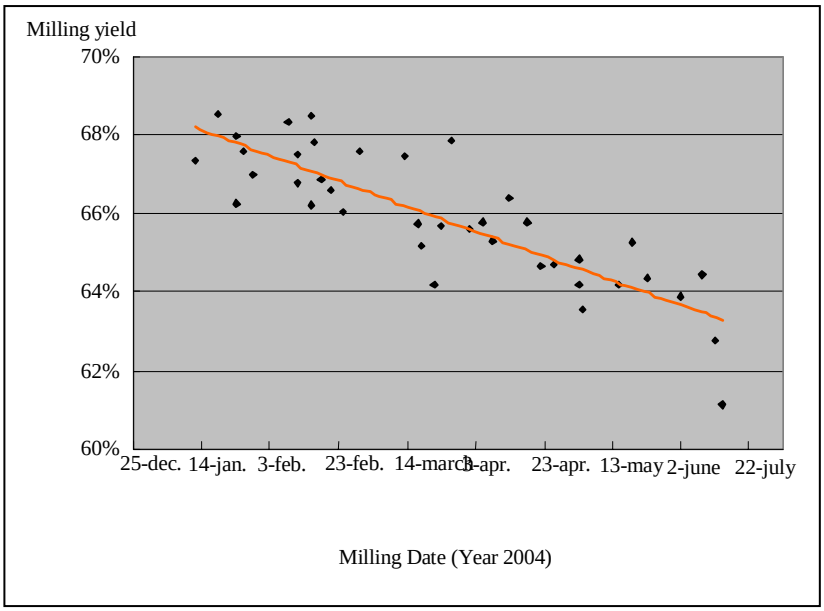
On the other hand, the production of paddy of all the valley in the last four years varies from 103.000 tons in 2000/01 to 153.000 in 2003/04, which means that rice-mills are capable of processing the totality of the production, at the condition, however, of being in activity all year long.

The Study is aware of the urgent need to revise the cropping calendar and the planning of rice production, credit and milling, as it is mentioned in Section 2.4.3 relating to Agricultural Economy. The problem is not related to the milling capacity but rather to the planning of the production activities, which is also one of the decisive factors.

3.3.2 Recovery Rates and Storage Periods

As indicated in section 2.4.3, the paddy is not harvested in due time because of the lack of combine harvesters in most cases. The grains of paddy are over-dried because of an unnecessarily long stay in the farms. The moisture content is well under the 14 %, optimal level of humidity after processing. As a consequence the recovery rates after milling are low.

Figure 2.5.1 indicates an example of relation between the duration of the storage, the date of harvest, the milling yield, and the recovery rate at the Debit-Tiguet rice-mill in 2003/04.



Source: Débi-Tiguet Union, 2003/2004

Figure 3.3.1 Evolution of the milling yield in the rice-mill of the Débi-Tiguet Union

The rice-mill of Debi-Tiget worked during six months, from early January to mid-May. The

milling recovery rate decreased from 68 % in January to 63 % in May. Some 250 kg of paddy are lost when the paddy yield is of 5 tons/ha.

3.3.3 Small Rice-Mills

Producers have recourse to the milling services of rice millers when they need cash to refund the CNCAS credit. Otherwise, they process their paddy with small milling units (Engelberg) for their consumption or to sell it to 'banabanas'. The milling expenses are of 12 FCFA/Kg, whereas those of an Engelberg husker vary between 8.3 FCFA/Kg to 10 FCFA/Kg. Producers often use the Engelberg huskers in their villages because it is difficult for them to transport the paddy to the big rice-mills, which are located far away from the paddy fields.

The previous study carried out by SAED (1996) identified 463 Engelberg in the Valley, of which 351, that is to say 75 % were operational. Their geographic distribution revealed a strong availability in Dagana where 232 units were identified, while there are only 80 in Podor, 30 in Matam, and 9 in Bakel in the region of Tambacounda.

3.4 Marketing

3.4.1 Background and Subject of Marketing Survey

Generally, it is said that 'Marketing' is the business activity related the development, sale and advertisement of products and or services which satisfy consumers'needs and desires. The surplus products except a part for selfsufficiency are distrivuted as cash crop in a market. Therefore, the concept of the Marketing is applied also to the rice.

Several marketing surveies on rice marketing and consumers' needs on rice quality have been done in Senegal. However, the marketing survey for analysis of the consumers' evaluation structure about rice quality has not been conducted. This kind of investigation offers the important information for establishment of the marketing strategy of rice.

Under such a situation, it is essential to evaluate the consumers' needs for rice in order to assess the potential for increased production and improve the quality of domestic rice. The necessary information should be collected directory from consumers as their own voice or a request. In order to accomplish this, marketing survey was planned and carried out during study period.

The subjects concerning marketing survey on rice are as follows.

1. to grasp consumers' needs and desires of rice quality
2. to reflect the consumers' needs and desires in the improvement of rice quality

3.4.2 Outline of the Marketing Survey

(1) The Purpose of the Marketing Survey

The main purpose of the marketing survey under the study is accumulation of "the voice of the consumers". The survey was planned based on the logic of the consumers' marketing. The survey is not only introduction of new survey method but also technology transfer to DAPS. It is expected that the main subjects on rice marketing become clear through the collection and analysis of data and the result of the survey is reflect in the technology transfer program.

(2) Kinds and Outline of Each Survey

The conducted marketing survey consists of three different survey as mentioned below. All interwiewees answered three of them.

a) Household Rice Consumption Survey：

This survey was done using the same questionnaire which prepared for Household Rice Consumption Survey in Dakar and Saint Louis done by DAPS in 2001.

b) Evaluation Grid Method (EGM) Survey：

The EGM Survey is a kind of interview survey which repeats fixed process of interview. The survey was done in order to grasp the most important information for marketing.

c) Analy tic Hierarchy Process (AHP) Survey

The survey was carried out to consider priority of the subjects for improvement of rice quality obtained by the EGM survey and to make evaluation of the consumesr about domestic rice and imported rice clear.

The survey areas and the number of interviewees are shown in the following table.

Table 3.4.1 Numbers of Examinees in Each Survey Area

Suvey Area	Dakar	Suburb of Dakar (Rufisque)	St. Louis	Valley (St.Louis, Dagana, Podor and Matam)	Fatick	Total
Nos of Interviewees	104	101	50	110	50	415

Source: JICA Study Team, Marketing Survey, 2004 - 2005

The relation ship of 415 interviewees to the head of house are described in the table below.

Table 3.4.2 Relationship of interviewees to the head of families

Relationship to the head of family	Dakar	Suburb of Dakar	St. Louis	Valley	Fatick	Total	
	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	%
The head of family (the person himself)	25	15	5	104	6	155	37.5
Wife	63	55	30	1	26	175	42.4
Son/daughter	7	16	10	4	11	48	11.6
father/mother		5	1	1		7	1.7
G father/G mother		2			1	3	0.7
Brother/sister	3	2	1		1	7	1.7
G child	2	2	1			5	1.2
Other relative	4	2	1		2	9	2.2
メイド		2			2	4	1.0
その他			1		1	2	0.5
Total	104	101	50	110	50	415	100.0

Source: JICA Study Team, Marketing Survey, 2004 - 2005

The majority of interviewees were the heads of family and wives. The wives in Dakar and other cities have no occupation. The major occupation of interviewees in urban and suburb areas was trade, while the most of the interviewee in the valley were farmers. Regarding the ethnic groups of injterviewees, Ouolof is the major ethnic group (52.0%) and Poulaar (26.0%) and Serere (13.0%) follow.

The main income sources of the households in the urban and suburb area are salaries or wedges. The result shows tha actual condition of city residents who make their living by cash earning. In contrast with this, the farmers in the valley is greatly depend on the income oftained by sale of rice harvested once a year. The actual condition of the farmers who are greatly dependent on

rice was confirmed. As for their income level, the monthly incomes of the majority of them are less than 100,000FCFA or between 100,000 and 299,999FCFA. Generally, the incomes of the households in city areas are high and the incomes of the farmhouses in the valley are low.

3.4.3 Household Rice Consumption Survey

The outline of the Household Rice Consumption Survey is as follows.

(1) Consumption Structure of the Staple Cereals

The following is a comparison table of the surcey results on consumption structure of staple cereals in 2001 and 2005.

Table 3.4.3 Major Consumed Cereals (Dakar and St. Louis)

Cereals	Dakar				St. Louis			
	2005		2001		2005		2001	
	Nos	%	Nos	%	Nos	%	Nos	%
Whole grain (Perfumed)	35	14.6	2	0.8	2	2.3	5	2.0
Whole grain (Non-Perfumed)	1	0.4			2	2.3	4	1.6
Broken (Perfumed)	93	38.8	112	43.4	8	9.2	16	6.5
Broken (Non-Perfumed)			82	31.8	4	4.6	3	1.2
Mix (Perfumed)	2	0.8	3	1.2			2	0.8
Mix (Non-Perfumed)			6	2.3			1	0.4
Whole grain (Local)	2	0.8			8	9.2	14	5.7
Broken (Local)					16	18.4	72	29.3
Mix（Local）					12	13.8	12	4.9
Sorghum			1	0.4				
Millet	94	39.2	42	16.3	30	34.5	87	35.4
Maize	11	4.0	5	1.9	3	3.4	28	11.4
Others	2	0.8	5	1.9	2	2.3	2	0.8
Total	240	100.0	258	100.0	87	100.0	246	100.0

Source: Household Rice Consumption Survey in the Regions of Dakar and Saint Louis, ONRS, 2001 and JICA Study Team, Marketing Survey, 2004 - 2005

The findings of the survey in 2005 reveal that imported rice was predominance in Dakar. The last time like investigation. The situation is similar to the result of the survey in 2001. The consumption ratio of local rice is extremely low. The situation has not changed, either. In contrast, the results of both surveys in St. Louis shows the predominance of the local rice. The figures indicate that Millet is still important staple cereal in both Dakar and St. Louis.

Table 3.4.4 Major Consumed Cereals (Suburb of Dakar, Fatick and Valley)

Study Area	1st		2nd		3rd	
	Nos	%	Nos	%	Nos	%
Suburb of Dakar	Broken（Perfumed）		Millet		Maize	
	88	48.9	55	30.6	23	12.8
Fatick	Millet		Broken（Perfumed）		Maize	
	38	34.2	32	28.8	19	17.1
Valley	Local（Own rice）		Maize		Sorghum	
	108	59.0	34	18.6	18	9.8

Source: JICA Study Team, Marketing Survey, 2004 - 2005

The consumption rate of imported broken rice is quite high in Suburb of Dakar and Fatic. The consumption of Millet is also dominant in Fatic. In contrast, the consumption of local rice (selfsufficiency) is extremely high and maize and sorghm follow it in the rural area along the Senegal river valley.

(2) The price Range of the Rice

The following table shows the price range of rice in the survey areas.

Table 3.4.5 The Price Range of Major Cereals

	The Price Range (FCFA/kg)					Total
	>175	175～200	200～ 220	220 ～250	250<	
Dakar 2005	12 9.0%	3 2.3%	4 3.0%	95 71.4%	19 14.3%	133 100.0%
Dakar 2001		3 1.5%	11 5.4%	161 78.5%	30 14.6%	205 100.0%
St. Louis 2005		13 26.5%	12 24.5%	24 49.0%		49 100.0%
St. Louis 2001	2 1.6%	72 56.3%	24 18.8%	30 23.4%		128 100.0%

Source: JICA Study Team, Marketing Survey, 2004 - 2005

The table shows that the prices of rices were at its peak between 220FCFA/kg and 250FCFA/kg in Dakar. The price range between 220FCFA/kg and 250FCFA/kg is the ordinary price range of imported broken rices in Dakar.

The peak of price range prices of rices were between 175FCFA/kg and 200FCFA/kg in St. Louis in 2001. However, the peak price range in 2005 shifted to the same range of Dakar. In St. Louis, the amount of supply of local rice influences the price of rice. The survey in St. Louis was done during Jury in 2005. The local rice was in short supply during the season and the prices of rice. It is expected that the prices of rices went up a little by the effect.

Table 3.4.6 The Price Range of Major Cereals (Suburb of Dakar, Fatick and Valley)

	The Price Range (FCFA/kg)					Total
	>175	175～200	200～ 220	220 ～250	250<	
Suburb of Dakar	1 1.0%	1 1.0%	1 1.0%	88 91.7%	5 5.2%	96 100.0%
Fatick		3 5.9%	10 14.6%	37 72.5%	1 2.0%	51 100.0%
Valley	7 8.0%	33 37.5%%	1 1.1%	47 53.4%		88 100.0%

Source: JICA Study Team, Marketing Survey, 2004 - 2005

The above table shows that the prices of rices in Suburb of Dakar and Fatick were at its peak between 220FCFA/kg and 250FCFA/kg. The similar tendency as Dakar was observed in case of both of them. As mentioned in chapter 3.1.4, The difference between the rice price of the city near Dakar and the rice price of Dakar is small.

The clear two peaks were observed in case of rice prices in rural area along the Senegal River. One were between 175FCFA/kg and 200FCFA/kg and the other ranges from 220FCFA/kg to 250FCFA/kg.

3.4.4 Evaluation Grid Survey

(1) Purpose

In order to grasp consumers' needs, several qualitative methods such as open-ended interviews, group interviews, and in-depth interviews have been proposed to enable direct communication between producers and consumers. The Evaluation Grid Methoed (EGM) which is based on a

clear cognitive psychological theory known as “the Personal Construct Theory” was adopted as the Method for the market survey.

(2) Feature of Evaluation Grid Method

As mentioned above, the method is based on a clear cognitive psychological theory known as “the Personal Construct Theory”, so this theory can be used to provide a lucid and visual explanation of the results of the survey.

> “The Personal Construct Theory”
>
> All mankind have their own peculiar mental structure for an understanding and judgment called cognitive structure. They processed the information acquired through their sense organ according to this structure, and have determined action.

The special features of EGM are as follows.

1) Clarification of Original Evaluative Constructs

   As this was originally an interviewing technique used in clinical psychology with the aim of healing patients, it is possible to use it to determine the way in which people assess products.

2) Acquisition of answers without bias

   While the survey technique is based on free responses by the interviewee, the systematic format imposed by the interviewing technique itself reduces to a minimum interference from the subjective opinions of the interviewer. Reliance on the interviewing ability of the researchers is also kept to a minimum, so little variations is found in the results obtained by different interviews.

3) Clarification of the relation between original evaluate contructs and constructs of higher level and constructs of lower level

   The results of the EGM survey are shown as hierarcy diagram which consists of constructs of higher level, original evaluate contructs and constructs of lower level. The hierarcy diagram shows the causal relationship between three elements clearly.

(3) Method and Process of the Survey

The various rices which were collected from retail shops and main markets in the survey areas were collected and used as samples for the EGM Survey. The features of samples are shown in the table below. Each sample was kept in the transparent plastic bag with a zipper. Only the Initial (Identification Initial) and the price per kg were shown on the plastic bag. The transparent plastic bag with a zipper enable interviewees to looks at samples well, to confirm a smell of smell, and to touch the samples.

Table 3.4.7 Outline of the Rice Samples

Origin	Form	Price (FCFA/kg)	Origin	Form	Price (FCFA/kg)
Thai	Broken	275	Thai	Whole	400-450
Thai	Broken	240-250	Short Grain (aid)	Whole	300
Vietnam	Broken	225	Thai	Whole	600
Thai	Broken	250	Thai	Whole	750
Thai	Broken	225	Pakistan	Whole	1800-1950
USA	Broken	220	Guinea-Bissau	Mix	600
Thai	Broken	240	Guinea-Conakry	Mix	600
India	Broken	200	Senegal	Mix	210
Senegal	Broken	210	Senegal	Mix	300
Senegal	Broken	185	Senegal	Mix	185

Source: JICA Study Team, Marketing Survey, 2004 - 2005

(4) Outline of the survey results

1) Ingestion Frequency, Cognizance and Grouping of Rice Samples

a) Ingestion Frequency and Cognizance

As the first step, the confirmation of the ingestion frequency and cognizance of each rice sample were done. The following table shows the evaluation of sample rices. The degrees of the ingestion frequency and cognizance are divided into 4 categories, namely (1) I eat frequently. (2) I eat sometimes. (3) I know but have not eaten. (4) I don't know and have not eaten.

b) Outline of the result

Table 3.4.8 Ingestion Frequency and Cognizance of Samples (1/2)

Ranking	Dakar	Suburb of Dakar	Fatick
	Origin and Form	Origin and Form	Origin and Form
1	Thai (Broken)	Thai (Broken)	Thai (Broken)
2	Thai (Broken)	Thai (Broken)	Thai (Broken)
3	Short Variety (Whole)	Thai (Whole)	USA (Broken)
4	Thai (Whole)	Short Grain (Whole)	Thai (Broken)
5	Thai (Whole)	Thai (Broken)	India (Broken)

Source: JICA Study Team, Marketing Survey, 2004 - 2005

It is clear that the broken rice is eaten frequently, and the result shows the same tendency as the result of a general survey of consumers' behavior in Dakar and suburb of Dakar. The ingestion frequency of the whole grain rice was high at the next. The other major findings are as follows:

a) The evaluation to crushed rice is divided into two. The evaluation of inferior quality rices is low.
b) Generally evaluation of mixed rices is low.
c) Both the ingestion frequency and ognizance of the domestic rices is low.

The similar tendency as Dakar and suburb of Dakar was observed in case of Fatick. The imported broken rice is eaten frequently and recognition of these rices are high. However, the ingestion frequency and recognition to whole grain rices are low, and the broken rice are preferred more. A high evaluation is set on the quality broken rices.

Table 3.4.9 Ingestion Frequency and Cognizance of Samples (2/2)

Ranking	St. Louis	Valley
	Origin and Form	Origin and Form
1	Senegal (Broken)	Senegal (Mix)
2	Senegal (Mix)	Senegal (Mix)
3	India (Broken)	Thai (Whole)
4	Senegal (Mix)	Senegal (Broken)
5	Senegal (Broken)	Jenegal (Mix)

Source: JICA Study Team, Marketing Survey, 2004 - 2005

In contrast, the survey result obtained from St. Louis and rural area along the Senegal river shows different tendency. The ingestion frequency and recognition of local rices in both of them were overwhelmingly high. It is estimated that the consumers can recognize local rice from the appearance. While the consumers in St. Louis prefer broken rices, the consumers in the valley prefer mixed rice or whol grain rice. The consumers in the valley utilize rice for various dishes instead of other cereals. The diversity of mixed rice and whole grain rice are preferred by them.

The question about self-support of rice is added for interwiewees in the valley. The outline of the result is as follows.

Table 3.4.10 Situation of Selfsuffisiency of rice of the Interviewees in Valley

Description	Survey Result
Rate of Rice Selfseficiency Farmers	18.0%
Period of Un sufficiency*	6 months (from June to November)

Source: JICA Study Team, Marketing Survey, 2004 – 2005

*: It means that the majority of interviewees buy rice during the period.

The table shows that the rice selfsufficiency rate of interviewees in the valley were below 20%. Furthermore, the self sufficiency period of majority of them were less than 6 months. They buy rice from other farmers or neighboring market.

2) Ranking

As the step 2, the interviewees were asked to rank rice samples according to their overall preference. Generally, the interbiewees divided into 2 to3 groups in this survey. The following table shows the result of ranking.

Table 3.4.11 The Result of Evaluation of Samples (1/2)

Ranking	Dakar	Suburb of Dakar	Fatick
	Origin and Form	Origin and Form	Origin and Form
1	Thai (Broken)	Thai (Whole)	Thai (Broken)
2	Thai (Whole)	Thai (Broken)	Thai (Broken)
3	Short Grain (Whole)	Short Grain (Whole)	AUSA (Broken)

Source: JICA Study Team, Marketing Survey, 2004 - 2005

In case of Dakar and Suburb of Dakar, the analysis result shows the same tendency as the result of ingestion frequency and recognition. That is, the imported both broken and whol grain rice from Thailand or other countries is ranked in higher positions.

The evaluation to Senegal rice is low as same as the case of ingestion frequency and recognition. However, quality Senegal rice was given better position than other low quality ones. Judging from these result, it is estimated that appearance is one of the most important factor.

The analysis result of Fatick is also similar. The high positions were given to the imported broken rices. The interviewees in Fatick also regarded appearance as important.

Table 3.4.12 The Result of Evaluation of Samples (2/2)

Ranking	St. Louis	Valley
	Origin and Form	Origin and Form
1	Senegal (Broken)	Senegal (Mix)
2	India (Broken)	Thai (Whole)
3	Thai (Whole)	Senegal (Mix)

Source: JICA Study Team, Marketing Survey, 2004 - 2005

The interviewees in St. Louis gave Senegal rice top positios as shown above. They gave high evaluation to quality India rice and Thailand rice, too. These result indicate that while they accept local rices, similar quality of imported rice is also demanded by them.

The same tendency was observed in case of the valley. The interviewees in the valley prefer the Senegal rices and demand high quality rice.

The consumer's preference was concentrated on three samples, i.e. Thai broken, Thai whole grains and local rice, in plural choice among 12 samples. The results were illustrated in Figure 3.4.1. and the photos of these samples are presented below.

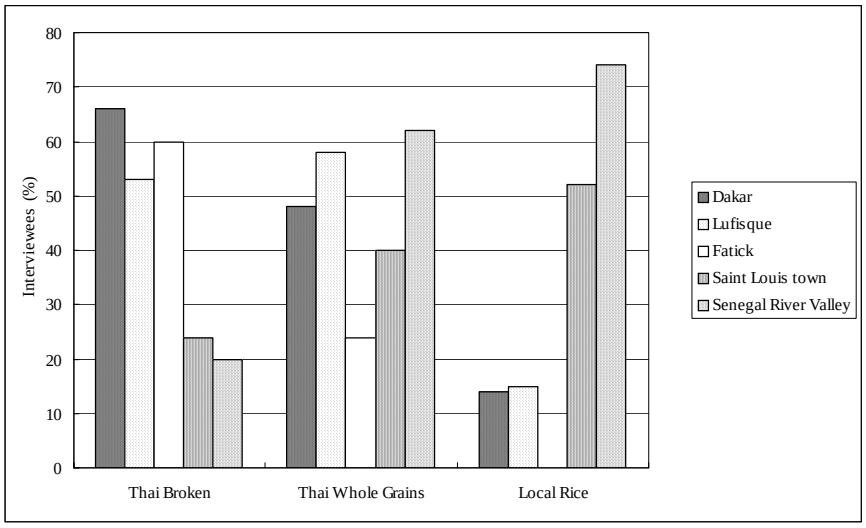


Fig. 3.4.1 Regional difference on preference for rice

Thai (Broken)

Thai (Whole)

Senegal (Broken)

The above figure shows the clear difference in the taste to the rice of consumers in the urben areas and rural areas.

3) Evaluation Grit Method

According to the Evaluation Grid Method, the hearing which repeats a rudder up and a

rudder down was carried out. The constructs of high level led by rudder up expresses expectation of a subject or an impression, and the constructs of lower level led by rudder down is expressing the material characteristic for satisfying evaluation criteria.

The most of interviewees answer “it’s good quality” as the original evaluation constructs. The good quality consists of two meanings, namely a “visual quality”y and a “quality characteristic”. A reasonable price and economical were mentioned as other original evaluation constructs. The original evaluation contents, the constructs of high level led by rudder up, and the constructs of lower level were tied up, and the evaluation structure model consists of these three constructs was obtained as shown Fig. 3.4.2.

These integrated models present the extent and structure of consumers’ viewpoints in evaluating rice.

4) Outline of Analysis based on the EGM

The original evaluation constructs which appeared frequently were 1. “better appearance”, 2. “better characteristic” and 3. “more familiar”. While the interviewees in Dakar and Suburb of Dakar generally regarded appearance as important factor, the interviewees in other three areas considerd physical and chemical character as important elements.

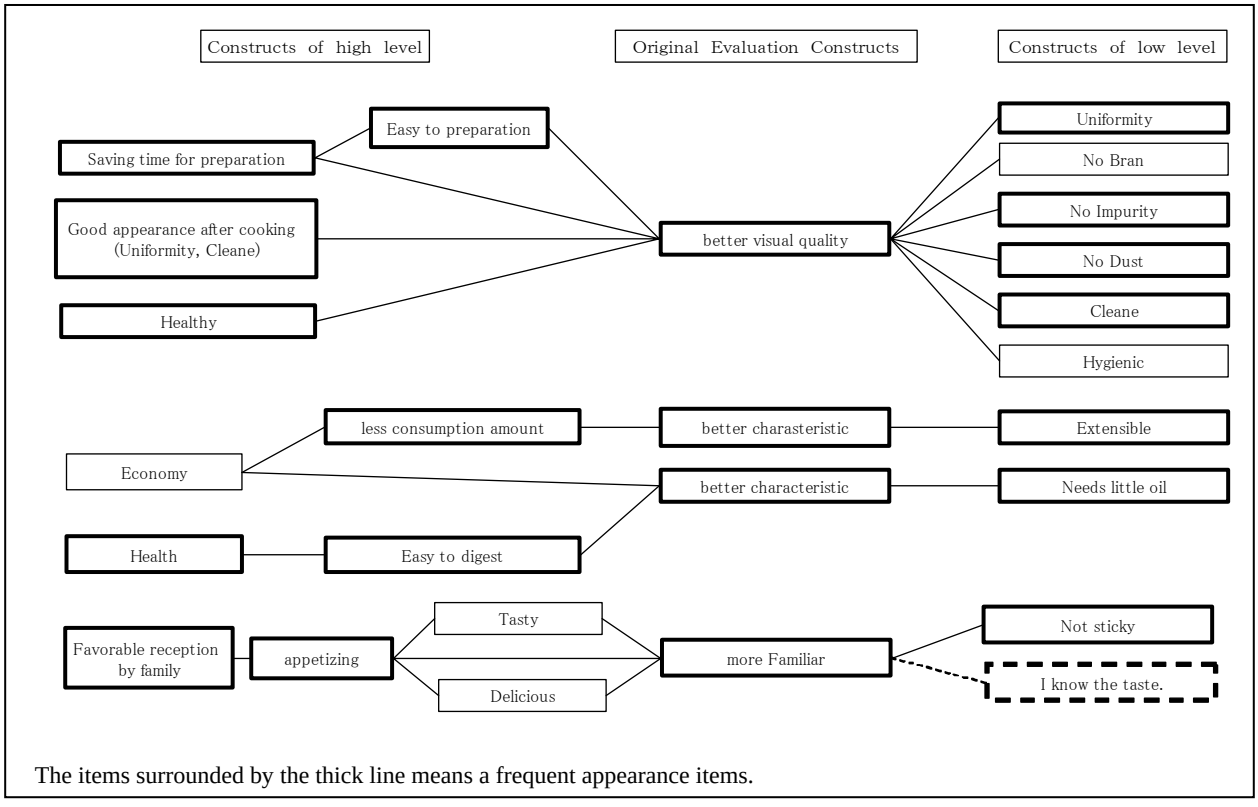


Fig. 3.4.2 General Hierarical Diagram

The findings which were obtained from the evaluation structure model are as follows.

a) visual quality

The interviewees generally regarded appearance as most important factor, that is to say “visual qulity”. When the interviewees recognize sample rice as good visual quality, they associate easy preparation or/and quick preparation with it. It is the most important determinant to save the time and effort of cooking. And it become clear that interviewees want to use the surplus time for themselves. The

characteristics for filling a demand of this are no impurity, cleand (no dust), uniformity and so on. It is required to fulfill these necessary conditions in order to excite consumer-buying will. It is interesting that the good visual quality is closely associated with healty food by some interviewees.

b) Charasteristic

The next major original constract is characteristics of rice. The evaluation factors for the EGM survey were appearance, touch, smell and price of samples. However, the interviewees evaluate the samples based on their experience and imagination. When they look at the sample, they are closery associated appearance with their experience. They evaluate samples by making use of imagination reminded from experience. The most important chuaracteristics for intervieweews were “extensible of grains” and “requirement of cooking oil”. This means that a little amount of rice and oil are enough for a meal. The saving materials is suggestive of the economy of money.

c) Familiarity

Familiarity as an original evaluative constract is led from same psychological structure as mentioned above. The interviewees associated “Tastiness” and “Deliciousness” as constructs of high level with familiarity led from appearance. The Interviewees expected the result as expected, satisfaction of a family and good appetite.

d) Economic Aspect

The economy and reasonable price are also mentioned as the original evaluation constructs. Almost all interviewees expected good quality with cheap or reasonable prices.

e) Health Aspect

The healt aspects as constructs of high level are occurring frequently. The health aspects including safety aspect should be considered as one of the most important factors.

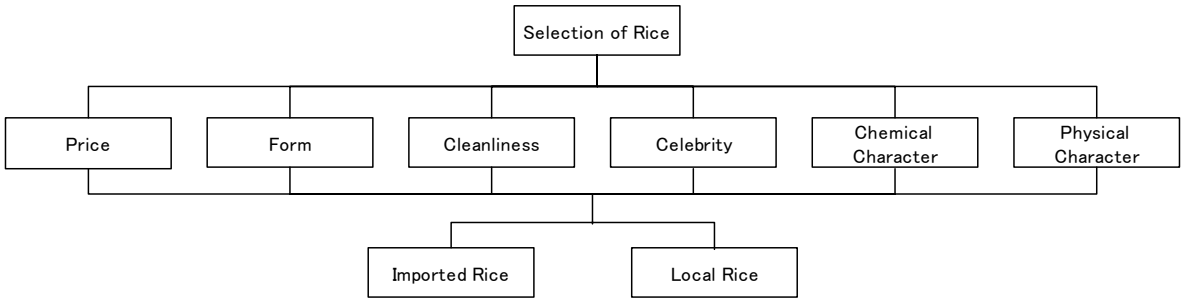
3.4.5 Quantitative Analysis using Analytic Hierarchy Prosess (AHP)

The subject for improvement of local rice quality consists of short term and long term ones. The improvement of facilities or equipments regarding processing is short term countermeasure. The long term measures such as development of breeding should be considered.

The necessary information for the qualitative analysis based on the Analytic Hierarchy Process were obtained through the paired comparison of the six (6) evaluation items for selection of rice. It is expected that a result of the qualitative analysis will provide useful information for decision of the order of priority on problems to be improved and formulation of the strategy in consideration of the specific conditions of the target areas.

(1) Stratefieed sutucture

The stratified structure of the determination of intention consists of “Subject”, “Alternatives” and “Valuation basis” for decision as shown below.



Subject : Selection of rice

Valuation basis : Price, Form, Cleanliness, Celebrity, Chemical character, Physical character

Alternatives : Imported rice, Local rice

Fig. 3.4.3 Structure of Decision Making

(2) Paired Comparison

Paired comparison of six valuation basis were done to all interviewees in order to make their sence of value clear. The standard for the paired comparison is as following.

Table 3.4.13 Standard for a Paired Comparizon

Value	Standard
1	Equal
3	The former is somewhat more important than the latter.
5	The former is re important than the latter.
7	The former is quite more important than the latter.
9	The former is absolutely more important than the latter.

The analysis results of the paired comparison for each survey area is summarized in the following table.

Table 3.4.14 Evaluation Results on Each Evaluation Items

(Unit : %)

Evaluation Vasis	Dakar	Suburb of Dakar	St. Louis	Valley	Fatick
Price	4.5	3.5	2.0	2.6	3.1
Form	17.4	35.9	20.2	30.6	20.3
Cleanliness	42.3	35.4	15.5	13.1	17.4
Celebrity	4.1	2.2	6.3	8.0	3.6
Chemical Character	16.9	10.0	8.2	6.7	10.6
Physical Character	14.7	13.2	47.8	38.9	44.9

Source: JICA Study Team, Marketing Survey, 2004 - 2005

The value of the evaluation vasis which interviewees regarded as important is high.

It is clear that interviewees in Dakar and suburb of Dakar regard the cleanliness as important. “Foem”, “Chemical character” and “Physical character” follow it. “Celebrity” and “Price” are not so important for them.

In contrast, “Physical character” is the most important evaluation vasis for interviewees in regional cities and the valley. The most attractive physical character dilatability. They genellary regard the expansion rate as vital. “Foem”, “Chemical character” and “Chemical character” follow it. “Celebrity” and “Price” are not so important for them.

As the next step, comparison evaluation of local rice and imported rice was done about each

evaluation vasis. The following table shows the comprehensive evaluation to the imported rice and local rice.

Table 3.4.15 Evaluation Result on Imported Rice and Local Rice

(Unit : %)

Origin	Dakar	Suburb of Dakar	St. Louis	Valley	Fatick
Imported Rice	55.8	62.9	29.4	10.0	23.6
Local Rice	44.2	37.1	70.6	90.0	76.4

Source: JICA Study Team, Marketing Survey, 2004 - 2005

A numerical value shows the grade of evaluation. The summary of the evaluation of the imported rice and local rice by interviewees is described as follows.

Evaluation of imported rice:

The comprehensive evaluation to the imported rice is higher than that of local rice in case of Dakar and suburb of Dakar. However, it is not overwhelming majority. Evaluation of imported rice is inferior to local rice in respect of chemical character and physical character. Genellary, interviewees in Dakar and suburb of Dakar are satisfied with cleanliness and form. However, they are dissatisfied with chemical and physical character of imported rice.

Evaluation of local rice:

Local rice is overwhelmingly predominance in the regional cities and the valley. However, the evaluation to the cleanliness is low. This is judged to be the important subject which local rice should conquer.

3.4.6 Marketing Needs

Numerous information for the improvement of quality and marketability of local rice was acquired from the analysis result obtained through the EGM survey and AHP survey. It is thought that the results of these surveys shows the market needs of rice in Senegal.

The facts verified through the marketing survey are summarized below.

a) Senegalese consumers in general prefer broken rice. However, the survey verified that whole grain rice is also preferred. Consumers selectively choose between broken and whole grains according to recipe.

b) Significant difference is recognized between urban and rural areas. Urban consumers are keen to rice quality, especially for purity without husks, soils, etc., well-whitened without bran and uniform in broken grain size. Thai broken rice is preferred in the urban because it satisfies these requirements.

c) Consumers in Saint Louis and Matam prefer local rice produced in the Senegal river valley. Consumers pointed out that local rice has good aroma and freshness immediate after milled. It was also verified that consumers pay particular attention to food safety, which can not be proved for imported rice but for local rice. Over 70% of the interviewees in the rural areas of the valley appreciate high swelling capacity of both Sahel 201 and 202 when cooked with oil. Both rice varieties are economical since sufficient rice can be served within a family with smaller amount of rice.

d) The price factor was not the main reason in their choice of rice. Consumers understand that cheaper rice is generally poorer in quality. As mentioned above, the consumers prefer the saving in amount of rice and oil to price.

The result of analysys of marketing survey which covered 410 households in 5 areas clarified

the requirement of rice quality expected by consumers. The necessary condition for produce of quality local rice were set based on the information in order to improve the marketability of local rice.

- To produce whole grain which has high value as much as possible.
- To divide broken brains according to their size and commercialize separately (The sorter should be equipped for the purpose.)
- To produce cleane and clear grains by complete milling
- To reduce colord grains and impurities as much as possible.
- To commercialize each variety separately, not mix different varieties.
- To Show the product information (a name of variety, a place of production, harvest time, milling time, type of grain, contact address etc.) to consumers

3.5 Agricultural Financing

3.5.1 Current Financing Situation in Senegal

(1) Roles and Activities of Central Bank of West African States (BCEAO)

BCEAO has functions for the common central bank in the eight countries covering Benin, Burkina Faso, Ivory Coast, Guinea-Bissau, Mali, Niger, Senegal and Togo in the West Africa for controlling common currency of FCFA under the West African Economic and Monetary Union (UEMOA). Head office locates in Dakar, Senegal.

Under the Banking Law approved in 1990, BCEAO implements evaluation of new banks and financial institutions to be registered (official approval made by the respective financial ministries of the member countries), pooling the union foreign exchange reserve, monetary policy implementation, keeping the accounts of the member states treasury, supervising financial status of the banks and financial institutions.

Beside the banks and financial institutions, growth of the microfinance institutions (MFIs) in the eight countries under UEMOA is significant. BCEAO has been monitoring financial conditions of MFIs as well as collecting their annual reports since 1988 under the provision on MFIs in the Banking Law.

(2) Activities of Banks and Financial Institutions in Senegal

The 18 banks and two financial institutions (without saving functions) are registered in Senegal. After restructuring of banking system in Senegal, the government holds its share in two banks, i.e. National Fund for Agricultural Credit of Senegal (CNCAS) and Housing Bank of Senegal (BHS). The outstanding amounts of savings and loans in the banks and financial institutions account for FCFA 1,256.3 billion and 895.2 billion, respectively in 2004.

(3) General Constraints of Senegal Banking Status

International Monetary Fund (IMF) published “Senegal, Financial System Stability Assessment Update, 2004” that included the achievement evaluation on the IMF recommendations in 2001 regarding the improvement of Senegal banking market. It is noteworthy that there are many recommendations on the MFIs. The followings items are not implemented or achieved against the 2001 recommendations:

① Banking Sector

- Divestiture of BCEAO equity participation in BHD and CNCAS
- Introduce law on bank insolvency
- Simplify formal procedures for obtaining authorization to operate in another UEMOA states under a single license procedure

② Microfinance Sector

- Slowdown the granting of new licenses
- Strengthen the microfinance unit within the Ministry of Economy and Finance
- Improve weal financial position of some MFIs

③ Legal and Judicial Framework

- Create special court divisions with specialized magistrates and promote arbitration and mediation in the banking sector to limit court cases

3.5.2 Current Conditions of National Fund for Agricultural Credit of Senegal (CNCAS)

(1) Organization

Along with liberalization in agricultural sector in Senegal, CNCAS became a government shared banking institution in 1994. CNCAS has 14 branches (five in the northern, three in the southern, three in the western, and three in the central and eastern regions). There is a plan to open another branch in Fatick in the central region. The CNCAS board is comprised of the president of Senegal and the cabinet representatives (2 persons), African Development Bank (2 persons), BCEAO (2 persons), National Union of Agricultural Cooperative in Senegal (NUCAS, one person), Federation of Non-Government Organization in Senegal (FONGS, one person), Senegal Bank Association (one person), observer from Ministry of Economy and Finance. The director general and its deputy (in charge of financing) and three management directors are assigned. It is noteworthy that there are no permanent assignment from Ministry of Agriculture and Water beside assignment from NUCAS and FONGS.

(2) Financing Activities and Situation of CNCAS as a Agricultural Financial Institutions

Available fund for financing from CNCAS is FCFA 71.7 billion that accounts for around 6% of the total available fund of FCFA 1,256.4 billion in all banks and financial institutions in 2004. Amount of outstanding loan in CNCAS is FCFA 52.7 billion that accounts for the same 6% of the total amount of FCFA 874.5 billion in the said organizations. Percentage of past due debts of the total amount of outstanding loans in CNCAS is 12.2% that is much higher that the average rate of 3.5% in the said organizations. Share of short term loans with repayment term below 12 months in CNCAS is 73% that is higher that the average share of 60% in the said organizations. This higher share of short term loans in CNCAS is due to majority of loans comprising agricultural production loans and individual loans under short term lending that is described later.

Of the total loan disbursement of FCFA 35.3 billion in CNCAS, agricultural production loan is a major lending scheme that accounts for around 48% of the total. Borrowers of agricultural production loans are organizations such as GIEs. Agricultural loans for individual lending are at others agricultural loans. The government campaign loan in 2004 is lending to the Groundnut Marketing and Processing Company (SONACOS).

Table 3.5.1 CNCAS Outstanding Loan Amount and Share of Banks in Senegal (2004)

Type of Borrowers	CNCAS			Leader Bank			All Banks (A)	
	Million FCFA	Share (%)	Share A (%)	Million FCFA	Share (%)	Share A (%)	Million FCFA	Share (%)
National or international financial inst.	0	0	0	29	0	0.2	18,903	2.2
Other economic agents	52,652	100.0	6.2	254,441	100.0	29.7	855,612	97.8
Short term	38,201	72.6	7.3	129,269	50.8	24.7	522,774	59.8
Medium term	6,832	13.0	2.5	111,035	43.6	40.5	274,237	31.4
Long term	1,181	2.2	4.2	5,083	2	18	28,161	3.2
Overdue debts	6,438	12.2	21.1	9,054	3.6	29.7	30,440	3.5
Total	52,652	100.0	6.0	254,470	100.0	29.1	874,515	100.0

Source : CNCAS Annual Report, 2004

Financing to other sectors and individual lending occupy around 24% of the total loan disbursement and a half of the total number of borrowers in 2004. Sole government shared agricultural bank, i.e. CNCAS, enlarges non-agricultural and individual loan and becomes a universal bank with expanding its branch network.

Table 3.5.2 CNCSA Loan Disbursement

Types	2003 Financial year				2004 Financial year			
	Borrowers		Amount		Borrowers		Amount	
	No.	%	Million FCFA	%	No.	%	Million FCFA	%
Government Campaign	2	0	2,511	9.6	1	0	8,000	22.6
Agri. Production loans (For Group)	1,001	13.5	9,157	34.9	3,656	41.6	17,070	48.3
Other agricultural loan sector(Include individuals)	675	9.1	6,545	25.0	741	8.4	1,888	5.3
Other sectors	405	5.5	4,259	16.2	569	6.5	4,891	13.8
Private individuals	5,345	72.0	3,745	14.3	3,812	43.4	3,498	9.9
Total	7,428	100.0	26,217	100.0	8,779	100.0	35,347	100.0

Source : CNCAS Annual Report, 2004

(3) Constraints on Agricultural Financing

Agricultural production loan provided by CNCAS was subsidized by the government for farm inputs such as seeds, fertilizers and agro-chemicals. CNCAS disburses its loan based on the subsidized prices of farm inputs. Loan conditions are the interest rate of 7.5%/year and repayment within 9 months. After 9 months period, the interest rate becomes 8%/year. CNCAS interest rate for ordinary loans is set at 12.5%/year and the spread rate between the ordinary loans and the production loan is also subsidized by the government. The production loan of CNCAS with the subsidized prices and interest rates is favorable for the beneficiary farmers.

Procedures of the CNCAS production loan for paddy from application to repayment are summarized as follows:

① Preparation of loan application form by GIEs : CNCAS basically provides the production loan for paddy GIEs. The GIEs shall indicate required quantities for seeds, fertilizers, agro-chemicals, machinery services for land preparation, O&M for irrigation, area for financing, unit prices provided by CNCAS, and total loan amount.

② SAED's technical evaluation of the applications: The GIEs shall submit their application forms to SAED for technical evaluation. Without SAED stamps with signatures on the application forms, the applications are not accepted by the CNCAS.

③ Committee's examination of the applications: The committee in the Senegal River basin is organized by three blocks, i.e. Saint-Louis to Dagana, Podore and Matam areas. The members of the committee are comprised of SAED, representatives from

rice producers, service providers, dealers and private individuals. The committee's secretariat is managed by the CNCAS.

④ Consolidation and verification the approved applications and their endorsement to Ministry of Agriculture and Water

⑤ Ministry of Agriculture and Water shall verify the loan applications and request to Ministry of Economy and Finance for the loan arrangement.

⑥ Ministry of Economy and Finance shall remit five (5) % of the total loan amount as a loan processing fee to the CNCAS.

⑦ CNCAS's Loan Processing :

- Issuance of coupons (letter of credit) to the registered organizations such as suppliers of farm inputs (seeds, fertilizers and agro-chemicals) and machinery service providers
- GIE shall request the farm input supply and machinery services to the registered organizations.
- Registered organizations shall supply farm inputs and services and get GIE's signature on the coupons for completion certification.
- Registered organizations shall submit the coupons with GIE's signature to the CNCAS for the payment.
- CNCAS shall reimburse the requested amount to the registered organizations after 15 days from their request for the payment, if no claims from the GIEs.
- Operation and maintenance (O&M) cost for irrigation including O&M cost for pumps, wages of pump operators, and depreciation cost of pumps shall remit directly to the accounts of irrigation unions before the start of irrigation practices. The rates of O&M cost are FCFA 60,000/ha for the area transferred O&M management and FCFA 40,000/ha for the area under SAED O&M. By using its fund, the unions shall manage the irrigation systems under their jurisdictions. In addition to the above O&M cost, the unions need to pay the O&M cost for major canals and drainages (FCFA 31,000/ha). After the paddy harvest, GIEs could apply the loan to the CNCAS. This O&M cost for the large facilities shall be paid to the account of the irrigation committee in the Senegal river basin and SAED shall receive the amount from the committee's account.

⑧ Loan Repayment to CNCAS : After the paddy harvest, GIEs shall collect the repayment amount from the beneficiary farmers and repay to CNCAS. O&M cost for irrigation shall collect the amount from the GIEs and repay to the CNCAS in some cases. Debi-Tijuet union who operate paddy sales and rice milling shall collect the paddy equivalent to the total repayment amount including O&M cost for irrigation from the beneficiary farmers and repay to CNCAS.

CNCAS's agricultural production loan is characterized by the direct payment to the registered supply and service organizations for preventing loan use for the other purposes. Farmers are always seeking timely acquisition of high quality of inputs and services that are depending on the organizations registered by the government. In addition, procurement and supply of fertilizers are managed by a monopoly (SENCHIM) and its activities influence significantly to the rice production at present. Free procurement of farm inputs and services is not permitted under the condition of CNCAS's production loan.

On the other hand, there are three steps for loan approval from the application i.e. SAED technical evaluation, the Committee's examination and approval of the central ministry, that requires a long processing and time. A higher loan repayment does not always accrue from

strict loan evaluation. Agricultural production loan handled by some MFIs achieves a higher repayment rate. It is recommended for CNCAS to promote user friendly and responsible loan system.

Considering promoting irrigation management transfer from SAED to irrigation unions, current production loan scheme based on the fixed farm input supply and services without free procurement of them is in the turning point. The current loan scheme might affect the producers' imaginative and original practices and increase in their productivity and decrease in their responsible loan repayment.

Improvement of the financial services of the subsidized agricultural production loan scheme through the CNCAS is recommended to implement based on the following considerations:

1) Trust management of the said loan scheme to the eligible MFIs with financial capacities: The number of financial service sites of MFIs is larger than the CNCAS branches as descried latter and MFIs can deliver further close financial management and supervision of beneficiaries. Some of the MFIs can use their fund for the said loan scheme. It will be expected to save the government provisions of interest rates between ordinary and subsidized loans.
2) Promotion of tie-up between CNCAS and MFIs: CNCAS could provide lower interest loans to MFIs (wholesale lending) and transfer the loan operation works that are made by the CNCAS at present. The coverage of area and beneficiaries under the said loan scheme could be enlarged by in this arrangement.
3) Introduction of free procurement of farm inputs and machinery services by the respective retail financial institutions: It will be required for solving the monopolized fertilizer trading by the SENCHIM. The procurement of other farm inputs and machinery services could be implemented under the responsibilities of borrowers. It will promote the competitive markets among the providers that could make the market prices lower.

3.5.3 MFIs' Current Condition and Their Potentials for Expanding Agricultural Loans

(1) Classification of MFIs and Organizations

Ministry of Small and Micro Enterprises, Women Entrepreneurship and Microfinance assisting MFIs activities classifies MFIs into three categories, i.e. informal saving and loan organization (GEC), registered saving and loan organization with large members and funds to be grown from GEC (MEC), and NGO's initiated financing activities under the respective activities. Agricultural cooperatives with loan services are included in the MEC. GEC and MEC elect their board members by one member one vote, however NGO financing is depending on the policy of NGOs. The government issues licenses to NGOs' financing activities under the renewal by five years.

Based on the monitoring results made by BCEAO, number of MFI organizations increased from 252 to 272 during 2001 to 2003. Number of members is enlarged one and a half times from 373,000 to 566,000 in the same period. One MFI operating many branches nationwide is counted by one. Women members occupy more than 70% of the total members. Average number of members per MFI increases from 1,478 to 2,029 persons in the same period. There are seven large scale MFIs holding more than 10,000 members that occupy more than 70% of the total number of MFI members. Some MFIs have nationwide networks same as the banks and are not like common MFIs.

(2) MFIs' Activities

The 80% of loan fund in MFIs is own fund such as members' savings that show the financial structure of MFIs in general. Other 20% is their profits generated by the financial operation. Sound financial activities in MFIs are observed. Loan and saving interests are varied by the MFIs and their programs. Based on the surveys made in some MFIs, their average loan interest is 12%/year and the saving interests are a half of loan interests.

Share of MFIs in the total amounts of savings and loans including banking sector is around 4% and 6%, respectively in 2003. The outstanding loan amount of CNCAS is FCFA 52.7 billion in 2003 that is a similar amount of the MFIs' outstanding loan at FCFA 51.3 billion in 2003. Increase of loan disbursement in MFIs is significant, i.e. the growth in MFIs is 100% (around twice) comparing 25% in the banking sector during 2001 and 2003. Number of branches and offices is 531 in MFIs and 133 in the banks and their numbers of employees are almost same. MFIs have a limited scale of loan disbursement than the banks, however MFIs hold 560,000 members and more in the country. MFIs are growing in close contact with the beneficiary members.

Table 3.5.3 Comparison between Banks and MFIs on Deposits and Loan

Item	Unit	2001	2002	2003	Increased 2001-03
1. Deposit amount					
Banks	Billion	680.8	776.2	1,129.6	65.9
	(%)	(96.4)	(96.0)	(96.4)	
MFIs	Billion	25.4	31.9	42.7	68.1
	(%)	3.6	4.0	3.6	
2. Loan disbursement					
Banks	Billion	655.5	685.7	819.8	25.1
	(%)	(96.4)	(95.7)	(94.1)	
MFIs	Billion	24.7	30.9	51.3	107.7
	(%)	(3.6)	(4.3)	(5.9)	
3. No. of branches					
Banks	No.	88	108	113	28.4
	(%)	(15.8)	(17.6)	(17.5)	
MFIs	No.	470	504	531	13.0
	(%)	(84.2)	(82.4)	(82.5)	
4. No. of employees					
Banks	No.	1,660	1786	1873	12.8
	(%)	(54.9)	(52.3)	(51.4)	
MFIs	No.	1365	1630	1771	29.7
	(%)	(45.1)	(47.7)	(48.6)	

Source : Monograph of Decentralized Financial Institutions, BCEAO 2003

(3) Potentials of MFIs and Donors' Assistance

MFIs financing directly for agricultural production are limited even in the Senegal River basin. MFIs have a shortage of financial capacities necessary for a wide range of farm inputs loan, medium to long term loans for farm machinery, a large scale working capital loans for procurement of paddy. The CNCAS rarely finances MFIs and limits loan provision to GIEs, irrigation unions, private enterprises with sufficient collateral. In order to expand the agricultural loans from MFIs, improvement of financial environment for MFIs together with provision of fund through the CNCAS are urgently required.

There are many potentialities in the MFIs, therefore many donor agencies have been assisting MFIs. Of the donor assistances, a large scale MFIs such as CMS, ACEP and PAMECAS are assisted by French, USA and Canadian governments, respectively.

3.6 Agricultural Support System

3.6.1 Research and Development

(1) ADRAO (African Rice Center)

ADRAO is one of the International Research Institutes under CGIAR (Consultative Group for International Agricultural Research). Its office in Saint Louis mainly focus on irrigated rice, especially in the Senegal river basin.

ADRAO, in cooperation with ISRA, has developed the varieties suitable for Senegalese citizen. So far three Sahel series (Sahel 108, 201 and 202) have been developed and released as official varieties. Other new varieties are about to be released.

Criteria for variety selection are not only the preference of consumers (non-sticky, medium to high amylase content, slender, uniform broken, etc.) but also productivity to optimize the available resources. Growth duration, height, salt tolerance, etc. are other selection criteria. Salinity tolerant variety is introduced from Cuba.

A thresher has been developed (ASI) in collaboration with ISRA and SAED, adaptable to this area modifying the one introduced from IRRI. The processing capacity is increased from original 600 kg/hr to two ton/hr.

(2) ISRA (Institute Senegalaise de Recherche Agricole)

The objectives of ISRA, Saint Louis, is to develop the research activities which harmoniously integrate in the production system of the basin on the one hand, improve and secure the income of the local populations on the other hand, and optimize the utilization of natural resources for sustainable management.

Due to its potentiality of natural resources and existing irrigation facility, the State accords the Senegal River basin the first priority role in the national socio-economic development policy, especially in the food security.

The research agendas on rice include the development of reaper (in collaboration with a private manufacturer, SAED and ADRAO), homologation of new varieties before releasing, development of weeding technology, comparison of the effect of cropping calendar on rice quality, etc.

The ISRA has another station in Ziguinchor (Djibelor), and produce improved seeds.

3.6.2 Extension

(1) SAED

The SAED assigns an agricultural advisor (conseil agricole) to each of the major irrigation schemes (perimetre) in the Senegal River basin, so that farmers can consult them whenever needed. Actually, the SAED has played a very important role to disseminate the recommended farming practice jointly developed by ADRAO, ISRA and SAED, to the farmers and to realize the high productivity.

(2) ANCAR (Agence Nationale de Conseil Agricole et Rural)

The ANCAR was creased on May 17, 1997, as one of the five agencies to execute the Program of Agricultural Services and Producers Organizations (PSAOP; Programmed des Services Agricoles et des Organizations de Producteurs), whose principal objective is to establish an new support system in the rural area.

In order for the decentralized and participative "Agricultural and Rural Advising" to be most effective, the ANCAR has a structures of: (i) one general assembly, (ii) one administrative advisor, (iii) Direction General, and (iv) 11 autonomous regional directions (each of 11 regional capital).

The principal objective of the ANCAR is to establish a service of agricultural and rural advising responsible for the results to the producers and responding to their needs through the contractual arrangement.

1) To comply with the producers' demand in the very wide range of innovative techniques,
2) To reinforce the capacity of farmers' organizations, the ANCAR's agents, and their partners, and
3) Involve the producers in all the processes of elaboration to make use of them and evaluation of agricultural and rural advising.

The sectors of intervention of the ANCAR are concerning agriculture, livestock, fishery, water and environment. Nevertheless, the ANCAR indirectly intervenes other sectors such as marketing, craft, health, training, cooperation, organization, credit, rural infrastructure and supply.

3.6.3 Seed Multiplication

As for the case of Saint Louis, the ISRA sells foundation seeds (pre-base) to the UNIS (Union Nationale Interprofessionalle des Semenciers). The UNIS then distributes them to the member farmers (seed producers) who want to multiply them. During the multiplication, controllers (government officer) visit the farmers regularly (four to five times in a cropping season) to supervise their farming practice (such as kind of seeds, water management, fertilizer application, etc.). After the multiplication, the farmers bring the seeds to the seed treatment center in Richard Toll owned by the UNIS. The seed inspection officer who is attached to the DRDR (Direction Regionale du Dévéloppement Rural), Saint Louis, examines the quality of seeds in the center's laboratory for certification. The items to be examined include humidity (less than 12%), contamination with red rice (less than 0.5% or 5g/kg) and purity of seeds (more than 98.5%). 400g of seeds are taken for the examination. The laboratory is equipped with homogenizer, balance, counter, red rice detector, and moisture meter. The laboratory officer was trained in the seed service department in Dakar in 1985. Variety of foundation seeds available were: Sahel 108, Sahel 201, Sahel 202, IR15-29, and Jaya. The following table shows the production of certified seeds during past five years.

Table 3.6.1 Production of Certified Paddy Seeds in the Senegal River Valley

Unité: ton

Type de Semences	2000/01	2001/02	2002/03	2003/04	2004/05
Base	207,52	34,72	116,31	77,64	77,05
R1	1.131,85	847,32	1.084,28	1.494,88	2.193,57
R2	599,60	23,36	116,24	211,76	256,44
Total	1.938,97	905,40	1.316,83	1.784,28	2.527,06

Source: DRDR Saint Louis

3.6.4 Provision of Mechanized Agricultural Services

With the reorganization of SAED in 1994, the section of mechanized agricultural services was privatized. Selling public properties benefited to the private operators of the region who thus

became service providers for farm machinery services, mainly in Ross Béthio and Richard-Toll (department of Dagana). According to the farm machinery inventory survey carried out by SAED in 1999, the inventory of farm machinery in the region of the Senegal River is as follows: see table 3.6.2.

Table 3.6.2 Inventory of Farm Machinery in the Senegal River Valley

Farm Machinery	1996		1999	
	Total	Operational	Total	Operational
Tractor	195	93	215	125
	(100%)	(47%)	(100)	(58)
Plow (for plowing)	48	-	45	-
Harrowing (for offsetage)	138	-	136	-
Motorized thresher	170	66	156	63
	(100%)	(39%)	(100%)	(40%)
Combine-harvester	65	53	73	51
	(100%)	(81%)	(100%)	(70%)

Source: SAED

Plowing is usually done with a disc or reversible plow drawn by a 60 horses tractor. This practice allows to turn over the surface of the ground and to bury the weed seeds. Nevertheless, it is practiced almost nowhere because of the high price of the service. The offsetage is done with a disc harrow, which is more widespread, but the soils are normally very hard after having spent 3 to 5 months since the previous harvest and it is difficult to warrant a satisfactory harrowing. In the immersed paddy fields, rice seeds are put in competition with those of weeds. Although the spreading of weed-killers, which is very expensive, is popular in the river basin, it would be possible to reduce the quantity of herbicide applied, with a regular practice of the appropriate plowing and leveling works.

Combine harvesters are mainly used in the department of Dagana. Machines are adapted to the GA (large developments) and the majority are secondhand combine harvesters old of over 10 years, coming from Europe. The above mentioned survey identified 73 units of combine harvesters, of which 51 units (that is to say 70 %) were operational in 1999. About 20 combine harvesters are currently spread in the Senegal river basin and the loss rate within the farm at the time of harvest is due to the state of farm machineries and also to their scarcity. It has became very difficult for service providers to invest in the acquisition of new combine harvesters after the devaluation in 1996. On the other hand, the size of an irrigated rice plot, about 0.5 ha at most, does not allow to use effectively the big sized combine harvesters.

In answer to the insufficient number of combine harvesters in the area, the use of the ASI thresher spreads very quickly. The makers of ASI threshers are about 5 to 6 in Ross Béthio and Richard-Toll, of whom some produce more ten a year. However, the demand always exceeds the making capacity and the number of ASI threshers is still not sufficient to cover the existing needs in the area. Besides, a motorized harvester is being developed and up to now, many rice producers use seasonal workers for the harvest.

In most of cases, producers pay the services of farm machinery with the CNCAS credit by means of coupon. The expenses for providing private services vary from 50.000 FCFA/ha to 60.000 FCFA/ha for the plowing by tractor and 18.000 FCFA/ha for the harrowing. The Débit-Tiguet union uses its own farm machinery by charging its members with user fees of 45.000 FCFA/ha for the plowing and 18.000 FCFA/ha for the harrowing. Regarding the harvest and threshing expenses, they are paid in kind, about 20 % of the harvested paddy. For the case of ASI threshers, 10 % of the paddy are paid to service providers. An ASI thresher can beat up to 5 tons a day.

3.7 Farmers' Organizations

3.7.1 Classification of Farmers' Organizations

Farmers' organizations (OPs) in Senegalese rice sector are diverse in terms of form and functioning and there are mainly four types of OPs, that are i) Hydraulic Unions, ii) Village Branches (of cooperative), iii) Village Development Associations, and iv) Economic Interest Groups (GIE). The roles and functioning of each organization in the Senegal River Valley are briefed as follows:

(1) Hydraulic Unions

In order to transfer towards the producers the management of large-scale irrigation scheme developed by SAED, Hydraulic Unions (Unions) were constituted through the gathering of users of the installations and facilities, namely producers at the sites. The members of the Union are often Economic Interest Groups (GIE) of producers. The transfer of irrigation schemes has started from 1989/90. Since then it is a Union which takes the responsibility to cover the necessary operation costs as well as to maintain the irrigation schemes. First of all, the following seven sites were targeted for the progressive transfer: Boundoum, Dagana A, Dagana B, Kassack Sud, Pont-Gendarme, Thiagar, and Thilène. Besides the general facilities (the irrigation and drainage pump station, the main channels and gates), farm equipment, storehouses as well as rice mills were transferred. Each Union collects irrigation fees from its members in order to cover management and maintenance costs. Maintenance works are often entrusted to SAED and thus, the producers always keep the link with SAED.

(2) Village Branches (SV:Sections Villageoises)

The SV constitutes Unions as their member and it was a division of agricultural cooperative by section of irrigated perimeters until the disengagement of SAED. The SV covers a whole village or a part of village.

(3) Village Development Association (AVD)

With the encouragement of the government in the 1980's, the AVDs were created at the village level. The AVD aims at managing the village, solving internal problems and also contributing to village's socio-economic development. Above the AVD, there is a traditional group of distinguished personalities with the village headman which is in charge of making decisions or giving decisive permissions at the level of village.

(4) Economic Interest Groups (GIEs)

A GIE is an entrepreneurial and economic group that can be started up without capital, with a minimum of two persons. In the case of agricultural groups, GIE is constituted on a family basis or of a group of producers. And there are also cases where some GIEs form a Federation. The creation of GIEs has been encouraged and promoted under the New Agricultural Policy (NPA) since 1984.

One can also add other types of farmers' groups that are often based on traditional structures according to age, sex, social status, etc. at the level of village.

1) Groups for the organization of festive events, collective activities, etc. (ASC, GPF, GPH);
2) Groups for a better and more efficient organization of works (ASC, GPF, GPH);
3) Groups aiming at improving the living standard (ASC, mother groups, health

committee, etc.).

3.7.2 The Activities of the Farmers' Organizations (OPs)

Table 3.7.1 shows the number of villages where exist activities of farmers' organization.

Table 3.7.1 Villages having active OPs in the Study Area

Region	Saint Louis*	Matam*	Fatick	Kolda
Village Branches (SV)	260	144	450	484
GIE (producers)	201	71	205	650
GIE (Service Provider - tractor, threshers, etc.)	28	31	117	694
Village Development Association	227	78	350	771
Water Management Committee (for public water point)	308	139	295	143
Women Promotion Group	931	294	640	1,226
Other groups of producers	118	45	222	423
Development related Management Groups	122	30	160	416
TOTAL	2,195	832	2,439	4,807

Source: Sénégal, pré-recensement de l'agriculture 1997-98

(*) At the time of the Agricultural Pre-census, the Region of Matam was part of the Region of Saint Louis. «Matam» of the table represents the Department of Matam at the time.

Data in the table also contain the groups that do not concern directly the rice sector. The very high number of farm equipment service providers (GIE) in the regions of Fatick and Kolda could correspond to the existence of many GIEs of groundnuts producers. In the rural communities of the rice producing regions, there are various actors of the rice sector who conduct diversified activities such as seed production and its distribution, agricultural credit, processing, marketing, etc.

The farmers' organizations in the Senegal River Valley are detailed in the table below. GIEs are the most numerous types of organizations and occupy 60 %. The OPs concentrate in the Department of Dagana and represent 60 % of the total number of OPs. In the region of Matam, the GIEs always occupy the first place and more than 10 % of the OPs are SVs and women's groups.

Table 3.7.2 Typology of OPs in the Senegal River Valley (2003/04)

Type of Ops	Dagana	Podor	Matam	Bakel	Total SRV
G.I.E.	1,481	674	256	37	2,448
Producteurs' Groups	227	105	32	78	442
Private farmers	352	41	7	6	406
Village Branches (S.V.)	205	42	75		322
Women's Groups (G.P.F.)	34	38	42	21	135
G.I.E. of Women	21	61		16	98
Individual Groups	76			3	79
Foyer	41	1	2		44
OP's Federation	29	10			39
SUMA		18			18
Women's Associations	11				11
Other types of associations	1	7			8
Cooperatives	1	1			2
Others	13	5	1	1	20
Unknown	125				125
Total	2,617	1,003	415	162	4,197

Source: SAED/DDAR/CSE

SUMA: Section d'utilisation en commun de matériel agricole (Agricultural Material Common Users Branch)

Many initiatives intended for rice producers has already emerged and been taken among the farmers' organizations. They are classified by category: (i) Providing farming services such as the Operation and Maintenance (O&M) of rice miller and the storage of seeds, ii) technical improvement for a better productivity, for example through the introduction of new varieties or the technique of transplanting, iii) consolidation of paddy fields through the realignment of plots and the desalinization, iv) improvement of marketing by separating the broken and complete rice and by package improvement, v) others including the conservation of traditional varieties and the advocacy in terms of the trade liberalization.

3.8 Agriculture Statistics

3.8.1 Background of Agriculture Statistics in Senegal

The survey of agriculture statistics in Senegal has been commenced since 1960, and the sampling design base and implementing framework for the agricultural statistics service in Senegal has been established based on experiences of DIAPER statistics project for the SILSS countries (1985-1999). The DIAPER has been carried out for the 14 years up to 1999 under financial aid of European Union, and aimed at making the system of agriculture statistics of the countries compatible by improving statistical survey method, focusing on grain crops.

During the period of the project implementation, the countries concerned CILSS have gathered in Niger in order to share the current crop performance in every November and final crop production in the next March. After DIAPER, no CILSS countries have carried out the agriculture statistics serves except for Senegal. Meanwhile, the agriculture statistics in Senegal has lacked a census of the number of farm households, thus the pre-agriculture census has been conducted in 1997 under technical cooperation made by FAO with financial aid of EU, USAID and Holland. As a result, the 437,000 of the farm households in the country was confirmed except for Casamance region and in the next year, the first agriculture census has been implemented by sampling the seven thousand of the farm households based on the confirmed the farm household number.

Through these agriculture statistics services, the fundamental implementation framework and sampling design for the agriculture statistics was established in Senegal. This is the sampling base to make up statistical data by *Department.* After from this agriculture census, the agriculture statistics service has been carried out by the Senegal budget under unification by DAPS. However, the current statistics service is confined to the elements focusing on large annual variation. That is the cultivated area, yield, crop production on grains and the grain stock in the farm household at the off-season. Moreover, a similar survey on the horticulture crops in the rainy season has been done as well. The agriculture statistics survey for the dry season, however, is not executed due to limitation of human resources, financial resources and statistical expertise.

Hereinafter the implementation framework, problems and issue to be tackled are mentioned.

3.8.2 DAPS

Background of DAPS is originated from the Agricultural Political Unit (UPA) in the Ministry of Agriculture and Hydraulics, where was in charge of formulating national agriculture policy and program and the division of agriculture statistics was stationed in the UPA. According to the proclamation of President Decree No. 99-909 (See Attachment-2) about establishment of DAPS in September 14, 1998, UPA and DSA were unified as one direction of the nine directions in MAH in March 2000. The scope of work for DAPS is comprised of analysis, formulation, evaluation and monitoring on projects and programs in the agriculture sector, and

moreover collecting agriculture information and statistics data for publication. The agriculture statistics service is evolved countrywide based on the DRDR and SDDR framework, which was established by the decree of agriculture minister proclaimed on March 15, 2000 in accordance with the president decree. The outline of DAPS is described as below.

(1) Function of DAPS

In accordance with the Decree of Agriculture Minister No. 003304 (proclaimed on March 15, 2000), the scope of work for DAPS is clarified as follows.

(1) Elaboration of proposition s of policies, of planning, and of strategies of agricultural development.

(2) Follow-up of the execution and the evaluation of results of the policies, plans, and strategies of agricultural development.

(3) Preparation and research of financing for the programs, the projects, and the actions of agricultural development.

(4) Follow-up of execution and evaluation of programs, projects and actions of agricultural development.

(5) Representative of the Ministry of Agriculture in its relations with the organizations involved in financing of the agricultural development

(6) Collection, centralization, analysis, processing and extension of the agriculture statistics

(7) Planning of human resources of the Ministry of Agriculture

(2) Structure Organization

In accordance with the Decree of Agriculture Minister, DAPS consists of the following three technical divisions with Division of Finance dealing with logistic work.

1) Division of Analysis and Prevision

2) Division of Statistics、Documentation and Agriculture Information

3) Division of Program and Project

4) Bureau of Administration and Finance

However, as shown in DAPS organization chart (See Figure 8.4.1), reorganization of DAPS was made when a new director of DAPS was inaugurated on January 2004; namely technical two divisions of Bureau of Information management, Communication and Agriculture Information, and Division of Negotiation for International Commerce and Integration were newly created with the three technical divisions. Thus the scope of work about these two technical divisions were not clarified in the Decree of Agriculture Minister No. 003304(See Attachment -1) and only verbally briefed to the staff assigned to the said divisions by the new DAPS director. Thus the scope of work for the divisions were not opened thoroughly among the staff concerned. In order to stipulate this reorganization in the legislation, the President Decree for MAH has to be revised and which is not observed for the time being. Hereinafter, the scope of work about each technical division, which clarified in the Minister Decree, is described.

Table 3.8.1 Scope of Work stipulated in the Minister Decree

Divisions		Scope of Work stipulated in the Legislation
1	Div of Analysis and Previsions	Elaboration of agriculture policy, monitoring of policy implementation, evaluation of effect of the agriculture policy
2	Div of Statistics, Documentation and Agriculture Information	Centralization of agriculture information and statistics data, management and update of agricultural documentation, and introduction/extension of computing method and models adapted to needs of services made by MAH
3	Div of Programs and Projects	Coordination, preparation and follow-up of progress for the agriculture programs and projects, and monitoring a compatibility among the agriculture policy, programs and projects
4	Bureau of Administrative and Finance	Logistic work for all divisions under sanction by the Director of DAPS

Source: Decree of Agriculture Minister No.003304, proclaimed in March 15, 2000

Hereinafter the scope of work for the newly established two technical divisions is described as follows.

Table 3.8.2 Task Work of New Divisions instructed by DAPS Director

	Division	Task Work Instructed by DAPS Director
5	Bureau of Information management, Communication and Agriculture Information	・Display of DAPS Activity in website ・Construction of database about agriculture statistics information and agricultural document, and sharing of information among the staff concerned through LAN system
6	Division of Negotiation for International Commerce and Integration	・The sub-committee member (agriculture sector) of the Government Committee for WTO commerce negotiation (Secretariat is established in the ministry of trade) ・The window for negotiation to the international committee consisting of African countries and international organizations ・Coordinator of ONRS

Source：Interview survey by JICA Study Team to DAPS Staff concerned

3.8.3 DRDR and SDDR

The Agriculture Minister Decree No. 003307(See Attachment-3) proclaimed on March 15, 2000 clarified the position of DRDR and SDDR as representing of Region and Department, respectively under an umbrella of MAH. The organization chart is shown in Figure 8.4.2. DRDR consists of the five divisions, and the three divisions for SDDR. In accordance with the Decree, the scope of work as per DRDR and SDDR are as follows:

Table 3.8.3 Responsibility of DRDR and SDDR about Agriculture Statistics stipulated in the Decree of Agriculture Minister

Administrative Level		Scope of Work
1	DRDR-DAPS	・To carry out collection, analysis, interpretation of the data necessary for elaboration and follow-up/evaluation of agricultural policies at regional level. - Collection and processing of data on agriculture sector, analysis of its evolution and elaboration of policy measures to be submitted to the MAH - Monitoring and evaluation of executing the programs and projects, and evaluation of its adequacy under the national agriculture policy - Extension of working methods in the field of planning and statistics - Treatment of agriculture statistics and basic economic information - Management of technical-professional documentation and supporting agriculture organization in regional level - Preparation and follow-up of the agriculture projects of the region and coordination - Capacity building of human resources contributed to agriculture development needs
2	SDDR-Agriculture Statistics	・Collection of basic data in the agriculture sector and participation of formulating and following up of the agricultural development plans

Source：Decree of Agriculture Minister (Legislation of DRDR creation）No.003307, proclaimed on March 15, 2000

3.8.4 Budget

The fiscal year in Senegal is January to December, and in every April, the meeting about budget execution of the previous FY with budget negotiation for the next FY is convened in Ministry of Finance. Prior to this meeting, the division of administration and finance in DAPS compiles the budget plan based on each division's annual budget proposal and submits to Ministry of Finance through MAH. Table below shows the activity budget in DAPS.

Table 3.8.4 Annual Budget of DAPS (unit:x1000 FCFA)

Fiscal Year	2000FY	2001FY	2002FY	2003FY	2004FY	2005FY
Total Amount	100,000	150,000	159,000	181,091	187,328	187,328
Ratio against previous year (%)	100	150	106	113.8	103.4	100

Source : Division of Administration and Finance /DAPS

This activity cost includes the costs of contract enumerator, temporal employee and fuel of vehicles in the FY activity plan, but not including personnel costs of DAPS staff and O&M const of the building. The approved budget for the 2004 FY was about 187 m FCFA (See Table 8.4.1), meanwhile DAPS proposed the 269 m FCFA by adding 80 m FCFA for the 2005 FY activity plan but not approved, thus same budget scale of the 187 m FCFA as before. This budget scale consists of the 179 m FCFA from Ministry of Finance and 8,328,000 FCFA from PSAOP (first phase: 1999-2004), in all 187.328 m CFA.

Concerning the budget issue of DAPS, the approved budget by Ministry of Finance is confined to agriculture statistics service but is reallocated for all activities among the divisions in DAPS UNDER sanction of DAPS Director, thus annual activity of DSA is remarkably limited. The division of Agriculture Statistics proposed the 2004 FY annual activity cost including enumerator's cost and allowance, vehicle operation and maintenance, and annual report as 137 m FCFA (See Table 8.4.2). This is equivalent to 73 % of the 2004 FY budget in DAPS. Thus, a smooth implementation of agriculture statistics service under the DAPS-DRDR-SDDR frame work is hindered. That is, the activity cost of agriculture statistics service for DRDR-SDDR are wholly shouldered by DAPS and results in a serious issue to secure skillful technical staff because of many staff changing of job due to decreasing of incentive to continue the agriculture statistics service in local level.

3.8.5 Staff

(1) DAPS Staff

The number of staff in DAPS consists of 53 as of the beginning of 2005. Among the 53, the permanent staff is 25, and the remaining 33 for the temporary staff. Of the 53 staff, two staff are dispatched by AFD as technical cooperation experts (advisor of law and development plan) attached to DAPS Director. Temporary staff are all engaged in the subordinate positions such as typist, PC operator, accounting and driver, meanwhile the specific work such as analysis and formulation of policy, survey and planning are shouldered by the permanent staff. The modality of contract for the temporary staff is based on renewal of every four months and unstable of life security. The number of staff by academic background for the permanent staff consists of almost 50 % comprising of PhD and BSc.

(2) Staff concerned Agriculture Statistics Survey in Region and Department

DRDR office stations the representative of each Direction in MAH including DRDR head, representative of DAPS and full time staff in charge of agriculture statistics. Meanwhile, SDDR

office which is actual organ to implement the statistics service consists of the staff like SDDR head, statistician, plant protection, and seeds including contract-basis enumerators. SDDR staff usually pursues his/her assigned work but shares an agriculture statistics service during the campaign period (rainy season) and follow up the survey of agriculture statistics after completion of the enumerator's three-month-contract. Staff allocation varies with region and department; that is no DAPS representative of two regions such as Matam and Tambaconda, then no statistician of four regions such as St. Luis, Matam, Ziguncher and Diourbel. As for SDDR office, no statistician is allocated in Bakel and Bambey Departments. Missing position is concurrently covered by the permanent staff but the SDDR office where permanent staff is insufficient strongly proposes an increment of staff because of following up of yield measurement work after termination of the contract enumerators. Although some difference about the number of SDDR staff by Department, the 233 staff consisting of 82 permanent staff and 151 contract staff are allocated in the 2004/2005 season. Assignment imposed to the staff relevant to agriculture statistics are as follows.

Table 3.8.5 Scope of Work for the Staff related to Agriculture Statistics in DRDR and SDDR

No	Administrative Office	Position	Scope of Work
1	DRDR	Head	-Superintendence of DRDR whole work including agriculture statistics - Coordination between region and central government
2		DAPS Representative	-Liaison work between region and central government and superintendence of agriculture statistics
3		Statistician	-Agriculture statistics in region
4	SDDR	Head	-Superintendence of SDDR whole work and agriculture statistics under DRDR's umbrella
5		Chief of statistician	-Supervision of agriculture statistics survey and control of questionnaire content
6		Enumerator	-Implementation of questionnaire survey (Q 5, 6, 13) 7 - Number of the Sampling farmers ranges from 40 to 120 depending on department.

Source：Interview survey to DAPS staff concerned by JICA Study Team

3.8.6 Administration of Agriculture Statistics in Senegal

Statistics administration in Senegal is the structure which spread over different organization, shared by each governmental organization in terms of statistics administration. DAPS under MAH is responsible for the country wide agriculture statistics, and which structure is shown in Figure 8.5.1. Central organization controlling the agriculture statistics administration is DAPS; meanwhile DRDR under MAH umbrella is the one. In department level, SDDR is actual implementing organ of agriculture statistics service. Although the agriculture statistics survey in Senegal is controlled by DAPS, implementing organs is shouldered by the four organs of DRDR, SAED, SODAGRI and SODEFITEX. The administrative relation between DRDR and public corporations is differed by each public corporation.

3.8.7 Method of Agriculture Statistics Survey by DAPS

(1) Sampling Design

Agriculture statistics survey by DAPS is carried out based on sampling theory; this sampling base has been established in the agriculture census executed in 1997-98 under FAO technical cooperation. The conceptual sampling design is shown in right Figure. Based on the confirmed number of farm households and population in this census except for Casamance

area, district sampling unit (DSU) is allocated by each department basis based on about 1000 inhabitants' size per DSU. The number of DSU by department ranges from 10 to 30 but the sampling design of Ziguinchor is differed from other regions because of exclusion from the agriculture census due to insecurity problem.

(2) Sampling Selection

Based on the district sampling unit design and the farm household ledger established in the agriculture census time, sampling extraction is made randomly in accordance with allocated number of the sampling farm households based on department area, where is agro-ecologically zoned. Setting of the zoning is entrusted to each department, thus DAPS does not control the detailed information about zone. The extracted sampling farm households are reshuffled every three years, and which has been made in July, 2005. Number of the sampling farm households per DSU ranges from 3 to 4.

Concerning the questionnaire sheet No.6 (yield measurement), 12 DSU are randomly selected as per each target crop in accordance with demarcated agro-ecological zone. Three Quadrant Sampling Plots (QSP) as per each DSU are measured. A crop yield per department is computed based on a mean over the 36 QSP per target crop per department. QSP point is selected in accordance with the manual and the random number table, and then survey of QSP proceeds based on a designated size of each target crop.

(3) Questionnaire Sheets for Statistics Survey

The questionnaire sheets by DAPS are the one based on reflection of many user's opinions through 5 times workshop including government staff concerned, many data users followed by the 1997-98 agriculture census. Annual statistics survey consists of grain and horticulture crops in the rainy season, especially for cultivated area, yield, production, and grain stockpile by farm household. Below Table shows the content of each questionnaire sheet and frequency use, survey time. Implementing time for annual statistic survey starts from the southern area at onset of rainy season and go north, thus each region reacts on this onset of rainy season.

Senegal government has continued the agriculture statistics survey since 2000 after the 1998 agriculture census. However, the huge human resources and financial input are necessary for carrying out the above 10 questionnaires nationally, thus it is impossible. Therefore, the survey items which are not drastically changed are executed every three years, meanwhile only the survey items influenced by precipitation such as Q5, Q6, Q13 and its pertained A, B and C questionnaires are carried out every year. The survey about the whole questionnaires was made in 2002 but no reliable survey results are generated due to limitation of man power and financial issues in DRDR and SDDR. As a reference, the number of questionnaires sheets distributed to each department is accounted for 46,000 sheets.

Table 3.8.6 Questionnaire Sheets about the Agriculture Statistics Survey by DAPS

Questionnaire No	Question	Objectives	Frequency to use	Time to use	Time to collect	Survey Items
Q 1	No of Family members	Grasp of Farmer's Population	Once in every 3 years	June to July	September	Characteristics of Sampling Farm Household
Q 3	Possessed Farm machineries and tools	Farming implements in the season				Name of farming implements//No/Purchased date、Custom hired machine

Q 4	Inputs （ Fertilizer, seed, etc）	Quantity of inputs by crop				Characteristics of cultivator, inputs by major crop, date of purchase(month, year), source of obtained seeds, etc
Q 5	Cultivated Area by crop	Clarify the characteristics of cultivated plot	Every year including horticulture crops in the rainy season	July to August	Late August	Characteristics of sampling farm household, side-length of sampling plot, measurement of magnetic direction of the sampling plot, No of cultivated crops and crop code, crop name, sowing date (month and week)
Q 6	Crop yield	-Crop yield evaluation is based on actual measurement of quadrant sampling method. -36 QSP over 12 district sampling unit should be made in each department. -3QSP/DSU		October t December	Collecting by 1st week of January	Characteristics of sampling farm household, circumference of sampling plot and half of it(m), area of quadrant sampling plot, 2 digit random table to decide QSP point, yield of QSP, crop code and crop name, No of plant/hills in QSP, No of cob, No of years, sowing date
Q 9	No of rearing livestock	Grasping the No of livestock reared locally and excluding the livestock that is seasonally moved.	Once in every three years	May to July	September	Characteristics of sampling farm household, Code of domestic animal, No of rearing livestock, livestock owner （ farm household or external owner）, reason of female owner who rears livestock, reason of external owner rearing livestock locally
Q 13	Farm household grain stockpile	Grasping the grain stockpile in the country excluding the grains for export; this figure is used together with the next crop forecast	Every year	July to August	Late August	Farmer name, crop code, category of farm household to keep grain crop stockpile, type of keeping grains, weight of grain bags, total grain weight except for grain bags
A	Registration of major crops	Clarifying local major crops		July to August	Collecting by 1st week of January	Plot No, Name of plot manager, name of farm household head, place name of the plot(or village name)
B	Questionnaire of the cultivated crops	Confirming cultivated crop name		August		Plot No, name of plot manager, sex, name of planted crop, crop code, management type of plot(collective or individual)
C	Questionnaire of crop production forecasting	Enquete survey about crop and vegetable production forecasting to SDDR		October	October	Collection of crop harvest prediction (t/ha) by department via DAPS-DRDR-SDDR channel, and forecast crop production in combined with crop cultivated area in Q5

Source : Formation des Chefs de Bureau Statistiques Volume 1/DAPS, May/2001 with the interview survey result by JICA Study Team

3.8.8 Issue of DAPS

Overall, the present situation and diagnosis were made by focusing on the central organ and St. Louis regional level organs concerned in terms of evaluation of DAPS, administration of statistics service, method of agriculture statistics survey. As a result of study, the four issues are roughly profiled as follows.

Issue		Outline
1	Function of DAPS	(1) Creation of new technical divisions without by-law Since the early 2004, two technical divisions have been established within the DAPS but it is not stipulated by the decree, thus the terms of reference in DAPS have progressed in gray position. (2) Policy formulation and statistics service Primarily, DAPS should have a function to integrate the policies for analysis, formulation and evaluation based on the data of the statistical service handled by DAPS. Namely, the statistical service should have a function to provide necessary information for evaluation of policy effect at pre and post stages, thus it should play an important role. However, a linkage of policy analysis and formulation based on statistical data seems to be very weak. Only the director of DNCII who works as coordinator of ONRS provides the DAPS rice statistics data to ONRS. (3) Human resource DAPS consists of the five technical divisions with overall logistic division; they are in charge of policy analysis, formulation, evaluation, project monitoring and agriculture statistics service, comprising of the 25 permanent staff and the 33 temporary staff. But the technical staff is insufficient, especially the specialty of agriculture statistician, data processing for visual presentation, negotiator of WTO, information management for agriculture, and analysis/formulation of policy and so on.
2	Budgetary Constraints	(1) Shortage of Budget for Statistics Service Annual budget scale for DAPS has been increasing since beginning of DAPS, and approved 187million FCFA in FY of 2005 alike last year for the overall activities. Among the DAPS activities, the agriculture statistics service is managed by the 233 staff over the 33 departments in the 11 regions in the country, and was estimated to 137 million FCFA comprising of personnel costs, fuels, publication and materials for survey in the FY 2004. However, the budget allocated to DAPS was shared by overall DAPS activities, thus actual budget going to the agriculture statistics service roughly amounts to 40 % to the proposed amount. Thus activities of strengthening a linkage between DAPS and local organizations (DRDR-SDDR) are extremely limited and moreover, the annual statistics report has not been published since the beginning of DAPS, 2000. (2) Decentralization and local organization for statistic service The activity budget for the statistics service is exclusively controlled by DAPS since the DAPS-DRDR-SDDR administrative frame work oriented to decentralization movement in 2000, and no activity budget allocated to DRDR and SDDR. Therefore, the both local organizations are unable to make a budgeting of annual activity plan at all, thus autonomous awareness for the local administrative organs in the statistics service is not created. (3) Decrease of Staff motivation Special allowance for the permanent staff of DRDR and SDDR are supposed to be paid with 20,000 FCFA per month during the statistics survey period (usually four months from July to late December) but has been stopped since 2 years ago. Also, travel allowance for the said staff is only 2,500 to 3,500 FCFA per day, while a monthly allowance for the contract enumerator ranges 90,000 to 100,000 FCFA per month. A consideration to labor is relatively low level, thus staff motivation to work decrease, and which makes capable staff keeping is extremely difficult.
3	Statistics Administration	(1) Duplication of the statistics survey system The agriculture statistics administration in Senegal is a sharing system among the stakeholders concerned. However, SAED, SODAGRI and SODEFITEX under Ministry of Agriculture and Hydraulics (MAH) have carried out the agriculture statistics survey in their project area beside a unitary management by the DAPS-DRDR-SDDR structure. The statistics data for the rainy season rice culture in St., Louis, Matam and Kolda regions as well as cotton in the central regions is quoted from the three organs concerned notified by the Agriculture Minister. These executive organs have their own survey methods, respectively. Although the DRDR-SDDR structure in St., Louis and Matam has conducted her own statistics survey covering SAED command area, the data surveyed is unemployed. (2) Limited survey items The annual statistics survey handled by DAPS is confined to the major cereal and horticulture crops

in the rainy seasons in terms of cultivated area, crop yield, and production because of limited resources of technical, budgetary and human resources. Thus no statistics survey is conducted in the dry season. On the other hand, the survey items with less annual variation are carried out on every three years such as farm household population, farm inputs, livestock and farming implements, and a level of data compilation is always department-basis. Expansion of survey items for the statistics is important in a view point of agriculture policy analysis, formulation and evaluation purpose, thus strengthening of statistics service so as to meet needs from the users including donor countries is a big issue in DAPS.

(3) Needs on statistical information

There are high demands to expand a level of data compilation from "department-basis" to "community rural-basis" from the end-users (international organization, NGOs and local government) on the statistics information. That is, the data compilation in the department-basis is too rough and could not fit to demand of carrying out emergency aid and project formation which should be based on local area. Thus, most of the staff in DRDR and SDDR has realized it keenly and requested the central government to materialize.

(4) Data processing system

According to the Decree No. 003307(March 15, 2000), it is clearly stipulated that DRDR should have a responsibility of data processing and submit a final output to DAPS. However, DAPS has controlled the whole process of statistics service like distribution/collection of questionnaires sheets, processing and compilation of the statistics data. Thus, a position of the local organs is always put as supporting part. This system always connotes some risk to bend real information of each department situation by political speculation of the central government.

4 Method of Statistics Survey

(1) Sampling Design

The sampling design base has been established by the 1998 agriculture census supported by FAO, and from the 2000, the annual statistics survey has been carried out based on that design. The sampling design comprises the district sampling units (DSU) of 10 to 30 per *department*, and which one DSU covers around 1000 population, and then the sampling survey is implemented by selecting 3 to 4 sampling farm households from each DSU randomly. In case of expanding the data compilation level to " Community Rural" (CR) from "Department ", the following points should be considered to meet a condition of sampling theory.

1	Redesign of the sampling base based on "Community Rural" as population
2	Determination of appropriate number of sampling farm households based on sampling theory
3	Lining up of proper number of the enumerators and establishment of efficient survey method
4	Establishment of data processing base from DAPS to DRDR level and capacity building of DRDR staff for that purpose
5	Strengthening of autonomy for the local government (DRDR, SDDR) and budgetary measures

(2) Method of quadrant sampling

At present, the enumerators in SDDR office use the tools for measuring area of sampling plot and weighing of harvest in a quadrant sampling plot (QSP) with a. 50 meter measuring tape, b. magnetic compass, c. scientific calculator with programmable function, d. spring balance with 5 kg scale (least measuring weight range: 25 gm), e. poll. Surface area of polygon-shape-plot is computed with scientific calculator by measuring each side length and each corner's angle against North-South direction. An area of QSP depends on crop, and for example, paddy rice is one square meter with counting of the number of heads. Then weighing sun-dried paddy for one week is made. In a series of measuring processes, there are three processes which can mitigate a burden work to enumerators with improving of accuracy. These points are a) measuring of side length of polygon-shape-plot, b) measuring moisture content of grain, and c) top load balance with minimum scale of 5 gm.

(3) Data processing and compilation

DAPS controls the whole process of data input, correction, processing and compilation after collecting of the filled questionnaire sheets from each department. The division of agriculture statistics (DSA) produces a final outcome file (Word and Excel) by spending three and half months

		with 12 temporary PC operators including data input and correction. The final outcome in compilation process is subject to notification of Agriculture Minister so as to quote the data from SAED, SODEFITEX and SODAGRI which compile the statistics data on irrigated paddy rice and cotton data in their project areas. Thus, future issues are pointed out as below four aspects. 1) Unification of statistics system Executing organs of the statistics survey have their own method, and a statistics survey of paddy rice in the rainy season has been overlapped by DRDR and SAED, and the latter data is quoted to the annual statistics report. This duplication is waste of limited resources, and it is highly preferable to unify the statistics method into DAPS way by eliminating a duplication of statistics survey. 2) Data Processing In case of expanding the data compilation from department level to community rural level, the number of sampling farm households increases as mentioned in 4-(1) and appears to be difficult to manage under the DAPS data processing capacity. Thus, a data processing system is better to be decentralized to the regional level. 3) Collection of the Questionnaire Sheets Usually, the questionnaire sheet No. 6 for the final stage of a yield measurement should be collected by the early January but it is not completed due to some budgetary problem. Disclosure of the survey result is very important, thus it needs the system of the statistics service based on the budgetary issue. (4) Publication of annual statistics report and its utilization The final output of the compiled statistics data has just been saved in PC as electronic file and not published at all since the beginning of DAPS. The electronic data file is provided in a request-basis. Therefore, the outcome of the statistics data produced under limited resources is not efficiently utilized. On the other hand, the statistics data which could provide a basic information for analysis and formulation of the policies are hardly utilized in DAPS.

Source: JICA Study Team, January 2005

3.9 Organizations Concerned in the Rice Sector

Many organizations including public and private ones are involved in the rice sector activities. In the government, three ministries are concerned. Ministry of Agriculture and Hydraulics is responsible for paddy production, Ministry of Commerce for marketing, and Ministry of Industry and Artisan for processing, respectively. However, coordination among the ministries is not sufficient.

Many of the organizations concerned with the rice sector have been born as the executive agencies when donor countries and aid agencies implemented their own projects, which resulted in the existence of the organizations with similar functions.

Keep the above in mind, more important organizations in relation to the master planning are studied.

Producers Organization - Conseil National de Concertation et de Coopération (CNCR) - Fédération des Périmètres Autogérés (EPA) - Comité Interprofessionnel du Riz (CIRIZ) - Comité National de Concertation sur la Filière Rizicole (CONCOFIR) - Fédération des Producteurs du Bassin de l'Anambé (FEPROBA) - Fédération Nationale des Producteurs de Riz au Sénégal (FNPRS)	Private Sector Representing Organization - Association des Riziers du Nord (ARN) - Regroupement des Prestataires des Travaux Agricoles dans la Vallée (RETADEV)
Governmental Organizations in relation to Rice Market Information Development - Agence de Régulation des Marchés - Observatoire National du Riz au Sénégal (ONRS)	Other Governmental Organizations - Commissariat à la Securité Alimentaire (CSA) - Institut Sénégalais de Normalisation (ISN) - Institute de Technologie Alimentaire (ITA)

(1) Producers Organizations

CNCR (Conseil National de Concertation et de Coopération des Ruraux) was established in 1993, as an autonomous organization to defend the rights of the producers in the rural areas. In the same year, FPA (Fédération des Périmètres Autogérés) was established as a collective of GIEs and rural unions which utilize large irrigation schemes transferred their management from the Government.

In 1998, CIRIZ was established to coordinate the activities of the actors in rice sectors including rice producers, rice millers, marketing and distribution traders. Background of its establishment is the arizen need for the discussion on paddy price of domestic rice among agencies when rice distributors have confronted the difficulty in procuring paddy after the rice producers set the farm gate price higher immediately after the devaluation of local currency in 1994. CIRIZ coordinates the paddy farm gate price setting, monitors the crop growth, execution of CNCAS credits and cropping plan in each cropping season. It also plays an important role to petition the Government.

On the other hand, the Government established CONCOFIR (Comité National de Concertation sur la Filière Rizicole), in accordance with the Law of the Prime Minister's Office issued in January 1998, gathering all the stakeholders of the rice sector including producers, money lenders and farm machinery traders. However, no prominent activities have been reported so far.

In 2000, FEPROBA (Fédération des Producteurs du Bassin de l'Anambé) was established to participate in various activities regarding the rice sector after SODAGRI withdrew from the rice business. In 2003, FNPRS was established, merging rice producers' groups in each Region, in order to ensure their profits, functioning as negotiation body with money lenders, traders and rice millers. FPA and FEPROBA participate in FNPRS.

(2) Private Sector Representing Organization

There is no such representative organization that aims at activating rice milling and farm machinery service by petitioning the government or coordinating with the producers. Only CIRIZ plays a limited role on this.

(3) Governmental Organizations in relation to Rice Market Information Development

ARM (Agence de Régulation des Marchés) is responsible for the collection and dissemination of the information on rice market. One of the important roles of ARM is the monthly monitoring of rice import amount. For market information, weekly monitoring of the price of milled rice and stock is carried out at 18 fixed points in the Country. ARM also advises the eight major rice importers to import rice when the rice stock reduces to below 100,000 tons. However, rice producers and consumers do not have access to the information to utilize them.

(4) Governmental Organizations regarding Food Security

CSA (Commissariat à la Sécurité Alimentaire), established after the experience of serious drought in 1974, was defined its function by law in 1984. Since May 2001, it has been belonging to the Ministry of National Solidarity (Ministère de la Solidarité Nationale). The main function of CSA is to store provisions and stabilize the market price. It procures the provisions at government determined price, stores them and release them at disaster or price jump. It also receives and distributes aid foods from WFP, Japan, etc. Target food stock amount by CSA is 20,000 tons, but the actual amount is far below.

Information sharing between ARM and CSA seems not harmonized.

(5) Governmental Organizations concerning the Rice Quality Standard

In 1996, ISN (Institut Sénégalais de Normalisation) established the quality standard for both paddy and milled rice. The standard for milled rice is only applicable to the imported rice. As milled rice is the commercial goods in the market, quality control has been under the responsibility of the Ministry of Commerce. However, as quality management of paddy is definitely important for the improvement of the quality of milled rice, coordination with agricultural extension is still important.

ITA (Institut de Technologie Alimentaire) was established in 1963, as a research organization concerning with food and nutrition. It belongs to the Ministry of Industry and Artisans. Having been supported by FAO, CIDA, etc., its facilities and management system have been evolved. It conducts research and technology development on food processing and preservation, while it controls quality of marketed food and provides necessary services on quality control of traded agricultural products. ITA has the facilities for analyzing cereal grains (moisture content, impurity content, protein and cellulose contents, etc.).

(6) Government Organization on Monitoring Rice Market

In August 1999, ONRS (Observatoire National du Riz au Sénégal) was established within DAPS, under the financial support by CIRAD (Centre de Coopération International en Recherche Agronomique pour le Développement). It provides more than 100 relevant organizations with the Senegalese domestic rice market information based on the analysis on the rice import, the market price, the stock amount, etc., by newsletter.

ONRS has no permanent staff and its activities depend on the financial assistance of donors. It is PRIAF (Projet de Renforcement de l'Information des Acteurs des Filières Rizicoles en Matière de Marchés et de Politiques, Markets and Policies –Related Information Strengthening Project for Actors of the Rice Sectpr) in which seven Western African Countries (Senegal, Mali, Guinea, Burkina Faso, Banin, Ghana and Niger) participate.

3.10 Problem Analysis

3.10.1 Workshop on Problem Analysis of Rice Sector

The series of workshop was held by inviting stakeholders of the rice sector for five priority regions, namely Saint Louis, Matam, Fatick, Ziguinchor and Kolda. Various opinions concerning problems the stakeholders encounter are listed and prioritized among the participants in the workshops. Furthermore, cause and consequence of major problem were discussed.

The workshops held were summarized below.

Table 3.10.1 Workshop on Problem Analysis of Rice Sector

Region	Date in 2005	Stakeholders	Attendants	Venue	Facilitators
Saint Louis and Matam	4 Jan.	Government staff	34	Chamber of Commerce, Saint Louis	Mr.Moreira (SAED) Mr.Thioune (DAPS) Dr.Guye (Consultant)
	5 Jan.	Rice millers & machinery service providers	18		
	6 Jan.	Producers	11		
Fatick	8 Feb.	Government staff	20	Meeting Room of DRDR Fatick	Mr. Thioune (DAPS)
	9 Feb.	Producers	25		
Ziguinchor	25 Jan	Government staff		Meeting Room of DAPS	Mr. Thioune (DAPS) Mr. A. Sall (DAPS)
Kolda	27 Jan	Government staff			

3.10.2 Problem Analysis

The problem trees were made based on the analysis result of workshops. These problem trees were attached as figures and listed below.

Fig. 3.10.1 Problem tree based on the analysis of the public sector in the regions of Saint Louis and Matam

Fig. 3.10.2 Problem Ttree based on the analysis of the Private Sector in the region of Saint Louis

Fig. 3.10.3 Problem Ttree based on the analysis of the producers of the region of Saint Louis

Fig. 3.10.4 Problem Tree on the rice sector based on the analysis the public sector actors in the regions of Fatick and Kaolack

Fig. 3.10.5 Analysis of problems related to rice production in Fatick region by producers

Fig. 3.10.6 Problem analysis of irrigated rice sector in Kolda region

Fig. 3.10.7 Problem tree on the rice sector (situation of rainfed rice) based on the analysis of the public sector actors of the region of Kolda

Fig. 3.10.8 Problem analysis of rice sector in Ziguinchor region

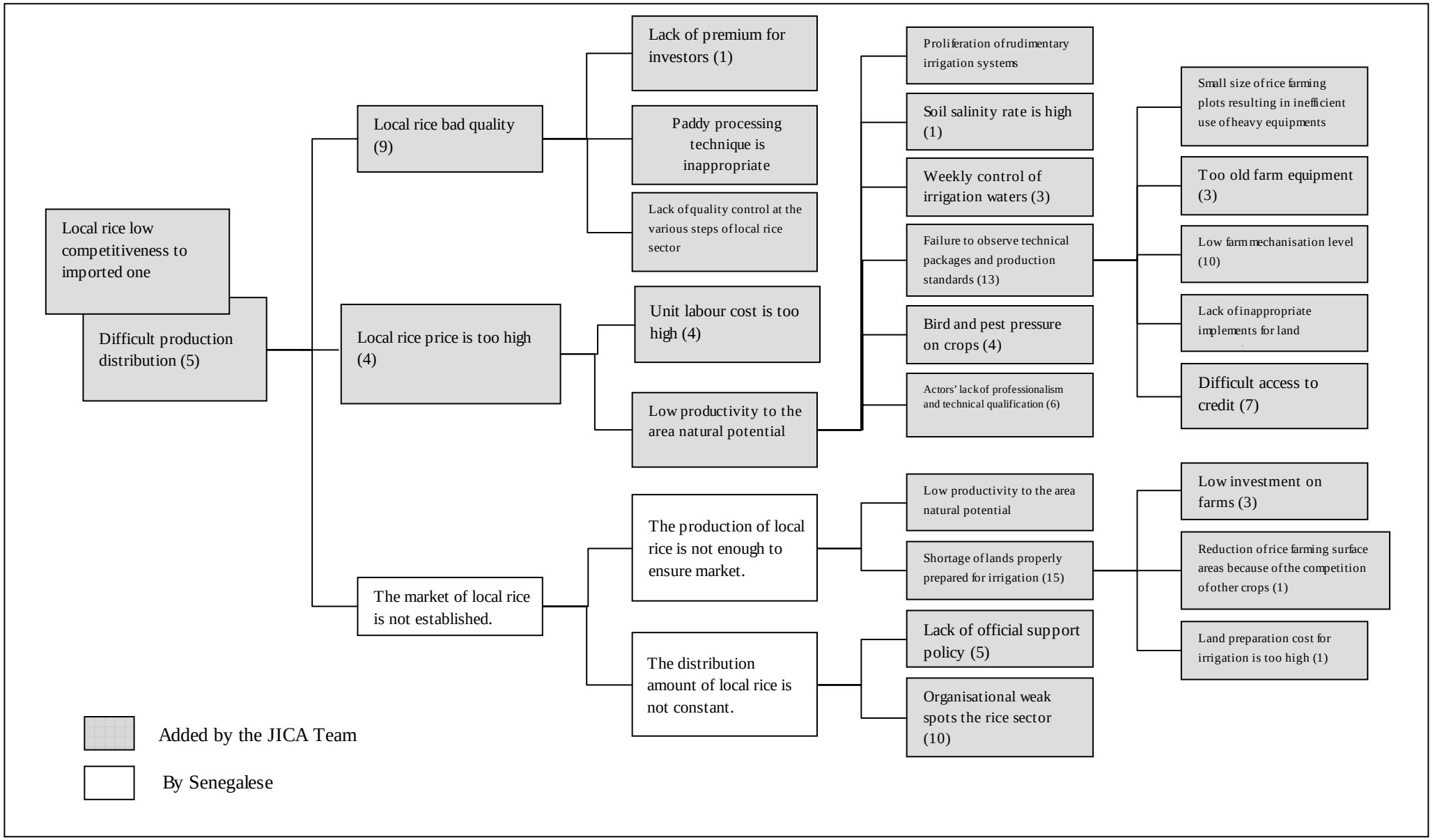


Fig. 3.10.1 Problem tree based on the analysis of the public sector in the regions of Saint Louis and Matam

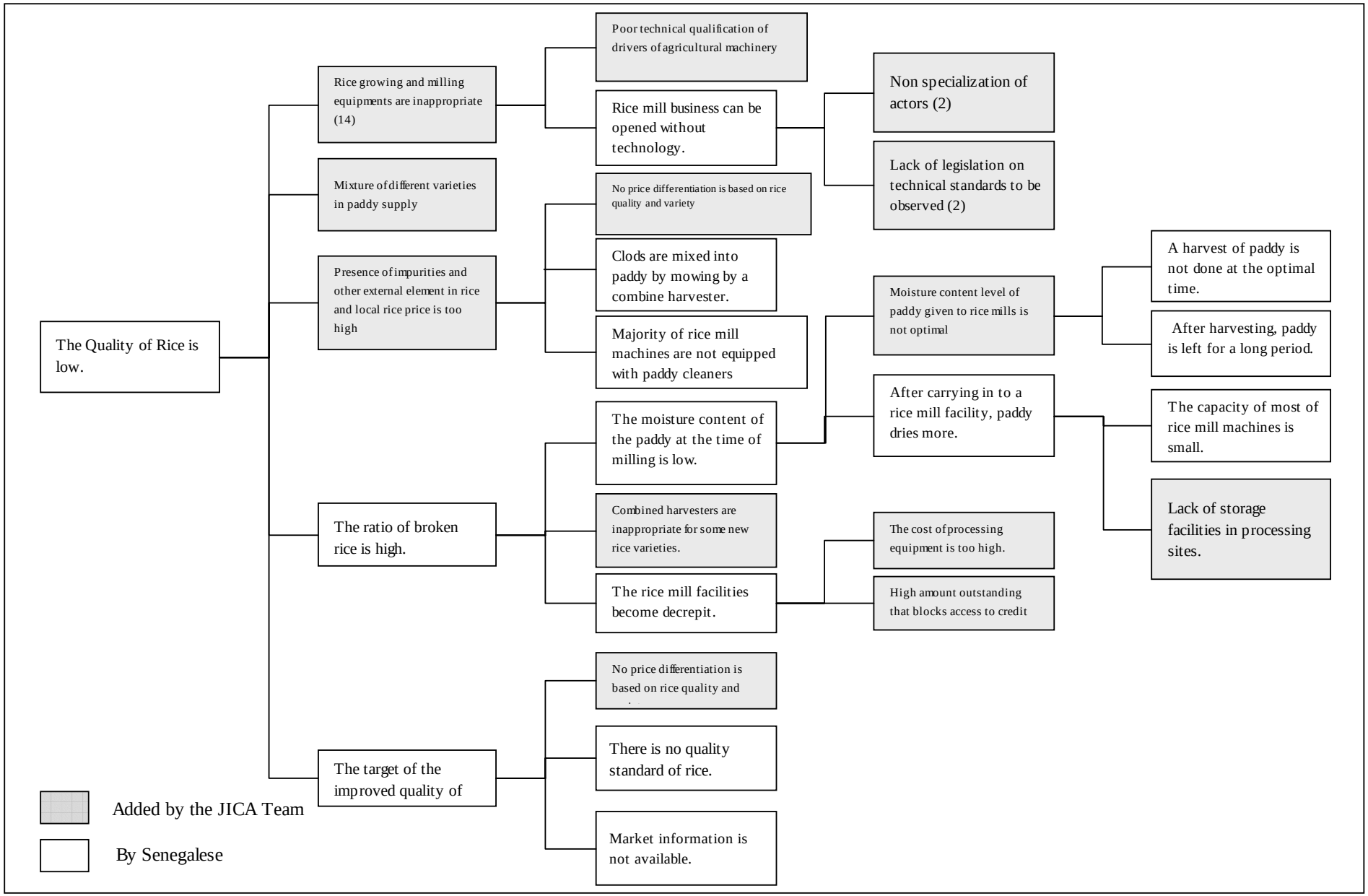


Fig. 3.10.2 Problem Ttree based on the analysis of the Private Sector in the region of Saint Louis

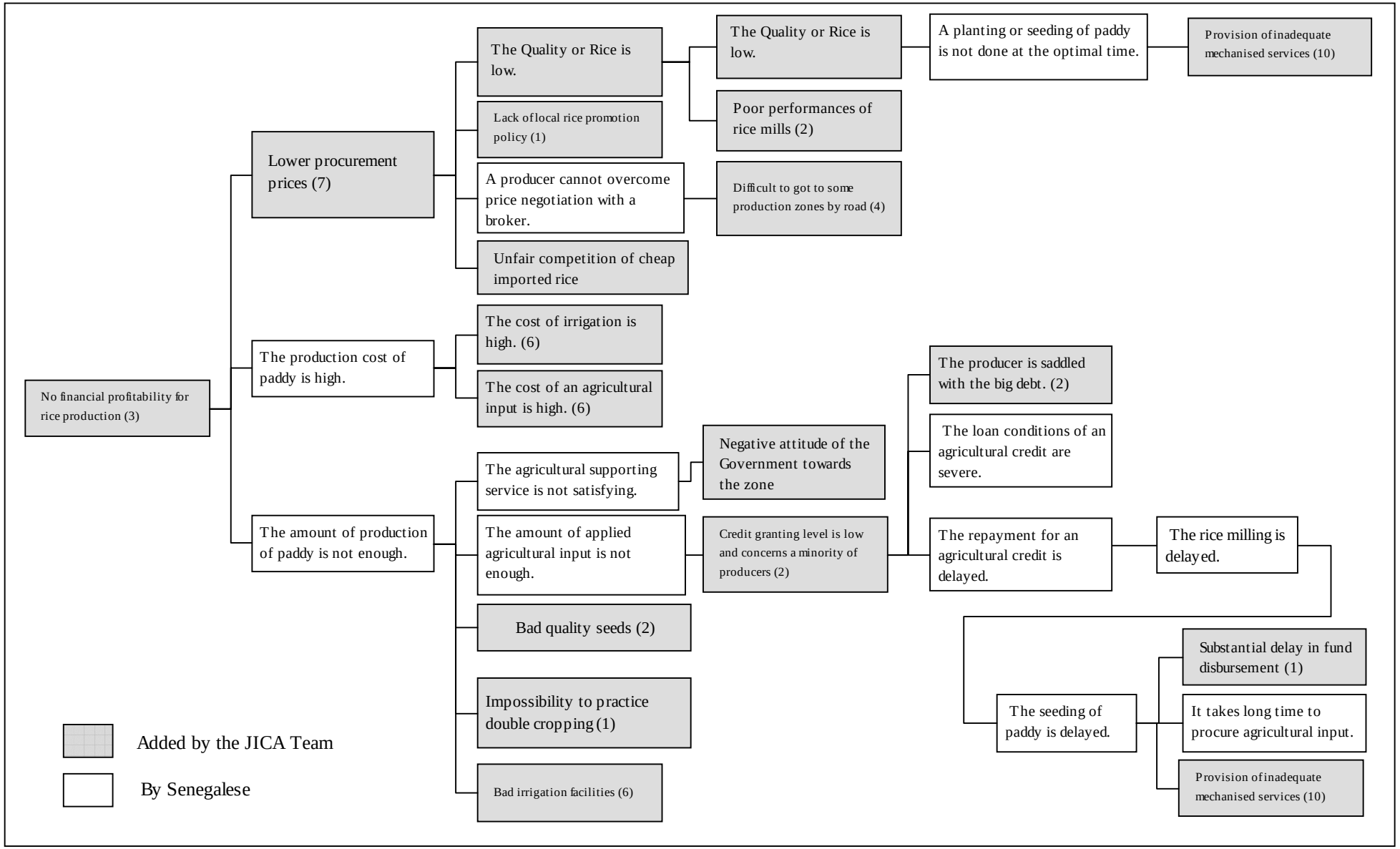


Fig. 3.10.3 Problem Ttree based on the analysis of the producers of the region of Saint Louis

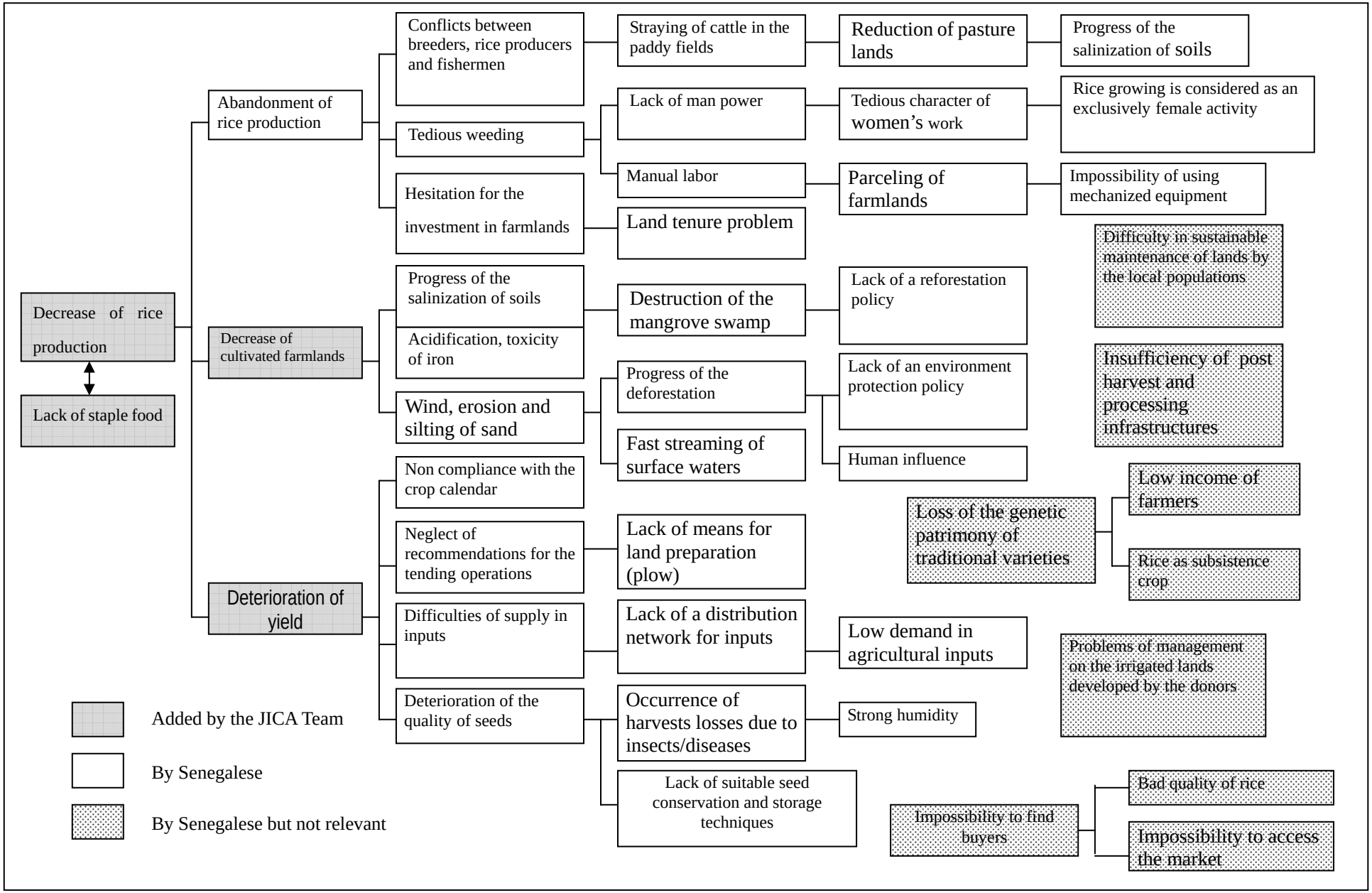


Fig. 3.10.4 Problem Tree on the rice sector based on the analysis the public sector actors in the regions of Fatick and Kaolack

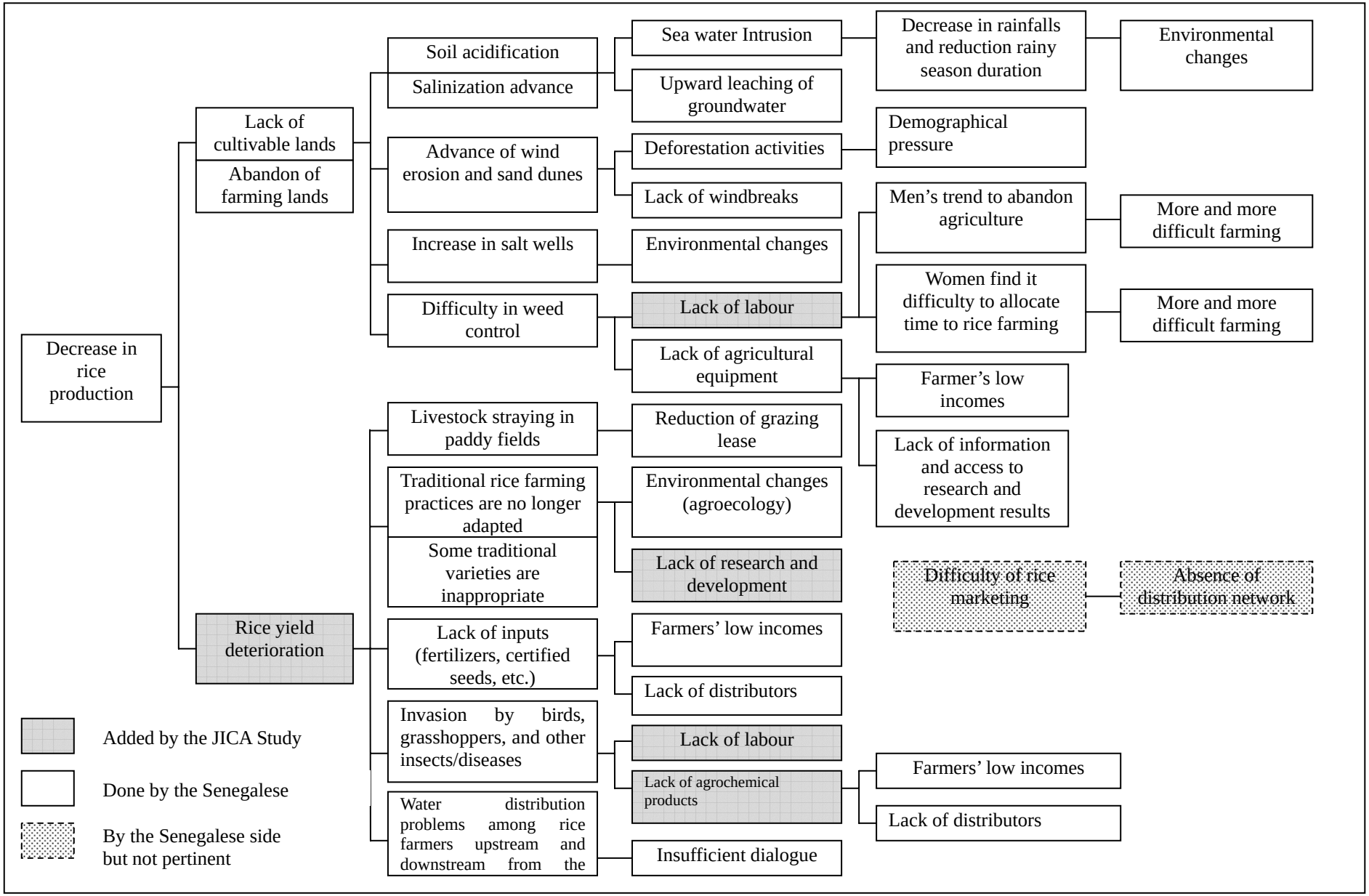


Fig. 3.10.5 Analysis of problems related to rice production in Fatick region by producers

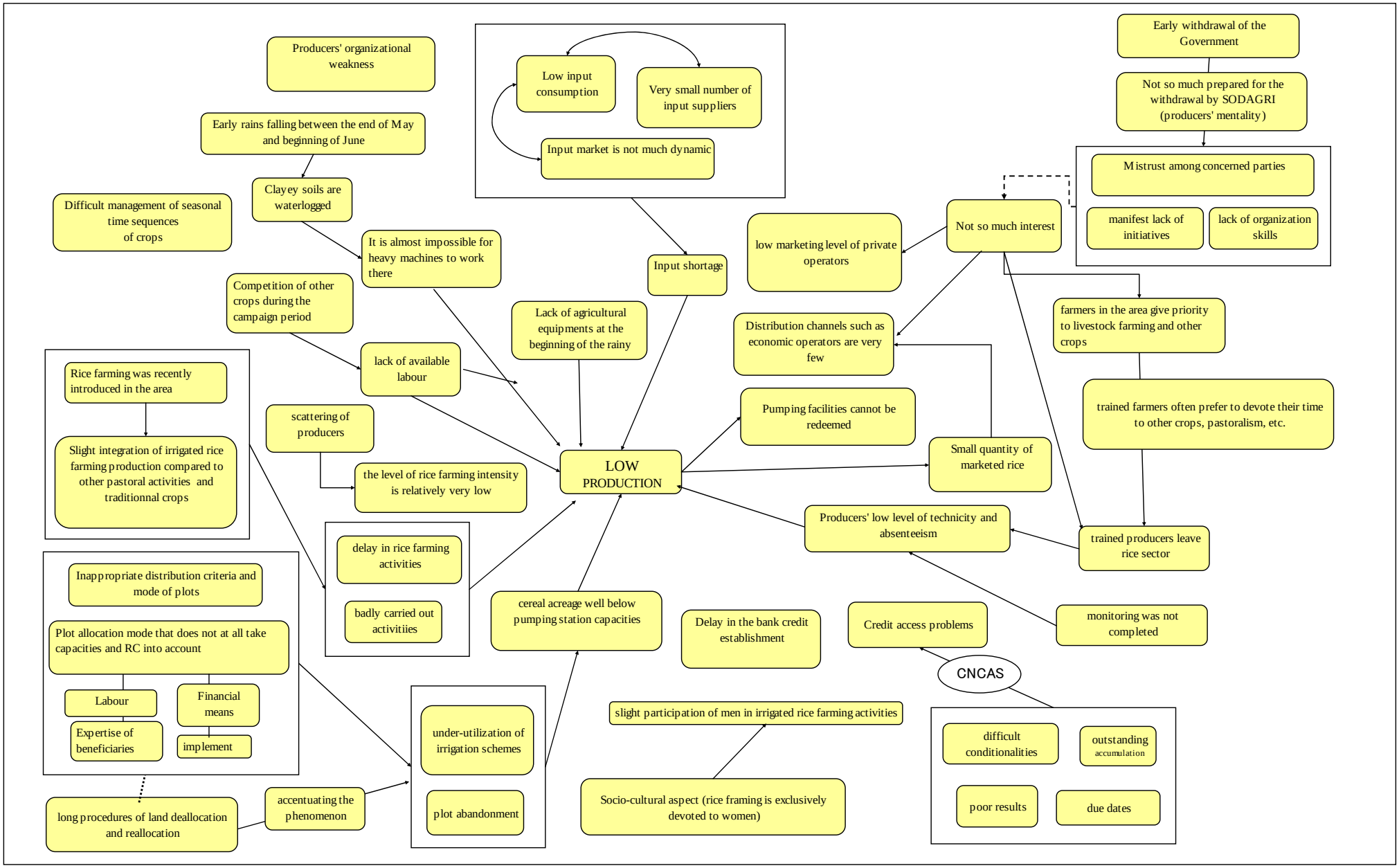


Fig. 3.10.6 Problem analysis of irrigated rice sector in Kolda region

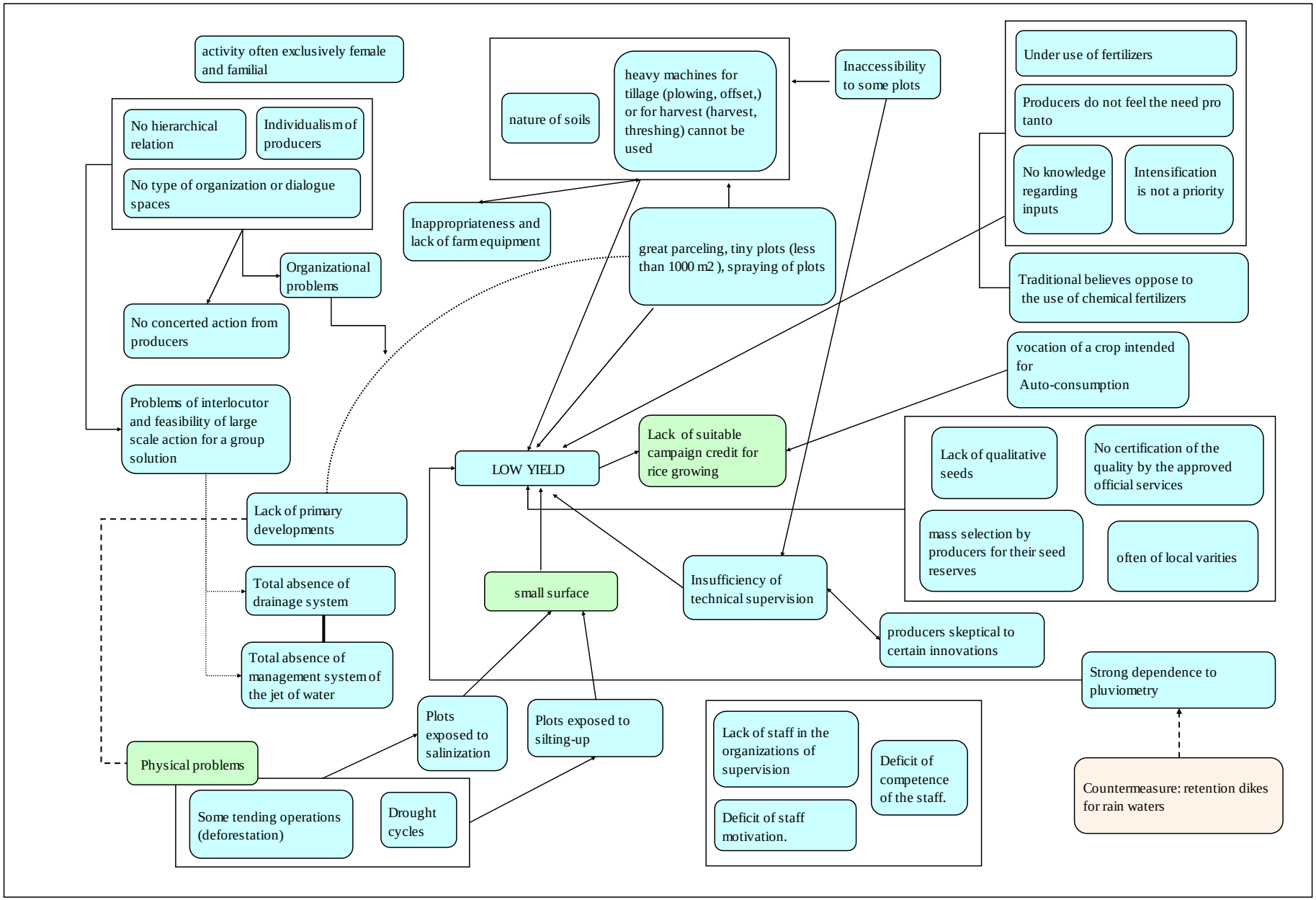


Fig. 3.10.7 Problem tree on the rice sector (situation of rainfed rice) based on the analysis of the public sector actors of the region of Kolda

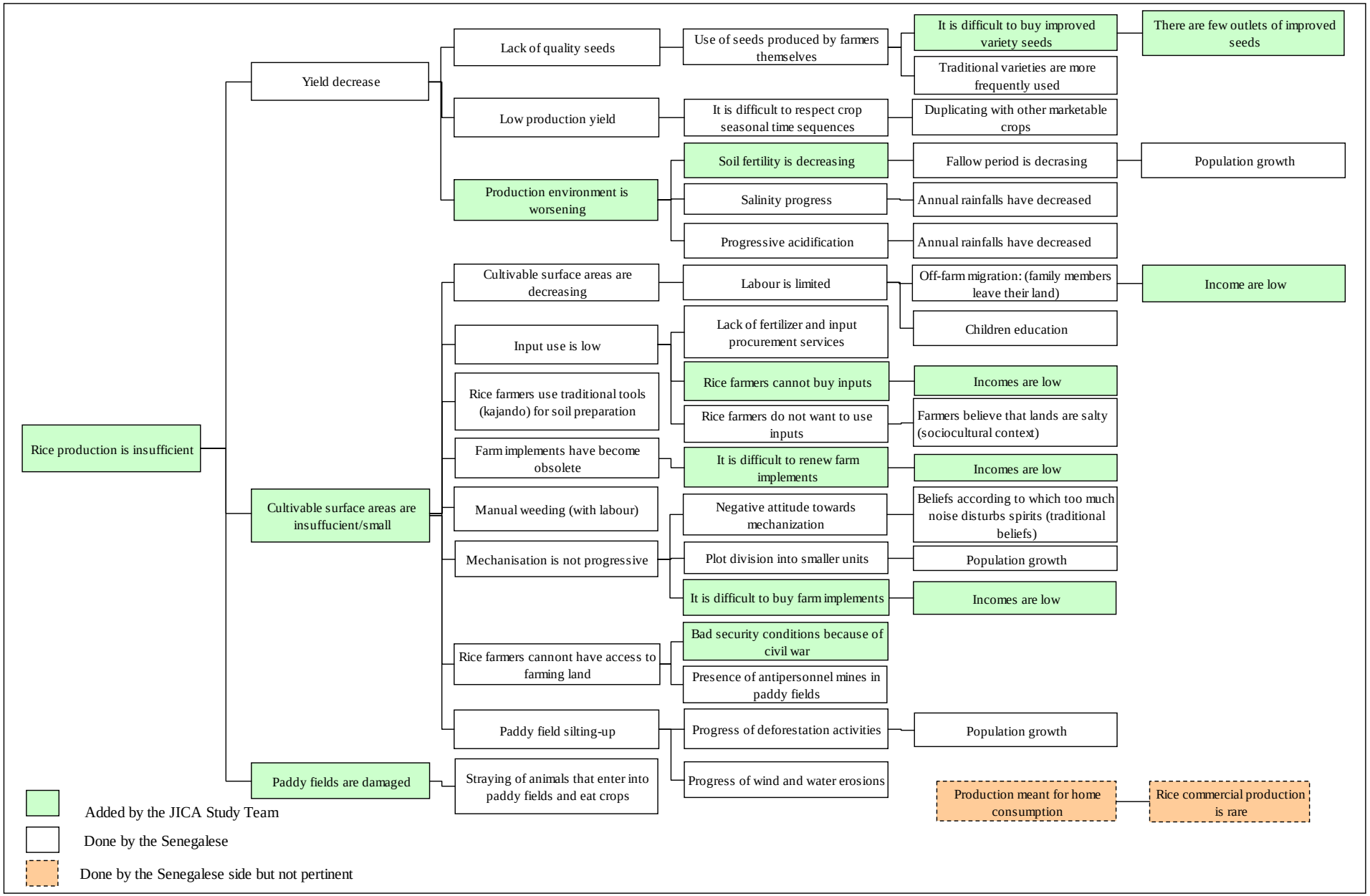


Fig. 3.10.8 Problem analysis of rice sector in Ziguinchor region

CHAPTER 4 MASTER PLAN

4.1 Introduction

Based on the analysis of the existing conditions, it is judged that the Senegal river valley will continue playing a leading role to attain the Master Plan's goal, "improvement of the self-sufficiency rate of rice towards the year 2015".

In the valley, basic infrastructure such as irrigation facilities, major roads and rice mill plants are available as a result of huge investment made in the past. Besides, capitalizing on the suitable soils for agriculture and abundant water resources, very high yield has been realized by the experienced farmers supported with the various services including technical extension, inputs supply, agro-machinery operation, credit, etc. Further increase in rice production could be attained more easily than the other areas in the Country.

The major part of the Master Plan (this Chapter) is, therefore, described focusing on the Senegal river valley. However, it does not necessarily mean that the Master Plan will not cover the other regions including Fatick, Kolda and Ziguinchor regions where traditional rice cultivation has dominantly been practiced under the rainfed condition. Although the drastic increase in rice production is not expected due to the various difficult problems in those areas, certain efforts should also be made, in the context of the Master Plan, to address the food security and poverty reduction. Several realistic projects and programs are formulated for improving the current situation to possible extent.

4.2 Problem Structure of the Rice Sector

A problem structure analysis has been conducted for the rice sector in the Senegal river valley. Results are shown in Figure 4.2.1, from which it is realized that the rice sector faces various problems, which would work as constraints to the sector development as a whole.

Referring to Figure 4.2.1, major problem phenomena in the Senegal river valley are identified from production to post-harvest and handling including milling and marketing, which leads to the core problem of 'decrease in the self-sufficient rate of rice'.

4.2.1 Major Problems

(1) Production related problems

The major problem phenomenon in relation to the production sub-sector is the insufficient rice production to meet the national demand. This phenomenon is caused by the disincentive of the producers to rice production due to low profit, which partly accounts for the increase in the abandoned/fallow paddy area and the change in crops.

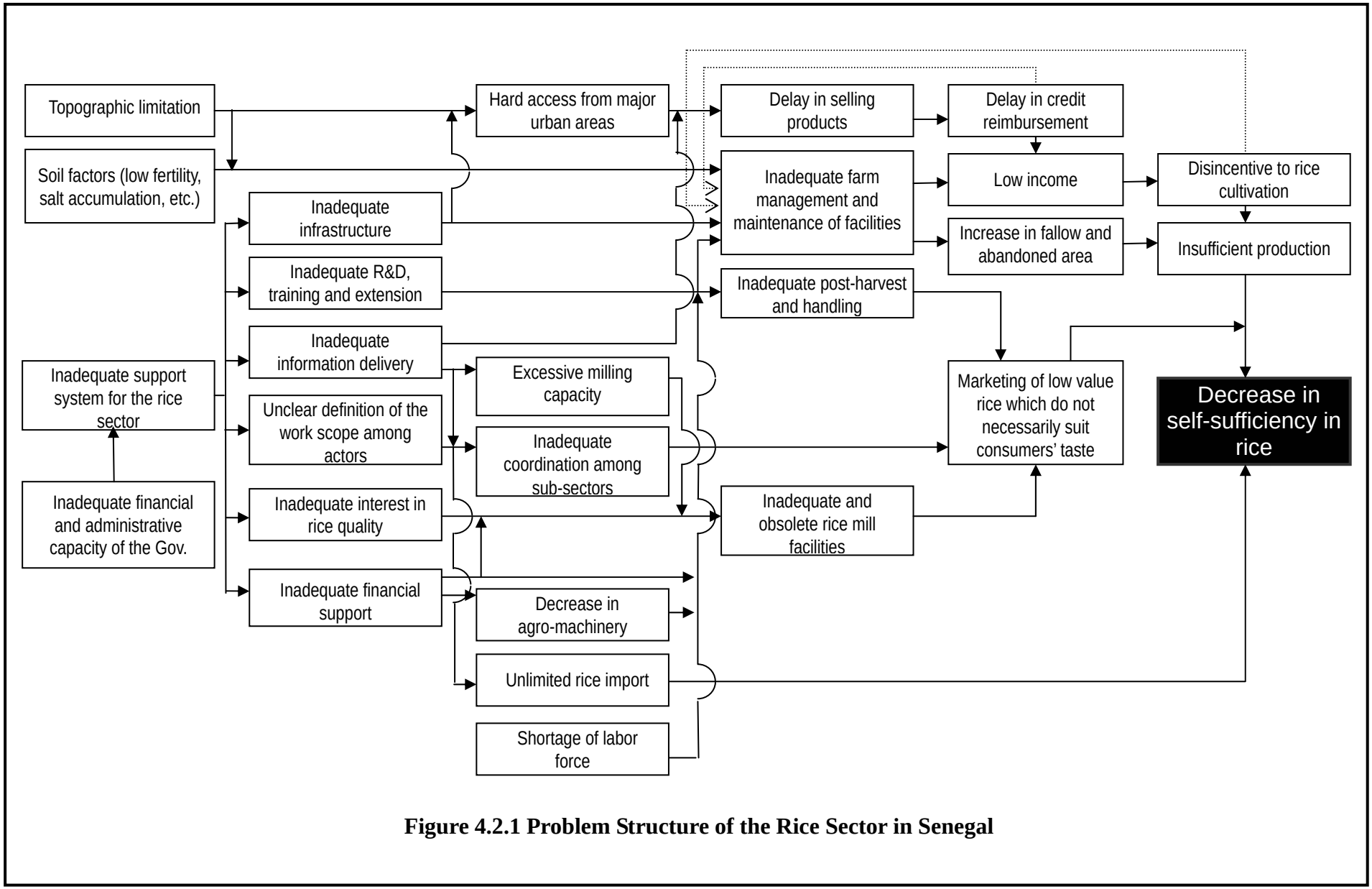


Figure 4.2.1 Problem Structure of the Rice Sector in Senegal

The cause of the low profit is relatively high cost of production in comparison with the gross benefit and/or lower actual yield level than the potential. High production cost results from the high cost of inputs, irrigation, harvest and transportation. At on-farm level, yield increase is only the way to increase income, as the paddy price at farm-gate is fixed irrespective of the quality.

Lower yield is attributed to the inadequate farm management and inadequate maintenance of the facilities. Other constraints to attain higher yield include the limited use of inputs due to the limit of credit amount by CNCAS as well as failure in the timely application of inputs according to cropping calendar due to the delay in arrival of inputs to supplier. The causes of the increase in abandoned/fallow paddy area include saline/alkaline hazard induced by low level of irrigation development, especially lack of drainage facility and inadequate leveling, and break down of irrigation pomp due to the inadequate maintenance. This is particularly true in private irrigation schemes (PIP) and village irrigation schemes (PIV).

The delay in selling paddy/rice delays the credit reimbursement which results in the bad debt. This is mainly caused by the delay in harvest as results of the decrease in harvest machinery and insufficient labor force at harvest time. Other reason for the delay in selling the harvest is remoteness of or difficult access to the irrigation schemes, which hinders the smooth marketing.

Disincentive to rice production and the delay in credit reimbursement, together with other factors, aggravate the inadequate farm management and maintenance of facilities, creating a vicious cycle.

(2) Problems on post-harvest and handling

The major problem regarding post harvest and handling is the lack of technology and system to process into milled rice which suits the consumers' taste. The direct causes include (i) inadequate post-harvest and handling, (ii) inadequate and obsolete rice mill facilities and (iii) inadequate coordination among the sub-sectors.

Inadequate post-harvest handling, including the delay in threshing after harvest, the delay in rice mill after threshing, inadequate storage, etc. often makes harvested paddy excessively dry, which brings about the decrease in milling recovery rate and increase in broken rice content.

Only a few existing rice mill factories are equipped with paddy cleaner, sifter and/or grain sorter, and the sorting work is often done by manually after milling. Many rice mills are obsolete which lowered the work efficiency. One of the reasons for it may be the excessive competition among rice millers as the total rice milling capacity in the Senegal river valley exceeds the paddy production in the area. Rice mill operators are normally hired seasonally, which hinders the improvement of operators' skill, as the rice mill operation duration is only several months a year.

Inadequate coordination among sub-sectors in paddy collection, milling and marketing hinders the improvement of quality of local rice. Rice milling business in Senegal is mainly on commission basis. The processing charge is almost fixed irrespective of the milling quality, which make rice millers reluctant to improve the facilities and technologies for quality improvement. This adversely affects the producers' incentive to supply better quality of paddy, as the price of paddy does not reflect the paddy quality.

(3) Problems on marketing

The most serious problem on marketing local rice is the difficulty in securing market due to the low supply quantity as compared with imported one. The domestic rice is marketed

mainly from January through March, and the stock will almost run out in July. On the other hand, imported rice supply is steady all the year round.

Rice import has been increased remarkably, especially after the liberalization of rice market in 1996. According to the statistics, the annual rice import amount exceeds actual rice consumption by 200,000 to 300,000 tons every year. This contributes to the decrease in self-sufficiency rate in rice based on the supply amount.

The information on marketing rice is not delivered properly. The collection of the rice market information is under the responsibility of the Ministry of Commerce, but the collected information has not been delivered and utilized fully. For example, information on the consumers' taste on rice has not been transmitted to rice millers and producers. Another problem is the lack of information on paddy harvesting date, which makes it difficult for the buyer of paddy to access to the producers timely.

4.2.2 Fundamental Problem

Four fundamental problems are noted as shown in Figure 4.2.1. Two of them are inherent problems: topographic limitation and soil factors. Two other factors are institutional: inadequate support system for the rice sector and inadequate financial and administrative capacity of the government. These problems have caused an array of problem factors causing the major problem phenomena. These linking factors are: (i) inadequate infrastructure development, (ii) inadequate research and development (R&D), training and extension, (iii) inadequate information delivery and (iv) unclear definition of work scope among the actors, (v) inadequate interest in rice quality, and (vi) inadequate financial support.

4.3 Objectives and Strategy for the Reorganization of the Rice Sector

4.3.1 Objectives of the Reorganization of the Rice Sector

Objectives for the reorganization of the rice sector in Senegal are defined addressing to the major problem phenomena identified above.

- To provide better rice production environment which allow paddy farmers to obtain more income and sustain paddy cultivation
- To produce high quality domestic rice corresponding to the consumers' needs.
- To prepare various conditions to assure the smooth marketing of domestic rice.

The above objectives are mutually related. Integrated approach is a must for the successful reorganization of the rice sector.

4.3.2 Basic Strategy for the Reorganization of the Rice Sector

The following four elements constitute the basic strategy for the reorganization of the rice sector in Senegal.

(1) Improvement of production environment for the rice farmers

To motivate rice farmers to continue cultivation, the production environment of rice should be improved in order for the rice producers to increase income. This following constitute the strategy:

1.1 Improvement of irrigation and drainage facilities especially in VIP and PIP;

1.2 Strengthening of linkage between research, extension and farmers to realize

production cost reduction and yield increase;

1.3 Improvement of the quality and efficiency of agro-machinery operation;

1.4 Development of farm tools and small machinery that farmers can operate;

1.5 Assurance of timely inputs supply; and

1.6 Improvement of agricultural credit system.

(2) Improvement of marketability of domestic rice

Domestic rice which suits the Senegalese consumers' tastes should be provided all the year round to secure the market channel. As an economic sub-sector, the value added of the domestic rice should be increased more through strategic marketing. This strategy may be supported by the following components:

2.1 Improvement of the quality of milled rice by renewing or upgrading rice mill facilities;

2.2 Reduction of post-harvest loss, improvement of milling recovery and extension of rice mill operation duration;

2.3 Development and dissemination of the system of timely harvest and threshing;

2.4 Improvement of paddy collection system;

2.5 Establishment of rice quality standard; and

2.6 Establishment of rice quality indication rule and its dissemination.

Improvement of the business environment of the rice millers is vital for increasing value added. The role of rice millers should be re-defined with financial support for them to be motivated.

(3) Strengthening of the monitoring on rice market

To promote healthy competition environment between imported rice and local rice, monitoring of rice market should be strengthened. Monitoring results should be disseminated to the public. The following are particularly important

3.1 Monitoring of rice import (quantity, quality and price) and stock;

3.2 Market price of rice at the major cities; and

3.3 Marketed rice quality and consumers' demand.

(4) Improvement of the access between production areas and milling places

To overcome problems related to hard access to rice production areas caused by topographic factor, road facilities and collection points should be upgraded or developed. Information on paddy harvest and collection time in irrigation areas should also be disseminated to fill gaps. The following are instrumental for this strategy:

4.1 Improvement of rural access connecting trunk roads with rice production area;

4.2 Construction of bridges to cross the seasonal rivers; and

4.3 Information dissemination on harvesting time.

4.4 Development Framework

4.4.1 Rice Demand Projection

FAO estimated per capita cereals consumption of Senegalese during 2000 through 2002 by crops, as shown in the table below.

Table 4.4.1 Per Capita Cereals Consumption Rate (2000-2003)

Cereal crop	g/day	kg/year	share（%）
Rice	203	74.1	46
Maize	27	9.9	6
Millet	99	36.1	23
Sorghum	32	11.7	7
Wheat	78	28.5	18
Total	439	160.2	100

Source: FAO Stat

The per capita annual rice consumption rate is assumed to be constant at 74 kg up to the year 2015 in this Study. The difference in per capita consumption among areas is not considered.

The future population towards the year 2015 is projected based on the census results in 1992 (revised in2006), as shown below.

Table 4.4.2 Population Projection

(unit: 1,000)

Area	2005	2010	2015
Dakar city	1,003 (100)	1,146	1,271 (123)
Suburb of Dakar	1,413 (100)	1,595	1,779 (126)
Urban	3,283 (100)	3,671	4,100 (125)
Rural	5,090 (100)	5,767	6,560 (129)
Total	10,818 (100)	12,179	13,710 (127)

Source: Population du Senegal, Structure par sexe et par age en 1988 et projections de 1989 a 2015 (Ministere de l'economie, des finances et du plan)

Based on the above, future rice demand towards the year 2015 is projected as shown below.

Table 4.4.3 Rice Demand Projection

(unit: 1,000ton)

Area	2005	2010	2015
Dakar city	74	85	94
Suburb of Dakar	105	118	132
Urban	243	272	303
Rural	377	427	485
Total	801	975	1,015

Source: JICA Study Team's estimate

From the above, it is estimated that the total rice demand in Senegal in 2015 will reach to one million tons.

4.4.2 Production Target of the Domestic Rice

In the Master planning, the production target of the domestic milled rice has been set at

400,000 ton in year 2015, accounting for 40% of the estimated total demand of milled rice with one million ton. Many government agencies commented that this production target was low.

To provoke further discussion, the basis of the production target is shown in the following. Rice production target is set by region, in consideration of the past performance, current production technology and environment, and future production plan, etc.

(1) The Senegal river valley

In the Senegal river valley, the harvest area of rice, once having been stagnant or even decreased since the rice market was liberalized, has been recovered in recent years. The average yields have been stable under irrigation condition, and improved with the improvement of farmers' cultivation techniques and the use of certified seeds. SAED, the leading agency of agricultural and rural development in the area, prepares and implements three year development plan including irrigation development and rice production. Various donors and international aid organizations have invested on the irrigation development projects, and several projects are on-going. As this area has been put priority in crop production, future rice production increase is most likely to be expected.

Table 4.4.4 Target Rice Production up to Year 2015 by Area

	Base year (2005)	2009	2012	2015
Senegal river valley				
Total area (ha)	23,500	44,000	56,000	68,000
Cropping Intensity (%)	115	135	135	135
Yield (ton/ha)	5.75	6.11	6.38	6.65
Production (ton)	135,100	268,800	357,300	452,200
Fatick and Kaolack Regions				
Total area (ha)	1,000	1,080	1,140	1,200
Yield (ton/ha)	1.05	1.63	2.04	2.50
Production (ton)	1,100	1,800	2,300	3,000
Tambacounda Region				
Total area (ha)	1,600	1,700	1,800	1,900
Yield (ton/ha)	0.9	1.54	2.02	2.50
Production (ton)	1,400	2,600	3,600	4,800
Kolda and Ziguinchor Regions				
Total area (ha)	56,000	58,000	60,000	62,000
Yield (ton/ha)	1.44	1.86	2.18	2.50
Production (ton)	80,600	107,900	130,800	155,000
Senegal Total				
Total area (ha)	82,100	104,780	118,940	133,100
Yield (ton/ha)	2.66	3.63	4.16	4.60
Production (ton)	218,200	381,100	494,000	615,000
Rice equivalent (ton)	142,000	248,000	321,000	400,000

Source: JICA Study Team's estimate

Based on the above, it is projected that the paddy area, taking the average harvested area in

the past five years between 2000/01 and 2004/05 as base, will increase by 3,000 ha every year up to 2015. Cropping intensity will increase from 115% to 135%. The total harvest area in 2015 will then be 68,000 ha. A conservative cropping intensity (not 200% but 135%) is set due to the experience of the farmers who practice double cropping that the continuous double cropping results in the yield decrease because of the decrease in soil fertility. Here four cropping in three years is adopted.

Meanwhile, the yield will increase by 90kg every year, from the one recorded in 2004/05, to reach to 6.65 ton/ha in 2015. As a result, the total paddy production in 2015 is estimated at 452,200 ton, as shown in Table 4.4.4.

(2) The other rice areas including Fatick, Kolda and Ziguinchor

In the other rice areas including Fatick, Kolda and Ziguinchor, paddy cultivation is done mostly under the rainfed condition, under which both the harvested area and yield depend much on the rainfall amount and its distribution. Rice cultivation is mainly done by women who are less powerful than men with low technology in farming. The average annual rainfall amount in the past 30 years has decreased much as compared with that in the previous 30 years, which, combined with the decline in vegetation in the upstream areas, has brought about the considerable decrease in the cultivated area as well as increase in salt-affected areas. Donors and NGOs have assisted them in implementing sea water intrusion prevention projects or rural development projects, which have resulted in modest improvement. Tremendous investment is needed to improve the situation drastically.

Based on the above, it is projected that the paddy area, taking the average harvested area in the same period as above as base, will increase by 10% for Kolda and Ziguinchor and by 20% for the other areas in 2015, respectively. Cropping intensity will be 100%. Total rice harvest area in 2015 will be 64,480 ha. The yield, taking the average of past five years as base, will increase up to 2.5ton/ha in 2015. Based on the above, the total paddy production in the other areas than the Senegal rive valley is projected at 162,800 ton in 2015, equivalent to 105,820 ton of milled rice assuming the milling recovery rate of 65%.

It should be mentioned that the all the above projection is made on the assumption that the climate conditions will not be changed in the future and that the annual rainfall amount will be kept normal.

From the all above, the JICA Study Team has set the production target of domestic rice in 2015 as 400,000 ton of milled rice. To attain the target, harvest area will increase by 62%, from 82,100 ha at present to 133,100 ha in 2015, and the yield will increase by 73% from 2.66 ton/ha at present to 4.6 ton/ha in 2015.

(3) Seed production

In addition to the above, seed production will also have to be increased. The production of certified paddy seed by UNIS in 2004/05 was 2,500ton. On the assumption that the average seeding rate of 100kg/ha for the normal paddy production, the produced seed amount in 2004/05 covers 25,000ha of paddy field, which accounted for some 83% of the harvested paddy area, or 30,000ha in the Senegal river valley in the same year. The rice producers do not always use the certified seeds for cultivation but use a part of the previous harvest as seeds.

The future seed production of paddy will be targeted to cover 90% of the paddy production area in 2015. Assuming that the seeding rate for the paddy production will not change at 100kg/ha and that the yield of certified seeds will be 6.0 ton/ha (90% of the produced seeds

will be certified), some 1,000 ha of the seed production farm will be established. In the other areas including Kolda and Ziguinchor, assuming that the paddy seeds amount will cover 50% of the total paddy production area of some 66,000 ha, some 500 ha of seed farm will be established.

4.4.3 Supply Amount of Domestic Rice

In order to meet the rice demand of one million tons in 2015, on the assumption that the present importation amount of 600,000 ton is maintained, 400,000 ton of domestic rice production is needed.

Table 4.4.5 Rice Supply Frame

Unit: 1,000ton

Area	2005		2015	
	Domestic rice	Imported rice	Domestic rice	Imported rice
Urban	50	650	100	400
Rural	100		300	200
Total	150	650	400	600
	800		1,000	

Source: JICA Study Team

Current annual domestic rice production is some 150,000 ton, having been stagnant during the last five years. The attainment of 400,000 ton of domestic rice production is a big challenge.

The above supply frame does not include the stock. According to the ARM, the Senegalese government set the minimum stock amount at 100,000 ton. As the population in 2015 will increase by 30% from that in 2005, 130,000 ton of stock will be necessary, if the stock level is maintained. This amount will be supplied by import.

4.5 The Scenarios of Development

(1) Support to Rice Millers

The significant increase of the self-sufficiency rate by 2015 depends on the improvement of the local rice production conditions. Thus, in the long term, several programs including the development of irrigation, research, extension of the appropriate cultivation techniques and the development of agricultural mechanization, will be carried out within the next 10 years.

However, the rice producers of the Valley are more and more attracted by truck farming, which provides more interesting profit margins and benefits from more stable markets. It is for this reason that the only chance offered to the rice sector is to create the conditions that can make the activity more attractive and highly profitable in order to better incite producers to produce more, and actions in that direction will be carried out from the starting up of the Master Plan.

The national economy of Senegal has been through notorious changes following the progressive disengagement of the Government since the starting up of the structural reforms introduced at the beginning of the 1980's. Afterward there was a liberalization of the rice market in 1996. The private sector was encouraged to invest the rice market, in particular the processing and distribution fields, but the private operators were soon confronted with the cheap and "high quality" rice imports.

Due to the lack of measures to make local rice more competitive, most of them were obliged to leave the circuit. Such a situation continues to negatively affect the rice sector. The scenario of development in 2015 is proposed with the hope of creating a more favorable environment for

rice farming activities within the framework of a market economy.

Rice millers constitute the key actors likely to create added value with the improvement of the processing technology. Therefore, they are going to benefit from a multiform support in the Master Plan. However, in order to realize reasonable profits in their activities, they should invest more in the sector. Generally, they get their income only from the services they provide to producers or to traders. In the future, they owe to invest more in activities tending to improve the quality of paddy, the quality of processing and the fluidity of the distribution networks. On the other hand, as well aware entrepreneurs, they should acquire information about the eating habits and preferences of consumers relating to the quality of rice and according to that information, plan their investments and program of activities.

(2) Supply of high quality rice in Dakar and in the other urban areas

All the activities proposed in the Master Plan will be preceded by a vast program of information and sensitization. Priority will be given to the production of 100 000 tons of high quality rice intended for the consumers of Dakar and the other urban areas. Local rice will be preceded on the market by a good reputation relating to its aroma, its taste, its freshness and its healthy quality, which will make it highly appreciated and adopted by the urban consumers.

For these conditions to be met, rice millers should accept some investments in order to acquire cleaners, vibrating calibrators and grain sorters. The storage capacities will be increased so as to extend the processing period from 5 months to 12 months. All these acquisitions should be made profitable and a cost and profit analysis will be carried out, the results of which will be given to the rice millers.

The urban consumers will be sure to get high quality rice. The quality standards will be studied and fixed, and the governmental organizations will see to their application. All the information relating to the origin of the rice, its variety, date of harvest, and broken rice ratio, will be mentioned on the packaging bags. Many actors will be requested to carry out the marketing operations.

The consumers, regrouped in associations, will directly send their orders to rice millers or to producers. At the same time, the public will be informed of the complaints of consumers relating to the neglects of rice millers.

(3) Intensification of the support of public authorities

In Dakar and in the other urban areas, the promotion will have as a result the appreciation of local rice following the increase of the demand, which will result in the rise of the price. The producers convinced of the high profitability of their activity, will thus be more motivated to produce and to sell more paddy to rice millers. This increase of supply and demand will come along with the support of the Government to the rice sector.

The programs of research introduced within the framework of the Master Plan will be directed towards the identification of the optimal conditions of production of rice in the Senegal River Valley. Emphasis will be put, in particular, on the reduction of the production costs, the increase of yields and on double cropping in order to increase the profits of producers. The association of rice cultivation with truck farming for diversification will also be encouraged, as well as the intensification so as to reach the objective of 400 000 tons, targeted in the Master Plan. Programs of seed multiplication and selection of varieties, the organoleptic characteristics of which correspond to the requirements of the market, will be carried out.

Irrigation will be developed and the abandoned perimeters will be rehabilitated for a maximal exploitation of the irrigation potentialities of the area. A new approach will be promoted in

order to better protect the environment. The causes of the low cropping intensity and the abandonment of plots will be studied more in details and the solutions for their eradication will be applied.

Under an approach of participative development, the Government will operate the action plan after having however defined clearly its responsibility and that of the producers. The support of the Government is not only going to concern the improvement of developments or equipments, but also capacity building for the managers of the associations in charged of water management. It is in this sense that capacity building programs will be carried out for the public service agents (mainly those in charged of the conception and the functioning of the irrigation systems) and the other agricultural extension officers. The service providers for the mechanized agricultural works will benefit from training programs in order to better meet the needs of producers.

In accordance with the Master Plan, the Government will set up a short term research program intended for the choice of a type of agricultural mechanization that is more adapted to the tending operations: land preparation and harvest operations. Due to the shortage of combine harvesters, the period of harvest gets longer. As a consequence the yields at processing decrease and the broken rice ratio gets higher. That is the reason why the introduction of mowers in Senegal as an alternative to the traditional combine harvesters will be strongly encouraged. The objective is to provide rice millers with high quality paddy, with the required moisture content and the minimum of impurity, at a higher price, which will lead, in their turn, the producers to pay more attention to the quality of paddy.

The contribution of the CNCAS, as a parapublic Agency in credit granting is essential for producers. However, in the near future, it is necessary to consider the intervention of credit unions that have became very dynamic in micro credit, and which are going more and more to replace the CNCAS. Besides, mid-term and long term credits will be introduced so as to allow clients to acquire farm machinery, warehouses and rice mills. Finally, to face the needs of inputs, producers specialized in the distribution of inputs will be selected.

(4) Food security and reduction of poverty in rural areas

One can notice a shortage of rice even in the regions of large production, especially during the period going from July to August. Solutions should be brought to such a problem. Besides, it is necessary to increase the food self-sufficiency rate.

The objective of the MP is to reach a production of 300 000 T, representing 60 % of the demand in rural areas or 500 000 T by 2015. Food security in the regions of production will be appreciably improved. In order to meet the demand in local rice, the rice consumed in rural areas will be better processed so as to obtain high quality white rice, which will be sold cash in town center. But for such a scenario to come true, it is inevitably necessary to install new warehouses.

In Casamance, traditional rice growing is the most wide-spread. Because of rains, yields in terms of grain get lower over the years. Productivity will be increased through the use of qualitative seeds, the improvement of cultivation practices, the development works intended to stop the advance of the salty isthmus, and through the retention basin and other rainy waters collection and stocking techniques.

In the Anambé basin, where irrigated rice growing is practiced, another approach will be proposed. It will be about measures that will be taken for the intensification meant to increase production and productivity.

Rice demand is fairly lower in the areas of the groundnut basin and in the oriental part of the

country where millet still remains the staple food. Nevertheless, rice growing, which remains the domain of preference of women in the region of Fatick, will benefit from some support through the implementation of programs, especially in the field of seed multiplication.

(5) Integrated approaches

The implementation of the Master Plan for the reorganization of the rice sector will be carried out under the coordination of a committee within the Office of the Ministry of Agriculture and Hydraulics. The organizations involved will be members of this committee and will be responsible for the definition of the strategy to reach the objectives assigned to the Master Plan.

4.6 Programs of Master Plan

The eleven programs proposed in the Master Plan are shown in the following table.

Table 4.6.1 Programs of Master Plan

Title of programs	Corresponding Development Strategies
Senegal River Valley (Saint Louis and Matam)	
1. Rice Productivity Improvement Program	1.2 Research, development and extension of the technologies for the reduction of production costs, yield increase, and increase in cropping intensity including double cropping
2. Mechanized Rice Farming System Improvement Program	1.3 Improvement of the efficiency of the agro-machinery work
3. Irrigation Development Program	1.1 Improvement of irrigation and drainage facilities and capacity development of water users' assoctiation (especially VIP and PIP)
4. Rice Quality Improvement Program	2.1 Improvement of rice quality through the renovation and improvement of rice mill facility 2.2 Reduction of post-harvest losses, improvement of milling recovery rate and extension of rice mill operation period by augmentation of paddy storage capacity 2.3 Development and extension of timely harvest and threshing work system 2.4 Improvement of rice pick-up system 2.5 Establishment of quality standard of paddy and milled rice 2.6 Establishment and diffusion of the rule of the indication of rice quality
5. Program for Improvement of Rice Distribution	3.1 Monitoring of imported rice (quality, quantity and price) and stock 3.2 Monitoring of rice market price at major consumption places 3.3 Monitoring of quality of marketed rice and consumers' needs 4.1 Improvement of the market road connecting trunk road with rice production area 4.2 Construction of the bridges crossing seasonal river 4.3 Open information on harvesting time of each production area
6. Program of improving credit access for the rice production and marketing	1.5 Assurance of the timely supply of inputs 1.6 Improvement of the agricultural credit 2.1 Improvement of rice quality through the renovation and improvement of rice mill facility 2.2 Reduction of post-harvest losses, improvement of milling recovery rate and extension of rice mill operation period by augmentation of paddy storage capacity 1.3 Improvement of the efficiency of the agro-machinery work
7. Environment Management Program in Irrigation Development	7.1 Environment Management System Development Project in the Lower and Middle reaches of the Senegal River valley
Traditional rice production areas (Kolda, Ziguinchor and Fatick Regions)	
8. Seed production and distribution program	・ Capacity building of seed production system and production increase
9. Support for the rainfed rice farmers	・ Stabilization and improvement of rainfed rice yield ・ Collaboration and support of on-going salinity hazard prevention and restoration of paddy field
10. Rehabilitation of irrigation area and capacity development of farmers' group in the Anambé basin	・ Extension of irrigated rice farming under the established natural and social conditions. ・ Formation of the nucleus for the rural development of the Casamance
Construction of the Master Plan Implementation Structure	
11. Establishment and operation of the committee for the promotion of the reorganization of rice production in Senegal	・ Coordination among stakeholders of the rice sector and institutional development

The Master Plan is formulated in accordance with the strategies derived from the problem structure analysis. The programs/projects are 11, as shown in the next page, of which seven are for the Valley (Saint Louis and Matam Regions).

Three other programs/projects are for the traditional rice cultivation areas of Kolda, Ziguinchor and Fatick Regions. Rice production in those areas is susceptible to the climate conditions and constrained by salinity/alkalinity and acidity of soils and water. Yield increase under such conditions is a big challenge. Social issues such as gender and development are also to be addressed. In consideration of such current conditions, only those projects which need urgent measures are taken up. Another one is the program to provide a framework for the sustainable and efficient implementation of the master plan.

The outlines of the programmes which constitute the master plan are described as follows.

4.7 Master Plan Programmes for the Senegal River Valley

4.7.1 Rice Farms Management Improvement Programme

The purpose of this research and extension programme on production cost reduction and profitability improvement is to improve incomes of rice farmers in the Senegal River Valley. As mentioned in Chapter 3.6 «Support Services», ISRA and WARDA are in charge of agricultural research and development and SAED in charge of extension. These three bodies will collaborate in order to popularize agricultural techniques among rice producers. The programme will use acquired experiences and learnt lessons as much as possible for its implementation (cf. Chapter 6.2.1).

There are several production cost reduction techniques such as lower use of seeds (by means of row seeding or transplanting), combined use of urea and azolla, improved levelling of irrigated paddy fields (lower use of weed killers). There are also several techniques that can improve rice production profitability. Some of them are as follows: Row seeding thanks to which the density of young plants will be homogeneous in paddy fields, grain weight increase and better maturity rate through appropriate use of fertilizers, timely harvest, threshing, and proper storage to improve paddy quality, production increase through a better use of double cropping, etc. The programme will examine high priority techniques taking into account viewpoints of rich farmers, agricultural agents etc.

Table 4.7.1 Rice Productivity Improvement Programme

Descriptive heads	Summary of the programme
Objectives of the Project	Paddy productivity of target farmers in the Senegal River Valley has improved
Results	Phase 1: Measures for a better rice growing financial management are developed (2007-2011) Phase 2: Techniques for the improvement of rice growing financial management are popularized (2008-2013)
Activities	Phase 1: Technique development for a better financial management of rice growing Component 1： Development of techniques meant to reduce rice growing production costs 1) enumeration of potential agricultural production cost reduction techniques 2) Prioritization of candidate techniques based on their technical and economical pertinence relating to production cost reduction. 3) Research and development of high priority techniques 4) Evaluation of research results Component 2： Development of techniques meant to improve rice growing profitability 1) enumeration of techniques that may improve rice farming profitability 2) Prioritization of candidate techniques based on their technical and economical pertinence relating to profitability improvement 3) Research and development of high priority techniques 4) Evaluation of research results Phase 2: Extension of techniques meant to improve rice growing management. This activity is common to both abovementioned components. 1) demonstration of research achievements in the valley (establishment of demonstration plots) 2) Organising study trips and feedback workshops for farmers 3) Training agents in improved extension methods 4) Monitoring and evaluation of producers applying new methods
Concerned agencies:	Executing agency: ISRA (Phase 1), SAED (Phase 2) Collaborating agencies : SAED (Phase 1), ISRA (Phase 2), WARDA

4.7.2 Programme for the Improvement of Mechanized Rice Growing Techniques

The purpose of the programme is to reduce production costs and improve productivity through appropriate soil preparation (ploughed land, clod crushing), harvest, and rice growing mechanization in the Valley. It includes, for instance, human resource training in mechanized rice growing, standardization of appropriate land preparation, direct seeding, transplanting, development and extension of ASI harvesters, quality improvement of services performed by agricultural machinery.

SAED, ISRA, and SODAGRI staffs along with leaders of farmers' associations are trained in mechanized rice growing by JICA. Furthermore, experimental sites with different types of soils are selected in the valley to examine the most appropriate land preparation techniques performed by tractors and other agricultural machinery. The selection of agricultural machinery, working efficiency, weeding effect, irrigation water saving, and impact of the abovementioned techniques on salinization will be studied in minute detail.

The programme also aims at developing and popularizing a harvester that may improve harvest efficiency through a combination with ASI thresher. ISRA, SAED, and WARDA have already started the development of a harvester made in Senegal and this programme is financially and technically supporting their work. That support concerns studies on harvesters used throughout the world and their comparison with the Senegalese prototype. As a result, the design will be modified and the new harvester will be better suited to soil conditions and rice growing in the valley. The plan will be opened to the public during the extension period. The programme will

also carry out technical training sessions for mechanics working in agricultural machinery plants and craftsmen. Trainings in operation and maintenance of agricultural machinery will be carried out for the rice sector service providers as well.

Table 4.7.2 Mechanized rice growing improvement programme

Descriptive heads	Summary of the programme
Objectives of the Project	Development and extension of an efficient and pertinent mechanized rice growing method in the Senegal River valley
Results	Mechanized rice growing specialists will be trained. Mechanized rice growing techniques (direct seeding in dry paddy fields, transplanting) will be standardized. Agricultural machinery service providers will receive technical instructions. Fees of services performed by agricultural machinery will be optimized. A harvester suited to rice growing in the valley will be developed and popularized.
Activities	Component 1: Training programmes dealing with rice growing mechanisation systems 1) Systematic training programme in mechanized rice growing for SAED, IRSA, and SODAGRI staff and leaders of farmers' associations as well Component 2: Appropriation of land preparation (ploughed land, clod crushing, **affinage**) 1) Trial of mechanized rice growing appropriation 2) Paddy field levelling 3) Tractor specifications 4) Levelling and **affinage** effect on water saving, weeding effects on production cost reduction 5) Production of educational equipments and manuals Component 3: Development of harvesters 1) Improvement of the (ISA) prototype harvester 2) Exhibition of the harvester and its design 3) Technical training for mechanics working in agricultural machinery plants throughout Senegal 4) Extension and monitoring activities
Concerned agencies:	Executing agency: ISRA, SAED, WARDA Collaborating agencies : private manufacturers of agricultural machinery, agricultural service providers

4.7.3 Irrigation Development Programme

This programme targets irrigation schemes where actual irrigation rate is decreasing (the rate of actually irrigated area within the developed zone). It also deals with the rehabilitation and partial extension of existing schemes. Target sites include all types of irrigation schemes that can be found in the valley, that is, large-scale (GAs), medium-scale (AIs), and small-scale irrigation areas (PIV and PIPs). Small-scale irrigation areas are generally badly developed and their abandonment rate is very high. At present, PIVs and PIPs represent 2,725 schemes covering a total surface of 63,983 ha.

SAED is in charge of giving concerned farmers a sense of responsibility so that they can cover costs needed for operation and maintenance of irrigation infrastructures. So, it is necessary to clearly specify responsibilities of government agencies and producers and then revise all concerned rules and regulations. The programme also intends to build SAED staff's capacities relating to participatory development. The staff in question will form the basic unit in charge of implementing the programme. Furthermore, it is necessary to build the capacities of hydraulic unions and individual farmers as far as organisation and management are concerned so that irrigated rice farming should be sustainable in rehabilitated schemes. Such capacity buildings have to be carried out by the programme. The programme aims at developing irrigation completely.

Table 4.7.3 Irrigation development programme

Descriptive heads	Summary of the programme
Objectives of the Project	Really used irrigation surfaces and paddy production are increasing.
Results	1. Small-scale irrigation areas (PIVs and PIPs) rehabilitation and extension programme will be optimized and executed. 2. Large-scale and medium-scale irrigation areas' rehabilitation and extension programme will be planned and implemented.
Activities	1. Optimisation and implementation of PIVs and PIPs rehabilitation programme Phase 1: Optimisation of PIVs and PIPs rehabilitation, extension procedures and establishment of a regulatory framework. 1) Baseline study for existing schemes (problem analysis and categorisation, selection of pilot schemes, inventory of existing infrastructures, confirmation of farmers' needs (PRA), etc.) 2) Planning of the rehabilitation programme must clarify roles of the government and those of concerned farmers. 3) Agreement on the rehabilitation plan between SAED and concerned farmers (WUA: Water Users'Associations) 4) Rehabilitation programme implementation (part of it will be subcontracted by the private sector) 5) Publication of a manual on the rehabilitation of existing irrigation schemes 6) Preparation of a training programme for WUA Phase 2： Implementation 1) Capacity building for SAED staff 2) Implementation of the published manual's basic programme 3) Monitoring and evaluation activities 2. Planning and implementation of large-scale and medium-scale irrigation areas' rehabilitation programmes Phase 1: Development study to elaborate enforcement programmes 1) Several inventories of existing infrastructures and financial situation of producers in the 10 GA and 10 AI sites screened in by SAED 2) Planning of infrastructure rehabilitation and cost estimation 3) Agreement on the rehabilitation plan between SAED and concerned farmers (WUA) 4) Preparation of annual operational programmes 5) Cost-profit analysis and preevaluation of the programme Phase 2: Programme implementation 1) Rehabilitation programme implementation (part of it will be subcontracted by the private sector) 2) Monitoring and evaluation activities
Concerned agencies:	Executing agency: SAED Collaborating agencies : DRDR in the regions of Saint-Louis and Matam

4.7.4 Rice Quality Improvement Programme

The purpose of this programme is to establish milling techniques that enable local rice to be competitive to imported one in terms of quality and price and popularize those techniques. In other terms, the programme focuses on the creation of an environment where customers can buy quality local rice at a good price on the one hand, and rice millers can carry out long-term economic activities generating good profit on the other one. Regarding milled rice quality, it is necessary to establish an appropriate post harvest management system. This programme also deals with technology transfer. After selecting farmers' groups, the programme will show the positive effect of improved management through timely harvest and use of storage facilities to prevent paddy from drying after being harvested. The use of techniques preventing paddy from drying excessively will result in a better recovery rate and better milled rice quality. Then, rice

millers will be trained in milling techniques. They will enjoy material support to improve their facilities (distribution of sorters).

Quality standards for paddy (NS03-28) and milled rice (NS-03-29) were established in June 1996 in Senegal. The Ministry of Commerce took control and inspection measures regarding imported rice by enforcing both above-mentioned standards but they are not applied to local rice marketed quantities of which are very limited. Milled rice standards distinguish only three categories (head rice, mixed rice, and broken rice) and indicate specifications of each category. The findings of this Study have revealed that consumers in urban areas request additional information (rice chemical components, nutritive values, consumption deadlines, etc.). Current standards cannot meet those needs expressed by urban consumers.

The programme will re-examine standards in force and make recommendations for their improvement. At the same time, new criteria will be established to meet consumers' needs including information on the product itself. The programme will also provide assistance to disseminate and have those particular criteria enforced.

Table 4.7.4 Rice quality improvement programme

Descriptive heads	Summary of the programme
Objectives of the Project	The quality of local rice has improved. Producers and rice mills are making better profits. Senegalese consumers have access to high quality local rice.
Results	Timely harvest and threshing techniques will be improved among producers Paddy will be kept properly. Milling techniques will be improved within rice mills. Milled rice quality standards and indication of qualitative information will be widely applied.
Activities	Component 1: Training in timely harvest and threshing techniques Component 2: Training in paddy storage techniques Component 3: Training in milling techniques of high quality rice Component 4: Revision of current milled rice standards and recommendations Component 5: Wide application of milled rice quality standards and indication of qualitative information
Concerned agencies:	Executing agency: SAED Collaborating agencies: ITA, ARM, DTD

4.7.5 Rice Marketing Improvement Programme

Improvement of rice self-sufficiency rate necessitates a better environment in which local rice can be distributed easily within the national market and be at the disposal of all consumers even ordinary ones. In this respect, it is important for all concerned parties (producers, rice millers, traders) to have access to the right information on the rice sector. On the one hand, producers seek information on consumers' needs including retail price, required quality, etc. On the other one, rice millers and traders need information from production sites such as available rice varieties, harvest periods, expected production, etc. Providing good information on paddy production and rice marketing to all actors of the rice sector will help boost their activities and thus increase the value added of the whole sector.

Furthermore, it is important for the Senegalese Government to keep all information on the rice sector (from rice production to marketing) with a view to making political decisions or preparing a legal framework in order to promote food security. The Ministry of Agriculture and Hydraulic has also been in charge of food security since February 2006. So, it would be

appropriate to suggest that all information on the rice sector should be centralized.

ONRS whose secretariat is located in DAPS, has been collecting, analysing, and disseminating information on rice inside and outside of Senegal for many years. However, it will stop its activities at the end of the year 2006. This programme enables the continuation of activities carried out by ONRS. It also contributes to facilitating information exchanges with SAED (information on varieties, harvest periods, expected productions) and ARM (information on rice export and import, retail prices, stock volumes). These exchanges enable the creation of a centralized rice information system within a short period of time.

Some isolated perimeters located along the Senegal River have been facing an access problem. It is necessary to improve that situation so as to facilitate rice marketing and transport into and from those isolated sites. The construction of access roads connecting the national road to existing irrigation schemes could be an answer to that problem. That construction must be a sustainable rehabilitation of rural tracks the operation and maintenance of which must be entrusted to a body.

Table 4.7.5 Rice Distribution Improvement Programme

Descriptive heads	Summary of the programme
Objectives of the Project	Local rice distribution has improved and consumers can get it more easily. Profits made by producers and rice mills have increased.
Results	Information on rice sector are centralized. Rice market information is released to all actors of the sector. Access to villages in the valley has improved
Activities	Component 1: Training in timely harvest and threshing techniques Component 2: Training in paddy storage techniques Component 3: Training in milling techniques of high quality rice
Concerned agencies:	Executing agency: DAPS Collaborating agencies : SAED, ARM, DRDR/Saint-Louis and Matam

4.7.6 Agricultural Credit Support Programme

This programme is implemented to reinforce the agricultural financial sector in favour of producers, rice millers, and agricultural machinery service providers. Rice production increase necessitates an appropriate input supply to producers. In this respect, it is advisable that microfinance sector should develop to complete the existing agricultural credit system which is almost monopolized by CNCAS. First, microfinance institutions must be grouped together in an organisation recognized by the official agricultural credit system. Secondly, import formalities of agricultural inputs must be simplified; there must also be a proximity financial service for producers and improvement of repayment rate must be expected. MEC Delta, located in Saint-Louis region, is an example of the success of this type of agricultural credit. A new type of financial service answering producers' needs can be developed and promoted by making good use of lessons learnt and know-how acquired by MEC Delta.

Regarding irrigation development programme (chapter 4.7.3), high priority zones (small scale irrigation areas) are located in the medium and upper valley of the Senegal River. They are under the administrative authority of Podor prefecture, Saint-Louis region, and in Matam region. However, few micro-finance institutions deal with agricultural credit in those areas. Even CNCAS has no office there. In this context, it would be efficient for this micro-finance programme to cooperate with the irrigation development programme.

Extension of credit services to the private sector is also important.

The creation of a financial service supporting paddy purchase, operation and maintenance

activities and procurement of new sorters will significantly contribute to improving movements of high quality local rice produced by rice millers with a limited capital.

Furthermore, agricultural machinery service providers need a financial system enabling them to renew and get additional agricultural machinery. This programme tries to contribute to the extension of long-term agricultural credit to the private sector that has been trying to get agricultural equipments such as machinery, storage locations, rice mills, etc.

Moreover, a foundation for local rice consumption was created to encourage purchase of big quantities of milled rice and installation of milled rice storage facilities for consumers' organisations.

Table 4.7.6 Support programme for the rice sector agricultural credit

Descriptive heads	Summary of the programme
Objectives of the Project	Financial services answering the needs of the rice sector's actors will be created.
Results	Component 1: Increase in the number of financial organisations managing governmental agricultural credit for rice production and improvement of credit accessibility. Component 2: Extension of long-term credit to promote investment in paddy fields and procurement of agricultural machinery Component 3: Promotion local rice movement out of the market (direct deliveries from producers and consumers), creation and operation of a foundation for local market consumption
Activities	Component 1: Increase in the number of financial organisations managing governmental agricultural credit for rice production and improvement of credit accessibility. 1.1 Extended management of agricultural credit by micro-finance bodies (institutions, MEC, etc.) 1.2 Increase in the number of organisations managing agricultural inputs and liberalization of their handling 1.3 Creation of an efficient supply system through stock investment of imported fertilizers such as urea 1.4 Improvement of credit repayment rate thanks to the collaboration between CNCAS and MFIs Component 2: Extension of long-term credit to promote investment in paddy fields and procurement of agricultural machinery 2.1 Creation of a foundation of agricultural infrastructures (use of local resources, donations, loans) for the extension of long-term credits with low interest rates intended for rice mills, agricultural machinery (tractors, harvesters, threshers, etc.) and storage facilities 2.2 The Ministry of Agriculture administers the foundation. Fund management is entrusted to CNCAS. Farmers' organisations showing proof of good financial management (including MFIs such as MEC) receive and repay financial leases. Component 3: Creation and operation of a foundation for local consumption 3.1 Creation and operation of a foundation for local consumption - The Ministry of Agriculture, Rural Hydraulic, and Food Security administers the foundation and entrusts its financial management to CNCAS. - Consumer organisations showing proof of good financial management (including MFIs such as MEC) receive credits with a low interest rate. - The fund is used for temporary storage facilities of local rice, outlets, etc. - Consumer organisations enter into a contract in advance with their members who want local rice and sign a purchase contract with organisations of producers before harvest. 3.2 Support to awareness-raising of consumer organisations (not including MFIs) and direct commercial transactions between organisations of local rice producers and consumers in regional cities and Dakar
Concerned agencies:	Executing agency: The Ministry of Agriculture, Rural Hydraulic, and Food Security Collaborating bodies : Ministry of Economy and Finances (MFI support unit), Ministry of Small and Medium Enterprises, Women's Entrepreneurship, and Micro-finance, CNCAS, MFIs, and other concerned organisations (to be chosen)

4.7.7 Programme for Environmental Management relating to Irrigation Development

Salt content of the Senegal River Valley soil is generally high and salt naturally appears easily through irrigation development. Sea water intrusion into the River has been controled since the construction of Diam dam and salt accumulation is well controled. However, water plants grow and multiply quickly as the River water salinization decreases. Consequently, irrigation canals are invaded and cottage-type fishery is disturbed by those plants. Moreover, since rice has been produced for many years, it is feared that quality of the Senegal River valley will change a lot in the future because of big quantities of agricultural inputs used for production.

This programme includes a management system that enables environmental changes of the Senegal River valley resulting from irrigation development to be monitored. Measurements required for environmental conservation are specified by the aforementioned system and carried out continuously.

Table 4.7.7 Programme for Environmental Management relating to Irrigation Development

Descriptive heads	Summary of the programme
Objectives of the Project	An environmental management system relating to irrigation development is developed in the downstream part and medium valley of the Senegal River valley. Monitoring is continuing.
Results	1. Environmental evolution in and around irrigation development area located in the downstream part and medium valley of the Senegal River Valley is clarified and basic conditions are prepared. 2. Monitoring sites, indicators, and required measures are specified. Furthermore, the participatory monitoring system is set up. 3. Measures meant to prevent/reduce environmental degradation are proposed for the pilot zone. An environmental management system is also developed. 4. Environmental conservation measurements are carried out continuously.
Activities	1. Study on the current impact of irrigation development on environment 2. Creation of an environmental long-term monitoring system 3. Development of an environmental management system 4. Enforcement of measures meant to prevent/reduce environmental degradation
Concerned agencies:	Executing agency: SAED Collaborating bodies : Ministry of Agriculture, Rural Hydraulic, and Food Security, SRA, CERES-LOCUSTOX

4.8 Programs of the Master Plan for the Regions Producing Traditional Rice

4.8.1 Support Program for the Production of Seeds

This program is to be implemented, taking into account the lessons and experiences drawn from the technology transfer programs within the same framework, carried out during the present study in the regions of Kolda, Ziguinchor (Casamance) and Fatick (see Chapter 6.2.3 and 6.2.7).

The present program produces qualitative seeds and distributes them in the target areas of Fatick and Casamance where people practice traditional rice growing. In the first phase, the following will be examined and realiszed : The suitable system for the production and the distribution of rice seeds, the clarification of the responsibilities of actors concerned (public organs, NGOs, farmers organizations, etc.), the elaboration of the expansion plan for the seed production facilities and the plan of their management and maintenance, the training of specialists for the production and the control of seeds and also the training of farmers producing

seeds. Then, the program continues to install seed production facilities, seeing to their good operation and makes the production and distribution of seeds progress in the regions.

Table 4.8.1 Program of seed production and distribution

Section	Summary of the program
Objectives of the project	Qualitative seeds are produced and distributed in the target areas
Résults	A system of seed production is well organized and the necessary human resources are trained The need in rice seeds in the regions is satisfied by the local production
Activities	Phase 1: Organization of the seed production system and training of the necessary human resources 1.1 Inspection of the seed production system and clarification of responsibilities of the actors concerned (civil servants, roles of the existing activities and the spontaneous activities by NGOs and farmers organizations) 1.2 Elaboration of the plans of expansion and management/maintenance of the seed production facilities 1.3 Training of specialists for the production and the control of seeds 1.4 Training of the farmers producing seeds Phase 2: Production of rice seeds 2.1 Implementation of the plans of expansion and management/maintenance of the seed production facilities 2.2 Production of qualitative seeds 2.3 Distribution of the seeds produced
Implementation Actors	Implementation Agency : DRDR/Kolda, DRDR/Ziguinchor, DRDR/Fatick Contributing Organs : ISRA, IDECOM, NGO and others

4.8.2 Support Program for the Production of Rainfed Rice

The program targets Casamance (the regions of Ziguinchor and Kolda) and the region of Fatick where growing rainfed rice is widely practiced in a traditional way. The program aims at improving rice growing yields as much as could be by valuing the results and the activities of the projects/programs already realized and/or on going.

Using the rainfall of over 1 000 mm and the plentiful water of the river Casamance, this rainfed growing is the main activity of the populations of Casamance. The harvest surface is of more than 50 000 ha and exceeds that of the Senegal river valley, in spite of its low yield of about one ton/ ha. Since the severe drought of 1968, the paddy fields of the region were affected by problems of salinity and acidity, which consequently caused a generalized degradation of the soils in the region. As a consequence, the rice growing surfaces continue to decrease since then.

In the region of Fatick where the pluviometry is limited to 600 mm, rice growing is practiced in the valleys of the Sine-Saloum River and the bas-fonds of its tributaries. There, rice is the second most important foodstuff after millet. However, the harvest surface is only limited to 1 000 ha. Rice growing is considered as an agricultural work for women and in most of cases, they work in groups.

Due to the deforestation in the area upstream to the river, the expansion of crop fields excluding rice for a long time, and the reduced pluviometry, the area was affected by the intrusion of sea water in the river; this lead to the generalization of the problems of salinity and/or acidity in the rice growing areas. Now, several farmlands formerly used for rice growing are abandoned.

The present program aims at establishing a suitable rainfed rice growing in the target regions by valuing the results of the past and present projects and programs. For example, the following

are concrete activities: Proposition of rational measures for the prevention of acidity/salinity, introduction of salt tolerant varieties, development of simple agricultural tools, leveling of paddy fields, etc.. The rehabilitation of the degraded paddy fields could contribute to the process of reconstruction of Casamance after about twenty years of conflict.

Table 4.8.2 Support Program for the Production of Rainfed Rice

Section	Summary of the program
Objectives of the project	The rice yield in the regions of Ziguinchor, Kolda and Fatick increases
Results	In depth studies on problems of rice growing techniques and measures to improve the paddy yield in the regions are carried out (2009 2012) The on going projects and programs carried out by other donors and NGOs are supported (2009-2012) The measures for the improvement of the paddy yield are extended in the areas affected by the salinization (2009-2012)
Activities	1. Review of the problems trees prepared by the present JICA Study and observation of its details in the current state 2. Checking again the problems through survey to farmers households and collection of information on the traditional measures to avoid these problems of salinization, farmers know-how, etc. 3. Review of the cases of success and failure in relation with the anti-salinization measures 4. Feasibility study of the potential techniques of rainfed rice improvement 5. Advanced training in that field for ANCAR agents 6. Development and extension of the improved agricultural tools for rice growing
Implementation Actors	Implementation Agency : ISRA Contributing organs : DRDR/Kolda, DRDR/Ziguinchor, DRDR/Fatick, Ancar, Anrac, PBA, NGO, etc.

4.8.3 Program for the Rehabilitation of the Irrigation Schemes of the Anambé Basin and the Development of Farmers' Cooperatives

The present program contributes to the improvement of rice productivity in the Anambé basin, in the region of Kolda and consists of two elements : the rehabilitation of part of the irrigation schemes and the development of farmers' cooperatives. In the first phase, a development study is carried out in order to select the constituents of the project to be realized, which will bring an effective and sustainable development.

The program makes a general study and an analysis on the current situation of the irrigation program in the Anambé basin. Surveys are carried out properly on the following ones : the natural and socio-cultural conditions, the agro-pastoral situation, the hydraulic resources, the irrigation and drainage facilities, the rice growing practice as a whole, the post-harvest activities and the processing of farm products, the storage infrastructures, the provision of farm machinery services, the marketing farm products and the inventory survey if existing facilities, etc. The program also carries out the following activities: The analysis of the disturbing causes of development, the inspection of the development potentiality, the determination of the relevant organization for the execution of the program, the elaboration of the organizational and human resources training programs, the planning of the projects of rehabilitation of developments, the economic and financial analysis, etc.

There are already several on going projects in the Anambé basin, as PADERBA [a support for the producers (women) of the region] financed by the African Development Bank (ADB) and

a program of expansion of perimeters by the Islamic Development Bank (IsDB) and it is necessary to harmonize the present program with these precursor projects and program.

Table 4.8.3 Program for the rehabilitation of the irrigation schemes of the Anambé basin and the development of farmer's cooperatives

Section	Summary of the program
Objectives of the project	The production of rice in the Anambé basin increases
Results	1. Clarify the disturbing factors for the activities undertaken in the Amanbé basin 2. Reveal the causes of the low irrigations and profitability rates and suggest measures 3. Study the current situation of the processing and the marketing of rice and suggest measures 4. Elaborate a support program for irrigated rice growing in the Anambé basin 5. Implement the support program for irrigated rice growing in the Anambé basin
Activities	1-1 Study on the current situation of the irrigation program in the Anambé basin (4 180 ha) 1-2 Clarification of the causes of ill-development of the Anambé irrigation program 2-1 Study for the increase of rice production 3-1 Study on the processing and the marketing of rice 4-1 Elaboration of a support program for irrigated rice growing in the Anambé basin 5-1 Implemention of the support program for irrigated rice growing in the Anambé basin
Implementation Actors	Implementation Agency : SODAGRI Contributing organs : DRDR/Kolda, ANCAR

4.9 Implementation Organization for Master Plan

For smooth and proper management of the Master Plan, it is proposed to newly establish Promotion Committee for the Reorganization of the Production of Rice in Senegal in MAHRSA during the second half 2006. The outline of the committee is described as below.

(1) Organization

Chairman : high-ranking government official of the Minister's Secretariat of MAHRSA

Member : high-ranking government officials of MAHRSA and marketing/distribution Specialist (Donor Side)

(2) Purpose and Function

- Report of activity and progress to the vice-minister of MAHRSA
- Adjustment of the opinion with MOC and MIA
- Adjustment of the opinion with supporting organizations and donors and advice to them
- Monitoring progress of the programs proposed in the Master plan
- Advice about the budget allocation to the programs
- Preparation of recommendation on establishment of necessary legal system

- Holding of the rice sector forum (twice a year)

(3) Members of Rice sector forum

- Direction de l'Analyse, de la Prévision et des Statistiques (DAPS)
- Direction Régionale du Développment Rural (DRDR)
- Société d'Aménagement et d'Exploitation des Terres du Delta du fleuve Sénégal et des Vallées du fleuve Sénégal et de la Falémé (SAED)
- Société de Développement Agricole et Industrielle du Sénégal (SODAGRI)
- Caisse Nationale de Crédit Agricole du Sénégal (CNCAS)
- Agence Nationale de Conseil Agricole et Rural (ANCAR)
- Institut Sénégalais de Recherche Agricole (ISRA)
- Agence de Régulation des Marchés (ARM)
- Institut de Technologie Alimentaire (ITA)
- Institut Sénégalais de Normalisation (ISN)
- Institut des Sciences de l'Environnement (ISE)
- Comité Interprofessionnel du Riz (CIRITZ)
- Fédération Nationale des Producteurs de Riz au Sénégal (FNPRS)
- Supporting Organizations, Donors etc. (as observer)

4.10 Implementation Schedule

Implementation schedule of the proposed programmes is presented in Figure 4.10.1.

The fiscal year of the Senegal is from January to December, and the budgetary request of each ministry starts in August. The action plan for priority programmes was formulated as mentioned in Chapter 5 in order to implement programmes within the fiscal year of 2007.

The implementation agency of each priority programme should prepare detailed implementation plan and arrange budget as well as establish implementation organization in accordance with the action plan. Regarding the programs which require technical cooperation or financial support, the Government should apply for assistance request document to assistance organizations or donors while the Government raises fund in local currency.

For smooth and proper management of programs, it is proposed to establish Promotion Committee for the Reorganization of the Production of Rice in Senegal in MAHRSA during the second half 2006. It is expected that unified programme management will be conducted by the committee from the initial stage of the programme.

In the projects proposed, the projects with a high priority were carried out as a technology-transfer program during study period. The implementation period was from May, 2005 to June, 2006. The Technology Transfer Programs which constitute a part of proposed projects/programs in the master plan, have been implemented with the main objective of building the capacity of the government staffs who will be the main players of the implementation of the master plan in the future. The main outcomes of the Technology Transfer Programs are summarized in Chapter 6.

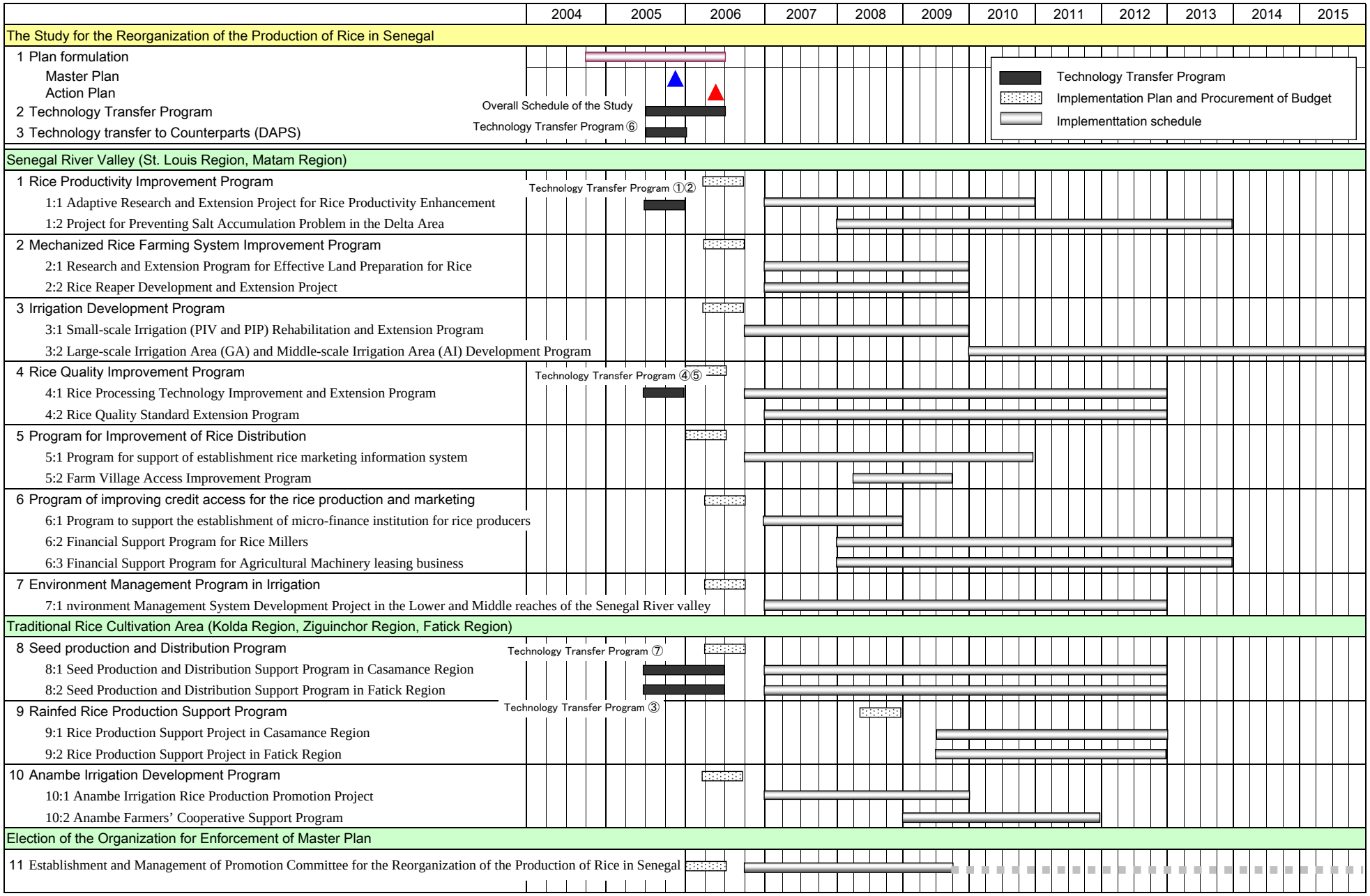


Fig. 4.10.1 Implementation Schedule of the Master Plan for the Reorganization of the Production of Rice in Senegal

CHAPTER 5 ACTION PLAN

5.1 General

The Master Plan consists of 11 programs as presented in Chapter 4. The Study further formulated 19 programs and projects as lisetd in Table 5.1.1, of which 11 were selected as priority programs and projects from the viewpoint of their urgent necessity. Action Plan was preprared for each of 11 programs and projects.

Table 5.1.1 Action Plan List

Master Plan Program	Program・Project	Action Plan Number
Senegal River Valley (St. Louis Region, Matam Region)		
1. Rice Productivity Improvement Program	1.1 Adaptive Research and Extension Project for Rice Productivity Enhancement	01
	1.2 Project for Preventing Salt Accumulation Problem in the Delta Area	
2. Mechanized Rice Farming System Improvement Program	2.1 Research and Extension Program for Effective Land Preparation for Rice	02
	2.2 Rice Reaper Development and Extension Project	03
3. Irrigation Development Program	3.1 Small-scale Irrigation (PIV and PIP) Rehabilitation and Extension Program	04
	3.2 Large-scale Irrigation Area (GA) and Middle-scale Irrigation Area (AI) Development Program	
4. Rice Quality Improvement Program	4.1 Rice Processing Technology Improvement and Extension Program	05
	4.2 Rice Quality Standard Extension Program	
5. Program for Improvement of Rice Distribution	5.1 Program for support of establishment rice marketing information system	06
	5.2 Farm Village Access Improvement Program	
6. Program of improving credit access for the rice production and marketing	6.1 Program to support the establishment of micro-finance institution for rice producers	07
	6.2 Financial Support Program for Rice Millers	
	6.3 Financial Support Program for Agricultural Machinery leasing business	
7. Environment Management Program in Irrigation	7.1 Environment Management System Development Project in the Lower and Middle reaches of the Senegal River valley	08
Traditional Rice Cultivation Area (Kolda Region, Ziguinchor Region, Fatick Region)		
8. Seed production and Distribution Program	8.1 Seed Production and Distribution Support Program in Casamance Region	
	8.2 Seed Production and Distribution Support Program in Fatick Region	
9. Rainfed Rice Production Support Program	9.1 Rice Production Support Project in Casamance Region	09
	9.2 Rice Production Support Project in Fatick Region	10
10. Anambe Irrigation Development Program	10.1 Anambe Irrigation Rice Production Promotion Project	11
	10.2 Anambe Farmers' Cooperative Support Program	
Election of the Organization for Enforcement of Master Plan		
11. Establishment and Management of Promotion Committee for the Reorganization of the Production of Rice in Senegal		

5.2 Action Plans

The details of the proposed 11 Action Plans are described in the following pages.

5.2.1 Action Plan01 Adaptive research and extension project for rice productivity enhancement (1/2)

Master Plan Program:	Rice Productivity Improvement Program		
Implementation Period:	2007 – 2010 (4 years)		
Target Group:	The rice farmers in the selected 30 irrigation areas in the Senegal river valley		
Implementing agency:	SAED	Cooperating agencies:	ISRA、ANCAR

Background and objectives

Average yield of paddy in the Senegal river valley has been as high as over 5 ton/ha, far exceeding the national average of around 2 ton/ha, with high input under irrigation conditions. However, the paddy yield varies much among farmers ranging from 1 ton/ha to 9 ton/ha, attributed to the difference in farm management techniques. On the other hand, high input agriculture needs high cost, which lowers the profitability, leading to a disincentive to rice farmers.

Under such situations, two technology transfer programs were implemented as a part of the Master Plan Study aiming at examining the effectiveness of new extension method and cost saving farming technique using azolla on rice yield increase, and both programs were found very promising. The continuation of the programs is expected to contribute to the rice productivity improvement further as well as rice profitability enhancement, conducive to the enhancement of farmers' motivation to grow rice.

This plan is to expand the coverage of extension by improved method and to extend the low cost rice farming technique using azolla, aiming at enhancing both rice productivity and profitability of the farmers in the Senegal river valley.

Project Purpose

Paddy productivity of the target farmers in the irrigated paddy areas of the Senegal river valley is enhanced

Outputs

1-1 Senegalese experts learn various new paddy production techniques
1-2 Future development of paddy production in the Senegal river valley is examined
2-1 Extension agents learn new irrigated rice cultivation techniques
2-2 Extension agents learn new extension method of irrigated paddy production
3-1 Rice farmers are trained using improved extension methods
3-2 Capacity of the rice farmers on problem analysis and problem solving is built up
3-3 The rice farmers improve cultivation techniques
4-1 Low cost rice cultivation technique with azolla is established
4-2 The rice farmers adopting rice production with azolla increase

Activities

1. Overseas training of the counterpart personnel (6months)
 1-1 Short term training at International Rice Research Institute (IRRI), Philippines (3months)
 1-2 Inspection trip to Japan for observing irrigated paddy farming (0.7month)
 1-3 Inspection trip to Indonesia for observing irrigated paddy farming (0.7month)
 1-4 Preparation of training report (1month)
 1-5 Preparation of a frame for extension training (0.6months)
2. Training on improved extension method to extension agents (5months)
 2-1 Preparation of a training manual (1month)
 2-2 Training on irrigated paddy production techniques (1month)
 2-3 Training on improved extension method for irrigated paddy production (2months)
 2-4 Field application of improved extension method learned by extension agents (0.9month)
 2-5 Evaluation of the training (0.1month)
3. Technical extension to rice farmers (3years)
 3-1 Selection of areas and farmers (10sites/year, 30sites in total)
 3-2 Baseline survey
 3-3 Problem analysis and identification of constraints
 3-4 Establishment of demonstration plots
 3-5 A series of training using improved extension method, study tour
 3-6 Monitoring and evaluation
4. Adaptive research and extension of transplanted paddy production with azolla (3years)
 4-1 Experiment on effect of azolla on paddy yield under low level of nitrogen
 4-2 Establishment of azolla multiplication method
 4-3 Adaptive research on azolla application at farmers' field
 4-4 Training on cultivation technique with azolla to extension agents and farmers
 4-5 Diffusion of rice cultivation technique with azolla

5.2.1 Action Plan01 Adaptive research and extension project for rice productivity enhancement (2/2)

Inputs

Donor side		Senegalese side (responsible agency: SAED)	
1. Provision of expert		1. Counterpart personnel (C/P) (SAED, ISRA)	
1-1 rice cultivation expert	48 pm	1-1 rice cultivation expert	48 pm
1-2 soil and fertilizer expert	32 pm	1-2 soil and fertilizer expert	48 pm
1-3 weed control expert	18 pm	1-3 weed control expert	48 pm
1-4 crop protection expert	18 pm	1-4 crop protection expert	48 pm
1-5 extension expert	48 pm	1-5 extension expert	48 pm
2. Training equipment		2. Office facilities	
2-1 video equipment	2 sets		
2-1 projector	2 sets		
2-2 computer	2 sets		
3. Office equipment	L.S.		
4. Yield survey kits	10 sets		
5. Soil analysis kits	2 sets		
6. Vehicles	4 units		
7. C/P overseas training cost	L.S.		
8. Other project costs (fuel, counterpart travel allowance, etc.)	L.S.		

Remarks:

1. Implementing agency should be SAED, as the organization has many agricultural experts including those who had worked for ADRAO and those who have been trained in Japan under the JICA training program. Counterpart personnel may be selected from SAED (experts in rice cultivation and extension, respectively) and ISRA (experts in soil and fertilizer, weed control and pest and diseases control, respectively). They will work with the donors' expert and train field extension agents in obtaining new extension method using PLAR approach.
2. In implementing the project, the donor will have to shoulder all the necessary costs except the salary of counterparts and office facility, as the Senegalese government can not allocate any extra budget for the project implementation.
3. Before the project starts, the role of each agency should be clarified.

5.2.2 Action Plan02 Research and extension program for effective land preparation for rice (1/2)

Master Plan Program:	Mechanized Rice Farming System Improvement Program		
Implementation Period:	2007 -2009 (3 years)		
Target Group:	Extension workers, Farm machinery service providers and Farmers group leaders in Saint Louis Region		
Implementing agency:	SAED	Cooperating agencies:	ISRA, SODAGRI, ANCAR

Background and objectives

Farm machinery has been used for rice farming in the Senegal river valley for a long time. In particular, land preparation and harvesting have been fully operated with aid of tractors and combine harvesters. In 1996, when the farm machinery service section of SAED was privatized, most of tractors and combine harvesters owned by SAED were sold off to private service providers. Consequently SAED's intervention to the farm mechanization services is limited only to technical advices. Further government supports are urgently required to establish economical and effective farm mechanization system and transfer the techniques thus established to service providers.

Direct sowing is broadly applied to rice cultivation in the Valley in order to mitigate farm labor requirement. Healthy germination and establishment of uniform seedlings with optimum plant density of 150 to 180 per m^2 are most important for yield maximization of directly sown rice. Moreover, weed control is crucial especially during initial stages of crop establishment. Herbicides are generally applied to the paddy fields in the Valley resulting in cost implication and environmental risks.

Action Plan 02 focuses on optimization of land preparation practices by farm machinery to minimize disturbance of land leveling quality of paddy field and to incorporate weeds and weed seeds into subsoils. Land leveling quality will be improved for appropriate on-farm water management resulting in water saving and control of salt accumulation on depression within a paddy field.

Transplanting of rice seedlings is also practiced in the Valley to the limited extent where Chinese and Vietnamese cooperation were introduced. Paddling under submerged conditions (water tillage) will be practiced in these areas to verify enhancement of work efficiency of transplanting, weed control and water saving by slow percolation.

Project Purpose

Effective land preparation method is selected and extended.

Outputs

1. Capacity building for SAED、IRSA、SODAGRI and farmers group leaders in the technical field of farm mechanization fir rice
2. Optimized land preparation methods for direct sowing and transplanting
3. Improved services by private farm machinery service providers
4. Optimized service charges for machinery services

Activities

1-1 Training programs for overall rice farm mechanization system
- 1-1-1 Provision of training programs for farm mechanization focusing on land preparation and harvesting
- 1-1-2 Overseas training in rice producing countries such as Indonesia, Egypt and Madagascar.
- 1-1-3 Preparation of farm mechanization research program

2-1 Farm mechanization research program
- 2-1-1 Land preparation under dry soil conditions
  - Selection of plow from viewpoints of weed control and adverse effect to land leveling quality by comparing bottom plow, disc-plow and reversible mould board.
  - Selection of harrow from viewpoint of weed control and effects to crop establishment of directly sown rice by comparing treatment with disc-harrow
- 2-1-2 Land preparation under wet soil conditions
  - Trial for wet tillage from viewpoint of weed control
  - Necessity of cage wheel to prevent bogging-down
  - Trial with hand tiller
  - Water saving effect of wet tillage compared with dry land preparation

2-2 Optimization of land leveling practices
- 2-2-1 Work efficiency of motor grader and tractor-grader
- 2-2-2 Effects of improvement of land leveling quality in terms of on-farm water management, water saving, weed control, salinity/alkalinity control, etc.

2-3 Selection of technical specification of tractors
- 2-3-1 Observation of workload to tractors, work efficiency, fuel consumption, etc. for selection of technical specification of tractors, e.g. 2WD or 4WD, horsepower ranges, etc.

2-4 Analysis for effect of improvement of farm mechanization system to production cost-saving
- 2-4-1 Analysis of depreciation of investment
- 2-4-2 Effect of water saving and weed control

2-5 Other surveys and researches
- 2-5-1 Necessary training for tractor operations and mechanic
- 2-5-2 After-sale services of farm machinery suppliers in Dakar and Saint Louis

3-1 Provision of technical training to services providers

4-1 Analysis of price setting for farm machinery services

5.2.2 Action Plan02 Research and extension program for effective land preparation for rice (2/2)

Inputs

Donor side		Senegalese side (responsible agency: SAED)	
1. Consultants		1. Counterparts	
1-1 Rice agronomy	24 pm	1-1 Rice agronomy	24 pm
1-2 Farm Mechanization	24 pm	1-2 Farm mechanization	24 pm
1-3 Irrigation and drainage	6 pm	1-3 irrigation and drainage	24 pm
2. Farm machinery for research		2. Vehicles for counterparts	2 units
2-1 Tractors 90hp and 60hp	2 sets	3. Travel allowances	
2-2 Plows and rotevators	2 sets	4. Motor workshop and garages	
2-3 Disc-harrow	2 sets		
2-4 Cage wheels	2 sets		
2-5 hand tillers	2 sets		
3. Equipment for land leveling			
3-1 Motor grader	2 sets		
3-2 Tractor grader	2 sets		
4. Training facilities			
4-1 Workshop facilities	2 sets		
4-2 Audio visual facilities	2 sets		
5. O&M Cost for machinery	Lump Sum		
6. Workshop expenditure	Lump Sum		
7. Vehicles for experts	3 units		

Further considerations to be required:

1. Close linkage is essential between SAED and ISRA for successful operation of Action Plan 02.
2. Action Plan 02 focuses on optimization of land preparation. On the other hand, Action Plan 03 focuses on optimization of harvesting practices through development and extension of rice reapers. Integration of both Plans will be effective.

Action Plan 02 will be carried out in the Valley. However, the results will be applied to the rice farming in Anambe irrigation project. It is highly recommended to involve participants from SODAGI in Action Plan 02.

5.2.3 Action Plan03 Rice reaper development and extension project (1/2)

Master Plan Program:	Mechanized Rice Farming System Improvement Program		
Implementation Period:	2007 -2009 (3 years)		
Target Group:	Extension workers, Farm machinery service providers and Farmers group leaders in Saint Louis Region		
Implementing agency:	ISRA	Cooperating agencies:	SAED、ADRAO

Background and objectives

Private farm machinery service is prevailing in the Senegal river valley. They deploy tractors and combine harvesters sold off from SAED under his privatization process in 1996. Through continuous and intensive operation for several years, most of their machinery is now deteriorated. Currently service providers can not undertake appropriate services in response to farmers' requests. In particular shortage of combine harvesters results in crucial delay of harvesting of paddy fields. However, it is highly difficult for service providers to replace combine harvesters without financial supports.

Under such conditions, ADRAO, SAED and ISRA developed and introduced engine-driven threshers, called ASI. Following this successful performance, ISRA, ADRAO and SAED are making joint effort to solve this problem by introduction of new rice reapers (ISA). Timely cutting and threshing are one of the most important issue for improvement of quality of milled rice.

Action Plan 03 aims at provision of technical and financial assistance to accelerate development of rice reaper suitable for the conditions of the Valley.

Project Purpose

Areas of paddy fields which are timely harvested is increased.

Outputs

1. Reapers which are suitable for local conditions of the Valley are developed.
2. Harvesting with newly developed reapers will be demonstrated in a pilot farm of 500 ha.
3. Farmers aware of effects of reapers and use reapers.

Activities

1. Development of reapers
   - 1-1 Collection of information including design drawing of existing reapers
   - 1-2 Comparative study between existing reapers and prototype of ISA reapers
   - 1-3 Review of design concepts of ISA reapers
   - 1-4 Trial assembly
   - 1-5 Trial operation and improvement
   - 1-6 Completion of reapers
2. Introduction and demonstration of ISA reapers in a pilot farm (500ha)
   - 2-1 Introduction of 20 units of ISA reapers
   - 2-2 Training of operation of ISA reapers by SAED, DRDR, ANCAR and farmers groups
   - 2-3 Monitoring of reaper operation particularly for harvesting dates and work efficiency (3 years)
   - 2-4 Review and feedback to 1-5
   - 2-5 Preparation of posters and leaflets for campaign of ISA reapers
3. Promotion of reapers
   - 3-1 Exhibition of ISA reapers and provision of design drawing to private manufactures
   - 3-2 Training for manufacturing of ISA reapers
   - 3-3 Price setting of ISA reapers
   - 3-4 Proposal to CNCAS to adopt a credit scheme to ISA reapers
   - 3-5 Farmers training for ISA reapers training
   - 3-6 Monitoring

5.2.3 Action Plan03 Rice reaper development and extension project (2/2)

Inputs

Donor side		Senegalese side (responsible agency: SAED)	
1. Experts		1. Counterpart(C/P)	
1-1 Rice Agronomy and Farm Mechanization	24 pm	1-1 Farm Machinery Manufacturing	36 pm
1-2 Farm Machinery Manufacturing Expert	24 pm	1-2 Farm Machinery Operation and Maintenance	36 pm
2. Workshop and Materials		1-3 Farm Management	24 pm
2-1 Workshop Facilities	1 set	2. Office Space・Accommodation	
2-2 Equipment such as bending machine, shearing machine, lathe, welders, etc.	1 set	2-1 Saint Louis	1 location
2-3 Materials such as sheet metals	1 set	2-2 Dagana	1 location
3. Equipment of Training Program		3. Vehicles for C/P	2 units
3-1 Projectors and screens	1 set	4. C/P field allowance	
3-2 Video camera, audio set	1 set		
4. 4WD vehicles	2 units		
5. Monitoring cost			

Remarks:

5.2.4 Action Plan04 Small-scale irrigation (PIV and PIP) rehabilitation and extension program (1/2)

Master Plan Program:	Irrigation Development Program		
Implementation Period:	2007 – 2009 (3 years)		
Target Group:	Representative PIV and PIP (6 schemes) selected in Podor and Matam		
Implementing agency:	SAED	Cooperating agencies:	DRDR St.Louis, DRDR Matam

Background and objectives

Irrigation development is essential to increase rice production in the Senegal river valley. Irrigation development under the Master Plan focuses on rehabilitation including partial extension of the existing schemes. Irrigation schemes in the Valley are categorized into large-scale (GA), medium-scale (AI) and small-scale (PIV and PIP) on the basis of size of scheme areas and management bodies. Among them, actual irrigation ration (actually irrigated area over developed area) is declined especially in PIV and PIP by abandonment of parts of irrigation areas. The reasons are represented by deterioration of irrigation and drainage facilities and salt accumulation within the scheme area, The Mater Plan attaches the highest priority to rehabilitation of PIV and PIP.

Currently, PIV and PIP account for 2,725 schemes with a total area of 63,983 ha. Around the concept of farmers participatory development, Action Plan 04 will firstly establish an appropriate development procedure by demarcating the responsibilities between the government agencies and farmers groups (water users associations). Representative six (6) schemes will be selected within Podor and Matam, where PIV and PIP are concentrated compared to Dagana. In line with the standardized development procedure thus established, the actual development will be carried out towards 2015.

Project Purpose

Procedures for rehabilitation and extension of exiting PIV and PIP are optimized.

Outputs

1. Irrigable area will be expanded by rehabilitation.
2. Management capacity of water users association will be strengthened.
3. Paddy production will be increased.
4. Paddy will be properly milled and rice sale amount will be increased.
5. Rice will be sold at higher prices and farm income will be ensured.
6. Rehabilitation program will be optimized.

Activities

1-1 Rehabilitation of existing irrigation schemes
- 1-1-1 Baseline survey for the existing schemes
- 1-1-2 Problem analysis and categorization
- 1-1-3 Selection of pilot schemes
- 1-1-4 Inventory survey of existing facilities
- 1-1-5 Confirmation of farmers needs (PRA)
- 1-1-6 Preparation of rehabilitation plan by SAED (6 schemes)
- 1-1-7 Agreement on rehabilitation plan between SAED and WUA
- 1-1-8 Implementation of rehabilitation

2-1 Capacity building of WUA
- 2-1-1 Interview to WUA
- 2-1-2 Problem analysis on WUA management
- 2-1-3 Preparation of WUA management improvement program
- 2-1-4 Implementation of WUA management improvement program

3-1 Technical guidance to Farmers
- 3-1-1 Problem analysis for improvement of paddy yield
- 3-1-2 Procurement of seeds and fertilizers (MEC)
- 3-1-3 Preparation of water and farm management programs
- 3-1-4 Implementation of water and farm management programs

4-1 Technical transfer of rice mill operation
- 4-1-1 Technical assistance to private millers
- 4-1-2 Introduction of test mills for technical training
- 4-1-3 Technical assistance to milling process and maintenance

4-2 Assistance for rice marketing
- 4-2-1 Assistance for formation of market channels
- 4-2-2 Assistance for rice marketing

5-1 Preparation of the entire rehabilitation program
- 5-1-1 Analysis of the program at pilot schemes
- 5-1-2 Preparation of a draft program
- 5-1-3 review and finalization of a draft program

5.2.4 Action Plan04 Small-scale irrigation (PIV and PIP) rehabilitation and extension program (2/2)

Inputs

Donor side		Senegalese side (responsible agency: SAED)	
1. Dispatch of experts		1. Counterpart personnel (C/P)	
1-1 Irrigation Farming	36 pm	1-1 Irrigation	24 pm
1-2 Irrigation Engineering	24 pm	1- Farm guidance	24 pm
1-3 Participatory development	12 pm	1- Rice processing	24 pm
1-4 Rice and Farm Mechanization	24 pm	1- Participatory development	24 pm
1-5 Irrigation Water Management	12 pm	2. Office space and field accommodation	
1-6 Rice processing	12 pm	2-1 Podor	1 location
1-7 Sociology	6 pm	2-2 Matam	1 location
1-8 Rice marketing	6 pm	3. Vehicles for C/P	2 units
2. Capacity development program		4. Travel allowance for C/P	
2-1 Workshop materials	1 set	5. Workshop (garage)	
2-2 Audio visual set	1 set	5-1 Podor	1 location
2-3 Soil survey and laboratory analysis	1 set	5-2 Matam	1 location
3. Heavy equipment (rental)		6. Irrigation equipments	
3-1 4WD vehicles	5 units	6-1 Motor pumps	6 units
3-2 Motor graders	2 units	6-2 Water conveyance pipe	6 sets
3-3 Backhoes	2 units	6-3 Cement and gabions	6 sets
3-4 Front loaders	2 units	6-4 Other materials	6 sets
3-5 15 ton lorries	2 units	7. Post-harvest facilities	
4. Monitoring program		7-1 Rice mill（2ton/hour）	2 units
		7-2 Paddy storage	6 sets
		7-3 Lorry for rice transport	2 units

Remarks:

1. Development procedure to be established through Action Plan 04 will be fully taken into consideration when irrigation pumps and rice mills are to be supplied by Indian government and Islamic Development Bank.
2. Implementation of Action Plan 05 as technical cooperation program was requested by the Senegalese government to the Japanese government in August 2005.

5.2.5 Action Plan05 Rice processing technology improvement and extension program (1/2)

Master Plan Program:	Rice Quality Improvement Program		
Implementation Period:	2007 – 2012 (5 years)		
Target Group:	The rice farmers, farmers' groups and rice millers in the Senegal river valley		
Implementing agency:	ITA	Cooperating agencies:	SAED

Background and objectives

At present, in Senegal, quality standard of rice is not controlled by the administrative organizations practically, at production stage, processing stage and distribution/consumption stage. However, market prices of milled rice differ much by their brand and/or quality. That is to say that market price is settled by its quality according to the eating habits.

Some portion of advanced farmers and/or rice millers knows that high quality rice can be sold at a high price. But most of them are unconcerned about the quality of rice. And almost all farmers and rice millers do not have the required know-how to improve the quality of rice.

At present, most of the rice millers are like "custom millers" and most of them are unconcerned about the quality of white rice after the milling process. However a small part of millers has started to purchase paddy from farmers with their own money, and sell white rice in the market after milling. It is expected that the number of "Paddy purchasing rice millers" like the above mentioned ones will increase. Rice millers are not directly involved in paddy harvesting or threshing works. However they have to recognize that paddy which is processed using the proper post harvest technology at the paddy farm owns high quality compared to the inappropriately processed one, and milled rice processed from high quality paddy can be sold at a high price.

This Program aims at improving the quality and the marketability of local rice, and increasing the self-sufficiency rate of rice, as the result of the improvement of post harvest and rice milling technology. At the same time, it also aims at increasing the profit rate of rice farmers, farmer's groups and rice millers.

Project Purpose

1. As the result of the improvement of post harvest and rice milling technology, the quality of local rice is improved and thus its marketability too is improved.
2. The Business Model which can produce and distribute high quality and high price local rice is created. The Business Model consists of rice farmers, farmers' groups and rice millers.

Outputs

1-1 Verify that the deterioration of the quality of paddy can be avoided and that high quality rice can be produced by using the proper farm management (harvesting and threshing of paddy in the farm).
1-2 The model paddy farm is operated properly and high quality paddy is supplied to storage facilities or rice mills.
1-3 The model paddy farm is used practically for the training and education of the farmers and farmer's groups. The useful information for proper farm management is understood and accumulated through the operation of the model farm.
1-4 Rice Millers understand and accumulated the technique allowing to judge if the paddy is processed using the proper post harvest technology at the paddy farm or not.
2-1 The model paddy storages are used properly. Verify that the deterioration of the quality of paddy can be avoided and that high quality rice can be produced through proper paddy storage.
2-2 The model paddy storages are used practically for the training and education for farmers, farmer's groups and rice millers.
2-3 Farmers, farmer's groups and rice millers understand the importance of quality management of paddy and accumulate the proper technologies for the storage of paddy.
3-1 Model rice mills are operated properly and high quality rice is produced. Selection of whole rice and broken rice becomes possible with the newly installed "Length Grader" in the Model rice mills.
3-2 Model rice mills are used practically for the training and education of farmers, farmer's groups and rice millers.
3-3 Farmers, farmer's groups and rice millers learn the high quality rice processing technology and understand that high quality rice can gain high profit.

Activities

1. Education and training for proper farm management (harvesting and threshing of paddy in the farm)

1-1 In order to transfer the proper farm management (harvesting and threshing of paddy in the farm), 3 groups (village or farmer's group) are selected.
Some part of paddy farm belonging to the above groups are designated as "Model farm for verification of proper harvesting and threshing technique" Analyze present condition and examine the improvement policy.
1-2 Establish proper harvesting, threshing and quality control technology, and issue the Practice Manual.
1-3 Educate and transfer harvesting, threshing, quality analysis and quality control technology to farmers and farmer's groups.
1-4 Hold a workshop at the paddy farm in order to educate and transfer to Rice Millers the technique allowing to judge that the paddy is processed by farmers, using the proper post harvest technology at the paddy farm

5.2.5 Action Plan05 Rice processing technology improvement and extension program (2/2)

2. Education and training for proper storage (Quality control) technology

2-1 In order to transfer the proper paddy storage technique, 3 groups (village, farmer's group or rice miller) are selected. Analyze present condition and examine the improvement policy. (Paddy storage on the paddy field should be avoided, but in case storage on the paddy field is unavoidable, the most suitable paddy storage method should be studied.)

2-2 Design and estimate the construction cost of Model Paddy Storehouses. Based on the design, construct Model Paddy Storehouses for the above 3 groups.

2-3 Establish proper storage and quality control technology, and issue the Practice Manual.

2-4 Educate and transfer storage, quality analysis and quality control technology to farmers and farmer's groups by using the Model Paddy Storehouses.

3. Education and training for the production of high quality rice

3-1 In order to transfer high quality rice production technology, 3 groups (village or farmer's group) who own or operate rice mills are selected. Those rice mills are improved and used as Model Rice Mills.

3-2 Analyze present condition of selected existing rice mills and examine the improvement policy. Selection work of whole rice and broken rice is very important to clarify the price differential. To accomplish the precise selection of grains by length, "Length Graders" are introduced and installed in the Model rice mills positively.

3-3 Design and estimate the modification and improvement cost of existing rice mills. Implement the Rice mills improvement work.

3-4 Establish proper rice milling and quality control technology, and issue the Practice Manual.

3-5 Educate and transfer high quality rice milling, quality analysis and quality control technology to farmers, farmer's groups and rice millers by using improved modern rice mills.

Inputs

Donor side		Senegalese side	
1. Provision of engineering consultant		1. Counterpart personnel	
1-1 Team leader	60 pm	1-1 Rice milling expert	60 pm
1-2 Rice milling expert	40 pm	1-2 Agriculture (paddy farming) expert	60 pm
1-3 Post harvest technology expert (management of paddy field)	30 pm	1-3 Post harvest technology expert	60 pm
1-4 Post harvest technology expert (paddy storage)	30 pm	2. Office/lodging facilities	
2. Training equipment		2-1 Dakar	1
2-1 Workshop equipment	1 set	2-2 St. Louis	1
2-2 Audiovisual equipment	1 set	3. Vehicle for counterpart	2 cars
2-3 Manual for education and training	1 set		
3. Laboratory and analysis equipment for paddy and rice			
3-1 Precision analysis equipment for paddy and rice (Laboratory use equipment)	1 set		
3-2 Simple type paddy analysis kit	15 sets		
3-3 Simple type milled rice analysis kit	15 sets		
3-4 Portable handy moisture meter for grain	45 units		
4. Leasing fee			
4-1 4WD vehicle	3 cars		
5. Cost for model farm			
6. Cost for model paddy storehouse			
7. Cost for modification of existing rice mill			
8. Cost for monitoring			
9. Other project costs (fuel, counterpart travel allowance, etc.)			

Remarks:

1 This program will be implemented after selection and decision of each three (3) following model facilities. When the selection will be done, it is important to discuss and arrange deeply with ITA etc. And farmer's groups and/or rice millers who are highly motivated to produce high quality rice should be selected in preference to other parties.

- Three (3) Model Paddy Farms to verify proper farm management technologies. (harvesting and threshing of paddy in the farm)
- Three (3) Model Paddy Storehouses to verify proper paddy storage technologies.
- Three (3) Model Rice Mills to verify proper rice milling technologies.

2 The Implementing agency of this program is ITA. However, also participation and cooperation of SAED and other stakeholders are badly needed. It is requested to establish the cooperation structure which can break the barriers between governmental organizations.

5.2.6 Action Plan06 Program for support of establishment rice marketing information system (1/2)

Master Plan Program:	Program for Improvement of Rice Distribution		
Implementation Period:	2007～2010 (3 years)		
Target Group:	Producer, Rice Miller, Trader		
Implementing agency:	Ministry of Agriculture, Rural Irrigation and Food Security	Cooperating agencies:	SAED, QCD, ARM、ITA

Background and objectives

The information in connection with rice sector includes a wide range of fields, therefore the each competent authority treat a different part of the information and centralized management is not made. The organization and system for centralized management of the information will be established for the purpose of support to the formulation of the integrated policy making on rice sector under this program.

In the market level, it is essential to establish the integrated information system on paddy production and local rice trade in order to improve and maintain the marketability of the local rice. In this context, it is urgently necessary for Senegal to establish the information system to provide information which rouse miller and trader/wholesaler to trade local rice, producer to cultivate paddy and consumer to purchase local rice.

In this action plan, the useful business information will be provided to the producer, miller, trader/wholesaler in order to improve the distribution of local rice in the market though the establishment of the information system. Furthermore, The consumer's needs survey will be carried out in purpose of the continuative improvement of local rice quality though the analysis of the consumer's needs.

Project Purpose

1. Various information on rice sector is practically used for policy making.
2. The market distribution of local rice is improved.
3. Various information for improvement of local rice quality is accumulated.

Outputs

1. Various information on rice sector is centralized.
2. Various information on paddy cultivation is centralized and provided to miller.
3. Various information on rice trade is centralized and provided to miller, trader and wholesaler.
4. Consumer's needs surveys are carried out and the voices of consumers are reflected in improvement of the local rice quality.
5. Significance of the observance of the Rice Quality Standard and Quality Indication Standard are understood by miller/maker and the registration of local rice under the standard are accelerated.

Activities

1 Establishment of the integrated information system on rice
- 1-1 Establishment of the office for the integrated information system on rice in MOA
- 1-2 Formulation and Operation of Steering committee which consist of related organizations (SAED、ARM、ITA、QCD、UEMOA etc.)
- 1-3 Integrated management of information on rice by the office
- 1-4 Establishment and Operation of the Home Page (Portal site) for information service

2 Establishment of the information system on the Paddy cultivation
- 2-1 Formulation of the information system on the Paddy cultivation
- 2-2 Establishment of the General Information Database of Rise scheme
- 2-3 Establishment of the Detailed Paddy Cultivation Information Database
- 2-4 Providing Information for Rice Miller
- 2-5 Business support for Rice Miller

3 Establishment of the information system on local rice trade
- 3-1 Formulation of the information system on the local rice trade
- 3-2 Establishment of the General Information Database of Rise miller and trader
- 3-3 Establishment of the Detailed rice trade Information Database
- 3-4 Providing Information for Rice Miller and trader
- 3-5 Business support for Rice Miller and trader

4 Formulation of the Consumer's Needs Monitoring System
- 4-1 Implementation of the Consumer's Needs Monitoring Survey
- 4-2 Extraction of constraints and Creation of Countermeasure for improvement
- 4-3 Guidance to producer, miller and trader based on the survey results
- 4-4 Provision of information on local rice to consumers
- 4-5 Provision of information of consumer's needs on rice to rice breeder

5 Promotion of the Rice Quality standard and Quality indication standard
- 5-1 Review of the existing Rice Quality Standard and Quality Indication Standard
- 5-2 Formulation of the action plan for promotion of application of the Rice Quality standard and Quality indication standard to local rice
- 5-3 Extension for rice miller and agency through campaign and hearing
- 5-4 Support on the procedure of inspection and registration of local rice
- 5-5 Provision of technology transfer and simple instrument for inspection to registered miller and agency

5.2.6 Action Plan06 Program for support of establishment rice marketing information system (2/2)

Inputs

Donor side		Senegalese side (responsible agency: SAED)	
1. Assignment of Consultants		1. Government Officer(C/P)	
1-1 Team Leader	36 pm	1-1 Marketing	36 pm
1-2 Marketing Specialist	36 pm	1-2 Distribution	36 pm
1-3 Distribution Specialist	36 pm	1-3 Quality Control	36 pm
1-4 Statistic Specialist	24 pm	1-4 Statistics	36 pm
1-5 Computer System Engineer	12 pm	1-5 Computer system	36 pm
2. Education and Training		1-6 Representative from related organizations	as required
2-1 Equipment for Workshop	1 set	2. Office space and Accommodation	
2-2 Audiovisual equipment	1 set	2-1 Dakar	1 place
2-3 Textbook and manual	1 set	2-2 St. Louis	1 place
3. Enlightment, extension and propaganda		2-3 Thies	1 place
3-1 Public Relations	1 set	3. Vehicles for C/P	2 nos
3-2 Pamphlet	1 set	4. Travel Allowance for C/P	1 set
3-3 Poster	1 set	5. Office space for the integrated information system office	
3-4 Seminar and hearing	1 set	5-1Dakar	1 place
4. Leases of Vehicles			
4-1 Vehicles for consultants	2 nos		
4-2 Small truck (2-3tons)	1 no		
5. Instruments for inspection of rice quality			
5-1 Instruments for inspection of rice quality	3 sets		
5-2 Simple instruments for inspection of rice quality	10 sets		
6. Computer System			
6-1 Data Base System*1	3 sets		
6-2 Home Page System*1	3 sets		
7. Office equipment			
7-1 Office furniture	3 sets		
7-2 Office equipment	3 sets		
8. Monitoring			
8-1 Monitoring Cost	1 set		
*1: Hardware and Software			

Important notice for implementation:

1. The Counter part organization of this action plan is MOA. However, it needs to establish a steering committee with Ministry of Industry and the Ministry of Commerce since cooperation of QCD, ARM, and ITA under these ministries is indispensable.
2. This action plan includes some direct supports to the private sector which have not been made by MOA until now. It is proposed that the formulation of task force which consists of counter parts in order to attain smooth implementation.
3. As mentioned above, this action plan includes some direct support to the private sectors. Special attention should be taken in order to give equal services to taget groupes without discrimination.

5.2.7 Action Plan07 Program to support the establishment of micro-finance institution for rice producers (1/2)

Master Plan Program:	Program of improving credit access for the rice production and marketing		
Implementation Period:	2007 - 2008 (2 years)		
Target Group:	Rice producers of PIV and PIP in the Departments of Podor and Matam		
Implementing agency:	SAED	Cooperating agencies:	DRDR, CNCAS, MPmeEFMF,

Background and objectives

For rice production, CNCAS is in almost full charge of necessary credits except for very rare cases of some mutual assistance mechanism. However, the present Study revealed problems concerning production related credits and various complaints were heard from rice producers. High interest rates, complicated application procedures, delay in reimbursement because of difficulty in paddy sale, suspension of credit due to heavy indebtness are among the problems and complaints. In face of such a situation, there exist groups of producers which seek an alternative credit mechanism and in fact run it in the Senegal River Valley (SRV). For example, Mec-Delta at Ronkho of Dagana Department and UJAK at Podor of Podor Department. The former is an organization specialized in microfinance and the second is a rice producers' organization with a function of micro credit and saving.

The present Action Plan sets its objective to support PIV and PIP rice producers to establish a microfinance institution to take care of input credit of rice production (crédit de campagne) on the basis of existing microfinance experiences in the region.

Project Purpose

Rice producers at the project sites are supported to establish their microfinance institution.

Outputs

1. Information on input credits for rice producers are collected and analyzed.
2. An appropriate form of input credits for rice producers is elaborated.
3. All the necessities for establishing microfinance institutions at the project site are prepared.

Activities

1-1 Study on the present situation of input credits use of rice producers in the Departments of Matam and Podor.
- 1-1-1 Basic study on the utilization of input credits by rice producers
- 1-1-2 Study on debt situation of rice producers
- 1-1-3 Problem analysis on credits by rice producers

1-2 Study on existing financial institutions dealing agricultural credits in the SRV
- 1-2-1 Study on the use of CNCAS credits
- 1-2-2 Detailed study on the activities of MEC-DELTA (Ronkho) and UJAK (Podor)
- 1-2-3 Study on the activities of other private microfinance institutions
- 1-2-4 Study on the micro-credit related activities of ongoing/past projects

1-3 Study on existing agricultural credits in other than the SRV
- 1-3-1 Gather existing cases (Examples of activities of NGOs such as Fongs, Congad, USE, AQUADEV)
- 1-3-2 Gather existing cases (Examples of activities of MECA of Anambe, UMEC de Sedhiou in Casamance, etc.)

1-4 Understanding about the present legal matters related to micro-credit
- 1-4-1 Investigation on legal matters related to micro-credit in Senegal
- 1-4-2 Understanding the administrative procedure for establishing microfinance institutions (Mec)

2-1 Determination of suitable form of input credit for rice producers
- 2-1-1 Analysis of the present form of CNCAS's input credits
- 2-1-2 Analysis of the present agricultural credits of other microfinance institutions
- 2-1-3 Determination of input credits applied by establishing microfinance institution (form of credit, amount, etc.)
- 2-1-4 Examination of collaboration with the existing structures such as CNCAS and MEC-DELTA

3-1 Training modules to support the establishment of microfinance institutions
- 3-1-1 Formulate basic concept and principal activities of training modules
- 3-1-2 Edit a draft manual for training of establishing microfinance institutions

3-2 Formation of preparatory committee for the establishment of microfinance institutions
- 3-2-1 Selection of target site for establishing microfinance institution (one in each Department (Podor and Matam))
- 3-2-2 Organize mobilization/sensitization workshops for the preparatory committee formation and microfinance
- 3-2-3 Organize a workshop for experience sharing between rice producers and MEC-DELTA and UJAK
- 3-2-4 Organize a field trip for experience sharing of rice producers to MEC-DELTA
- 3-2-5 Form a Preparatory committee for establishment of microfinance institutions (selection of the members)
- 3-2-6 Observation trip of the committee members to MEC-DELTA and UJAK

3-3 Put into practice the training modules and completion of the training manual in establishing microfinance institutions
- 3-3-1 Put into practice the training modules supporting the establishment of microfinance institutions
- 3-3-2 Review and revise if needed the training modules
- 3-3-3 Finalize the training manual for supporting the establishment of microfinance institution

3-4 Prepare a Plan of establishment of microfinance institution and administrative formalities
- 3-4-1 Draw up a Plan of establishment of microfinance institution
- 3-4-2 Arrange all administrative formalities for establishing microfinance institution

5.2.7 Action Plan07 Program to support the establishment of micro-finance institution for rice producers (2/2)

Inputs

Donor side		Senegalese side	
1. Experts		1. Government personnel (Counterpart)	
1-1 in microfinance and financial system	9 pm	1-1 in charge of Microfinance	24 pm
1-2 in Agricultural credits	9 pm	1-2 in charge of Agricultural credits	24 pm
1-3 in organization of farmers' group/participatory development	24 pm	1-3 in charge of Financial system and legal matters	24 pm
1-4 in Training material development for farmers	4 pm	1-4 in charge of Participatory Development	24 pm
2. Subcontract study (NGO)		1-5 in charge of Farmers' training	24 pm
2-1 on Use of input credit by rice producers	1 set	2. Office Space	
2-2 on exiting microfinance institutions	1 set	2-1 at Saint-Louis	1
2-3 on legal framework of microfinance	1 set	3. Vehicles for C/P	2 cars
3. Costs of Training program		4. Mission charges of C/P	
3-1 Equipment for workshops	1 set	5. Contribution to Workshop	
3-2 Training material development and printing	1 set	5-1 Venues	3
3-3 Production of a manual for establishing microfinance institutions	1 set		
4. Data analysis and training material development			
4-1 PC, Printer, UPS, etc.	1 set		
4-2 Software for Desk Top Publishing	1 set		
5. Office equipment			
5-1 PC, Printer, UPS, etc.	1 set		
5-2 Photocopy machine	1 set		
5-3 Fax machine	1 set		
5-4 Internet Connection (for 2 years)	1 set		
6. Rental costs			
6-1 4WD vehicles for the experts			
6-2 Minibus for the Field trip			
7. Costs for Workshop organization			
8. Costs for the Field trip organization			
9. Costs for monitoring activities			
10. Establishment Subsidy (100ha x 1 site x 2 Departments x credit (max. 100,000 FCFA/ha, for example))			

Remarks:

The project has to make sure of:

1. Close collaboration with existing Agricultural credit system such as CNCAS, Projects, private initiatives, etc.
2. Close cooperation with the authority in charge of microfinance and good understanding of the Senegal's legal framework regarding microfinance institutions
3. Full mobilization of PIV and PIP rice producers (and their groups) from the initial stage of the project to ensure their support and participation
4. Sensitization (awareness raising) on the benefits and risks of microcredit scheme in rice production vis-à-vis rice farmers, future users of the microcredit
5. Maintaining at a higher level the motivation of the core members of the Preparatory Committee

5.2.8 Action Plan08 Environment management system development project in the lower and middle reaches of the Senegal River valley (1/2)

Master Plan Program:	Environment Management Program in Irrigation Development		
Implementation Period:	2007 – 2012 (5 years)		
Target Group:	People in the pilot area of the lower and middle reaches of the Senegal river valley		
Implementing agency:	SAED	Cooperating agencies:	MOE, ISRA, CERES-LOCUSTOX

Background and objectives

In the lower reach of the Senegal river (Delta), the Senegalese government has promoted irrigation development for lowland rice grown under the submerged condition, to avoid the risk of salinity hazard, as the area is arid and as the soils contain much salts accumulated in the geological era when the sea front had advanced.

While those development efforts have been successful based on the high investment which made it possible to construct irrigation and drainage networks, many private irrigation schemes constructed with limited fund in 1980s have been abandoned only after a few cropping seasons, because of a salt accumulation in the top soil due to lack of drainage facilities in many cases. The tendency of the salt accumulation in the top soil has also been reported in the village irrigation schemes in the middle reach of the Senegal river (Podor). It is predicted that salinity problem would become serious if the same irrigation practice lasted for 30 years.

Meanwhile, the Diama dam, constructed to prevent the tidal water from going up and store fresh water for irrigating both river banks, has been reported successful in terms of water quality improvement and storage water amount increase. However the side effect of the dam construction to the inhabitants in the area has been reported. Among others, aquatic plants have been multiplied, which often clogged the water canal and hindered the fishermen from casting a net.

Further, elements of the chemical substances such as fertilizers and herbicides which have widely been used in irrigated paddy field are partly flown out of the field with the drainage water, and mixed with the river water or canal water which is the domestic water sources of the downstream people. Thus, there has been a growing concern of the deterioration of the quality of domestic water through eutrophication and pollution.

This project aims to establish a base for assuring sustainable irrigation development in the lower and middle reaches of the Senegal river through the development of a participatory environmental management system by establishing environmental monitoring system and proposing countermeasures to environment degradation.

Project Purpose

An environmental management system in relation to the irrigation development is developed in the pilot area of the lower and middle reaches of the Senegal river.

Outputs

1-1 Evolution of the environment in and around the irrigation development area in the lower and middle reaches of the Senegal river (the Area) is clarified.
1-2 Environmental baseline is prepared in the pilot area.
2-1 Environmental monitoring methods is determined in the pilot area.
2-2 Long term environmental monitoring system is established in the pilot area.
3-1 Prevention/mitigation measures to environmental degradation for the pilot area are proposed.
3-2 Indicators for environmental management are determined in the pilot area.
3-3 Environmental management system is developed in the pilot area.

Activities

1. Study on the present situation of the environment impact in relation to the irrigation development (Baseline survey)
   1-1 Review on the existing environment impact studies (soils, water, flora and fauna, land use, chemicals, health, etc.)
   1-2 Field survey (workshop, reconnaissance)
   1-3 Determination of pilot areas
   1-4 Determination of baseline items
   1-5 Baseline survey (interview, sampling and analysis) of the pilot areas
2. Establishment of long term environment monitoring system
   2-1 Determination of environment monitoring items
   2-2 Determination of environment monitoring methods
   2-3 Organizing environment monitoring workshop
   2-4 Establishment of long-term environment monitoring system
3. Development of environment management system
   3-1 Examination of countermeasures to mitigate and/or prevent environment degradation
   3-2 Proposing environment degradation mitigation/prevention measures
   3-3 Establishment of environmental management parameters
   3-4 Organizing environmental management seminar
   3-5 Development of environmental management system

5.2.8 Action Plan08 Environment management system development project in the lower and middle reaches of the Senegal River valley (2/2)

Inputs

Donor side		Senegalese side (responsible agency: SAED)	
1. Provision of expert		1. Counterpart personnel (SAED, ISRA, LOCUSTOX)	
1-1 environment expert	30 pm	1-1 environment expert	
1-2 soil expert	20 pm	1-2 soil expert	
1-3 irrigation expert	20 pm	1-3 irrigation expert	
1-4 pest management expert	15 pm	1-4 pest management expert	
1-5 remote sensing expert	20 pm	1-5 remote sensing expert	
1-6 social development expert	15 pm	1-6 social development expert	
2. Analysis equipment and agents		2 Office facilities	L.S.
2-1 soil analysis equipment	1 set		
2-2 water quality analysis equipment	1 set		
2-3 piezometer	20 sets		
2-4 portable soil analyzer	2 sets		
2-5 portable water quality analyzer	2 sets		
2-6 chemical agents	L.S.		
3. Office equipment (computers, printers, photocopy machines, internet facilities, accessories, etc.)	L.S.		
4. Satellite image analysis software	1 sets		
5. Vehicle	4 units		
6. Overseas training of counterparts	L.S.		
7. Other project costs (fuel, counterpart travel allowance, etc.)	L.S.		

Remarks:

1. Water and soils in the Senegal river valley has been changed in a long term range by human activities including irrigation development and the construction of the Diama dam. As this master plan study promotes further irrigation development, it is also important to propose the development of environmental management system.
2. SAED will be the implementing agency to cope with the environmental change in relation to irrigation development. However, it is essential for SAED to coordinate with other stakeholders including Ministry of Environment, donors and NGOs who have already started environmental monitoring in the area, OMVS, an agency responsible for water related environment of the Senegal river as the international river, and local people who are directly affected by the environmental change.
3. Considerable information related to the environmental evolution has already been accumulated. It is primarily important through the integration of the existing information to construct an efficient long term environmental monitoring system under the participation of local people.
4. It is also necessary to propose countermeasures to prevent and/or mitigate environmental degradation and environmental management indicator, and to develop an environmental management system as a basis for implementation.
5. Donor will have to shoulder all the necessary costs for project implementation except the salary of counterparts and office facility, as the Senegalese government can not allocate any extra budget for the project.
6. Before the project starts, the role of each counterpart agency should be clarified.

5.2.9 Action Plan09 Rice production support project in Casamance Region (1/2)

Master Plan Program:	Rainfed Rice Production Support Program		
Implementation Period:	2007 - 2010 (3 years)		
Target Group:	Rice farmers in the pilot project areas of the Ziguinchor and Kolda Regions		
Implementing agency:	ISRA/Djibelor	Cooperating agencies:	DRDR, Ancar, Anrac

Background and objectives

In Casamance, rain fed rice cultivation is widely practiced in a traditional manner. Making use of rain of over1000mm and abundant Casamance river water, this rain fed rice cultivation is the principal activity of Casamance peoples whose diet is mainly based on rice, despite its limited yield of 1 ton/ha or so. However, since the severe Drought in 1968, paddy fields have been affected by saline and/or acid problems which caused consequently a widespread degradation of soil of the region. As a result, the area of rice cultivation has become limited.

The present project aims at establishing a suitable manner of rain fed rice cultivation in the paddy field recovered from salinity/acidity problems. The outcomes of past and on-going projects and programs are to be fully utilized and some handy agricultural tools and small machines are introduced. The rehabilitation of degraded rice paddy fields could contribute to the recovering process of the region by encouraging the return of internal emigrants from Casamance region during the 20-year lasted conflicts.

Project Purpose

Rice yield in the pilot project areas of the Ziguinchor and Kolda Regions increases.

Outputs

1-1 Salinity/acidity hazard map is prepared for the middle and lower valley of the Casamance River (MLVCR)
1-2 Potential areas for rice production in MLVCR is largely delineated
2-1 Inventory of salinity/acidity hazard prevention project is prepared for MLVCR
2-2 Salinity/acidity hazard prevention plan for potential areas is formulated for MLVCR
2-3 Pilot projects for salinity/acidity hazard prevention is implemented in MLVCR
2-4 Effective measures for salinity/acidity hazard prevention for MLVCR are confirmed
3-1 Salt tolerant rice varieties adapted to MLVCR region are selected
3-2 Farming methods for selected salt tolerant rice varieties for MLVCR are established
4-1 Handy agricultural implements for rice cultivation are developed
5-1 Paddy fields in the pilot project area are leveled

Activities

1. Preparation of the salinity/acidity hazard map for rice cultivation area of MLVCR
   1-1 Soil survey
   1-2 Water quality survey
   1-3 Land use survey
   1-4 Salinity/acidity hazard map preparation
   1-5 Preparation of Hazard map of remaining land mines (subcontract)
   1-6 Delineation of rice cultivation potential area
   1-7 Selection of pilot project areas (Reg. Zig: 2 sites, Reg. Kolda: 1 site)
   1-8 Baseline survey for the pilot project areas
   1-9 Improvement of access to the pilot project areas
2. Assessment of the salinity/acidity hazard prevention measures
   2-1 Inventory survey of the existing salinity/acidity hazard prevention measures/projects
   2-2 Survey on indigenous techniques of water resources management for rice production in Casamance
   2-3 Examination of the mechanism of prevention measures
   2-4 Formulation of the salinity/acidity hazard prevention plan for the potential areas
   2-5 Implementation of the pilot project for salinity/acidity hazard prevention in the pilot project areas
   2-6 Project monitoring and evaluation
3. Selection of salt tolerant rice varieties and establishment of cultivation methods
   3-1 Comparative study on the salt tolerant rice varieties
   3-2 Selection of recommended salt tolerant rice varieties for MLVCR
   3-3 Experimental cultivation of the selected salt tolerant rice varieties
   3-4 Survey on rice farmers' opinion about production inputs (fertilizer, weed-killer, etc.)
4. Development and diffusion of handy agricultural implements
   4-1 Development and diffusion of handy weeder
   4-2 Development and diffusion of other useful implements
   4-3 Training on use of a walking tractor and its maintenance
5. Leveling of the paddy field of the pilot project areas
   5-1 Construction of dyke along the contours
   5-2 Leveling of the lands between the dykes
   5-3 Consolidation of paddy fields

5.2.9 Action Plan09 Rice production support project in Casamance Region (2/2)

Inputs

Donor side		Senegalese side	
1. Experts		1. C/P (DRDR、ISRA、ANCAR、ANRAC)	
1-1 Rice production (agronomy and breeding)	36 pm	1-1 Rice production (agronomy and breeding)	36 pm
1-2 Soil and fertilizer	36 pm	1-2 Soil and fertilizer	36 pm
1-3 GIS	8 pm	1-3 GIS	36 pm
1-4 Agro-machinery	18 pm	1-4 Agro-machinery	36 pm
1-5 Agricultural engineering	8 pm	1-5 Agricultural engineering	36 pm
1-6 Environmental issues	12 pm	1-6 Environmental issues	36 pm
1-7 Social development	8 pm	1-7 Social development	36 pm
2. Subcontract study (e.g. PROCAS)		2. Vehicle for C/P	2 cars
2-1 on Mapping remaining land mines		3. Mission allowance for C/P	
3. Soil and water analysis implements		4. Office facilities	
3-1 pH meter	2 sets	5. Parking lot for agricultural machinery	
3-2 Sodium meter	2 sets	5-1 Ziguinchor	1 site
3-3 EC meter	2 sets		
4. Yield survey kits	2 sets		
5. Soil survey kits	2 sets		
6. PC (with monitor and UPS), printer	2 units		
7. Office equipment	1 unit		
8. Mapping software	2 sets		
9. GPS	3 units		
10. Vehicle	2 units		
11. Other project related costs			
12. Motorized thresher	3 units		
13. Rice mill	3 units		
14. Grader	1		
15. Truck	1		
16. Simple grain storage facility	3 units		
17. Walking tractors *(motoculteur)*	6		
18. Tool Kit for Walking tractor	6 sets		
19. Costs for monitoring activities			

Remarks:

The project should:

1. Watch closely and carefully the starting peace process in Casamance and its development
2. Make sure of close collaboration among the concerned structures as well as projects, farmers' organizations and NGOs active at the field level

5.2.10 Action Plan10 Rice production support project in Fatick Region (1/2)

Master Plan Program:	Rainfed Rice Production Support Program		
Implementation Period:	2007 – 2010 (3 years)		
Target Group:	Rice farmers in the pilot project area of the Fatick Region		
Implementing agency:	DRDR	Cooperating agencies:	ISRA, ANCAR, PBA, NGOs

Background and objectives

Rice cultivation in the Fatick Region has been practiced traditionally by women at lowland of the downstream areas of the Sine-Saloum river and its tributaries. In many cases women grow rice by forming groups. Rice is the second most important staple food next to millet.

But, the area has been affected by sea water intrusion with the expansion of cultivation area in the upstream area and decrease in the rainfall over the years, which had resulted in the widespread of saline and/or acid problems in the rice cultivation areas. Now many farmland where rice has been cultivated before had been abandoned.

These problematic areas have partly been restored by the cooperation of donors including German and NGOs through the construction of saline water intrusion prevention dams which mitigate saline/acidity toxicity.

This project aims at recovering rice cultivation area, stabilizing rice production and increasing paddy yield by presenting rational salinity/acidity prevention measures, introduction of salt tolerant varieties, development of simple farm tools, and leveling of paddy field, etc., through the pilot project implementation.

Project Purpose

Rice yield in the pilot project area of the Fatick Region increases

Outputs

1-1 Salinity/acidity hazard map is prepared for rice cultivation area of the Fatick Region
1-2 Potential area for rice production is largely delineated
2-1 Inventory of salinity/acidity hazard prevention project is prepared
2-2 Salinity/acidity hazard prevention plan for potential areas is formulated
2-3 Pilot projects for salinity/acidity hazard prevention is implemented
2-4 Effective measures for salinity/acidity hazard prevention are confirmed
3-1 Salt tolerant rice varieties adapted to Fatick region are selected
3-2 Farming methods for selected salt tolerant rice varieties are established
4-1 Handy agricultural implements for rice cultivation are developed
5-1 Paddy fields in the pilot project area are leveled

Activities

1. Preparation of the salinity/acidity hazard map for rice cultivation area of the Fatick Region
   1-1 Soil survey
   1-2 Water quality survey
   1-3 Land use survey
   1-4 Salinity/acidity hazard map preparation
   1-5 Delineation of rice cultivation potential area
   1-6 Selection of pilot project areas
   1-7 Baseline survey for the pilot project area
   1-8 Improvement of access to the pilot project areas
2. Assessment of the salinity/acidity hazard prevention measures
   2-1 Inventory survey of the existing salinity/acidity hazard prevention measures
   2-2 Examination of the mechanism of the prevention measures
   2-3 Formulation of the salinity/acidity hazard prevention plan for the potential area
   2-4 Implementation of the pilot project for salinity/acidity hazard prevention
   2-5 Project monitoring and evaluation
3. Selection of salt tolerant rice varieties and establishment of cultivation methods
   3-1 Comparative study on the salt tolerant rice varieties
   3-2 Selection of recommended salt tolerant rice varieties for Fatick Region
   3-3 Cultivation trial of the selected salt tolerant rice varieties
4. Development and diffusion of handy agricultural implements
   4-1 Development and diffusion of drill seeder
   4-2 Development and diffusion of manual weeder
   4-3 Development and diffusion of other implements
5. Leveling of the paddy field in the pilot project areas
   5-1 Construction of dyke along the contours
   5-2 Land leveling between the dykes
   5-3 Consolidation of paddy field

5.2.10 Action Plan10 Rice production support project in Fatick Region (2/2)

Inputs

Donor side		Senegalese side (responsible agency: SAED)	
1. Provision of experts		1. Counterpart personnel （C/P） (DRDR、ISRA、ANCAR、PBA)	
1-1 Rice (agronomy and breeding)	21 pm	1-1 Rice (agronomy and breeding)	36 pm
1-2 Soil and fertilizer	18 pm	1-2 Soil and fertilizer	36 pm
1-3 GIS	8 pm	1-3 GIS	36 pm
1-4 Agro-machinery	18 pm	1-4 Agro-machinery	36 pm
1-5 Agricultural engineering	8 pm	1-5 Agricultural engineering	36 pm
1-6 Social development	8 pm	1-6 Social development	36 pm
2. Soil and water analysis implements			
2-1 pH meter	3 sets		
2-2 Sodium meter	3 sets	2. Office facilities	
2-3 EC meter	3 sets		
3. Yield survey kits	3 sets.		
4. Soil survey kits	3 sets		
5. Mapping software	1 set		
6. GPS	3 units		
7. Vehicle	4 units		
8. Motorized thresher	6 units		
9. Rice mill	6 units		
10. Hand tractor	6 units		
11. Grader	1 unit		
12. Truck	1 unit		
13. Office equipment (computer, printer, photocopy machine, internet facility, accessories, etc.)	3 sets		
14. Computer skill training	L.S.		
15. Other project costs (fuels, travel allowance for C/P, etc.)	L.S.		

Remarks:

1. The project should adopt a participatory approach, as it is important for the local people to take the initiative in implementing the project.
2. Being the area development planning both in macro and micro levels, the project should utilize a GIS technique.
3. The project should closely coordinate with on-going salinity prevention project like PBA.
4. The project would also pursue the farming efficiency enhancement through the promotion and development of farming tools, so that women would not shoulder more working load when rice cultivation revives.
5. Donor will have to shoulder all the necessary costs for project implementation except the salary of counterparts and office facility, as the Senegalese government can not allocate any extra budget for the project.
6. Before the project starts, the role of each counterpart agency should be clarified.

5.2.11 Action Plan11 Anambe irrigation rice production promotion project (1/2)

Master Plan Program:	Anambe Irrigation Development Program		
Implementation Period:	2007 – 2009 (2 years)		
Target Group:	Rice farmers in Anambe		
Implementing agency:	SODAGRI	Cooperating agencies:	DRDRKolda、ANCAR

Background and objectives

The irrigation development in Anambe of Kolda Region was launched by SODAGRI (established in 1974) in 1982. So far, two dam reservoirs with capacities of 90 million m3 and 60 million m3, six (6) pumping stations and irrigation area of 4,180 ha. In addition, the project has constructed rice mill with a milling capacity of 2 tons/hour, cowsheds, rural roads, schools, etc. Apart from the facility development, the project has organized farm machinery services, micro-finance and farmers training programs (450 sessions). However, the irrigation performance has gradually decreased to 60% due mainly to deterioration of the irrigation facilities. Crop diversification from rice to high values crops such as cotton and vegetables is another reason. Anambe irrigation project is the development core for promotion of irrigated rice production in Casamance. Keeping close collaboration with on-going activities assisted by donors as well as FEPROBA, rice farmers will be encouraged under Action Plan 11.

Project Purpose

Rice production in Anambe is increased.

Outputs

1. Development constraints against the Anambe irrigation project is to be clarified.
2. Reasons for low irrigation performance is clarified and solutions are to be proposed.
3. Constraints of post-harvesting and rice marketing are to be verified.
4. Promotion program for rice production is to be worked out.

Activities

1-1 Survey on present conditions of the existing irrigation area (4,180ha)
- 1-1-1 Natural conditions (physiography, topography、climate, hydrology, soils, vegetation, etc)
- 1-1-2 Social conditions(demography、administration, donors and government assistance, etc)
- 1-1-3 Histrorical background of the irrigation develppment
- 1-1-3 Irrigation farming (crop seasons, crops, planted area, farming practices, production, etc)
- 1-1-4 Irrigated rice (calendar, varieties, farm inputs, yield and production)
- 1-1-5 Progress of the integrated rural development under PADERBA(AfDB)
- 1-1-6 Progress of extension project for 920ha under (Islamic Development Bank)
- 1-1-7 Micro-finance（fund sources、beneficiaries、loan conditions、repayment, etc.）
- 1-1-8 Irrigation and drainage facilities, operation and maintenance, water users associations, etc.
- 1-1-9 Post-harvest facilities, agro-processing plants, etc.
- 1-1-10 Farm machinery services
- 1-1-11 Distribution and marketing of agro-products

1-2 Analysis of development constraints
- 1-2-1 Problem analysis on the basis of the study results of Item 1-1.
- 1-2-2 problem analysis by the governmental agencies including DRDR、ISRA、ANCAR, etc.
- 1-2-3 Interview to farmers organizations such as FEPROBA and IDECOM
- 1-2-4 Interview to rice millers and farm machinery service providers
- 1-2-5 Preparation of problem trees and development approaches

2-1 Analysis for increased rice production
- 2-1-1 Improvement of irrigation performance (actual irrigation ration)
- 2-1-2 Improvement of unit yield by appropriate manners of water management, variety selection, farm inputs and farming practices, etc.
- 2-1-3 Improvement of profitability of rice cultivation

3-1 Analysis of rice milling and marketing
- 3-1-1 Problem analysis of rice mill plants, operation and maintenance, related facilities such as storage, technical skills of operators, etc.
- 3-1-2 Production of milled rice, distribution, marketing channels, etc.
- 3-1-3 Rice quality and prices
- 3-1-4 Proposal for improvement of profitability from the viewpoint of rice marketing

4-1 Preparation of the Anambe Irrigated Rice Production Promotion Project
- 4-1-1 Preparation of rice production subprogram
- 4-1-2 Preparation of irrigation and drainage facilities rehabilitation subprogram
- 4-1-3 Preparation of rice processing subprogram
- 4-1-4 Preparation of agricultural support program including farm machinery services
- 4-1-5 Preparation of marketing promotion subprogram
- 4-1-6 Preparation of project organization plan and capacity building program

5.2.11 Action Plan11 Anambe irrigation rice production promotion project (2/2)

Inputs

Donor side		Senegalese side (responsible agency: SAED)	
1. Experts		1. Counterpart(C/P)	
1-1 Irrigation Farming	24 pm	1-1 Irrigation Engineering	24 pm
1-2 Irrigation and Drainage	18 pm	1-2 Farm Management	24 pm
1-3 Participatory Development	12 pm	1-3 Post-harvest	24 pm
1-4 Rice Cultivation and Mechanization	12 pm	1-4 Participatory development	24 pm
1-5 Irrigation and Drainage Facilities	12 pm	1-5 Environmental assessment	24 pm
1-6 Post-harvest	12 pm	1-6 Sociology	24 pm
1-7 Farmers Organization and Sociology	12 pm	2. Office space and accommodation	
1-8 Rice Marketing	12 pm	2-1 Veringara	1 location
1-9 Environmental Conservation	12 pm	2-2 Kolda	1 location
2. Training Program		3. Vehicles for C/P	2 Units
2-1 Workshop facilities	1set	4. C/P travel allowance	1 set
2-2 Video camera and audio visual set	1set	5. Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA)	
3. Laboratory and Equipment			
3-1 Chemical analysis apparatus	1set		
3-2 Current meter	3 units		
3-3 Water quality tester	3 units		
3-4 pH meter	3 units		
3-5 EC meter	3 units		
3-6 Grain moisture meter	5 units		
3-7 Laboratory rice mill	2 units		
3-8 Piezo-meter	10 units		
3-9 GPS, distance meter	5 units		
3-10 PC, printer, copy machine, etc.	2 units		
4. Vehicles			
4-1 4WD vehicles for experts	5 units		

Remarks:

1. Detailed discussion will be required between SODAGRI and donors in order to demarcate the scope of the Action Plan 11 from past and on-going similar studies.

CHAPTER 6 TECHNOLOGY TRANSFER PROGRAMS

6.1 Outline of the Technology Transfer Programs

The Technology Transfer Programs have been implemented during the second year study period for the stakeholder agencies which are expected to play leading roles in implementing the master plan. Seven programs were selected applying the following criteria in principle:

(1) Those programs/projects which are expected to contribute to the development of the administrative capacity of the agencies;

(2) Those programs/projects of which the effects can be evaluated within the Study period; and

(3) Those programs/projects which are expected to bring about the immediate effects.

The objectives, activities and participating agencies in each program are summarized in the following table.

Table 6.1.1 Objectives and Progress of Technology Transfer Programs

Program	Objectives	Activities	Participating agencies
1. Improvement of rice cultivation techniques for increasing yield	Improvement of rice cultivation techniques of low yielding rice farmers in Dagana and Podor through participative training methods	A series of theoretical guidance on rice cultivation techniques and their demonstration at farmers' fields in four irrigation schemes.	ISRA Saint Louis and SAED
2. Utilization of azolla for reducing production cost of paddy under irrigated field condition	Trial for examining the effect of azolla on the paddy yield and applied nitrogen recovery rate for pursuing low input paddy cultivation	Field trial at ISRA Fanay station by establishing eight treatments combining four nitrogen level and azolla inoculation. Yield analysis was conducted.	ISRA Saint Louis
3. Seed multiplication by women's groups in Fatick	Seed multiplication and motivation to use quality seeds for improving productivity of the traditional rice cultivation	Seed production (12ha) and paddy cultivation at 11 sites with 56 ha in total using certified seeds	DRDR Fatick, ANCAR Fatick, PBA and ISRA Saint Louis
4. Rice Quality Improvement	Examination of the possibility on the quality improvement of domestic rice, and transfer of technology of rice processing techique	Demonstration of rice milling techniques and importance of the management of paddy moisture content on high milling recovery and head rice rate	SAED, Union of Debi-Tiguette
5. Marketing Promotion of Senegalese Rice	Examination of possibility of adding value to high quality domestic rice, and market development	Market development through the sales of 50 tons of domestic rice, and hand over to the farmers of Debi-Tiguette	SAED and Union of Debi-Tiguette
6. Capacity building of rice yield sampling survey	Transfer of techniques of rice yield survey and methods of data analysis.	Introduction of measurement devices and instruments for rice yield survey, and training of relevant people on the survey by using them	DAPS, DRDR and SDDRs Saint Louis
7. Re-construction of seed multiplication system in Casamance	Preservation of foundation seed and technical guidance to farmers on seed production as the basis for the re-construction of seed production system	Preservation of 17 varieties of seeds and seed production at two sites in Casamance	ISRA, DRDR, SODAGRI, IDECOM, ANCAR, PROCAS, NGOs

6.2 Outcomes of the Technology Transfer Program

The Technology Transfer Programs which constitute a part of proposed projects/programs in the master plan, have been implemented with the main objective of building the capacity of the government staffs who will be the main players of the implementation of the master plan in the future. At the same time the implementation of the Technology Transfer Programs as the development activity will be expected to bring about some benefit. The lessons learned will be reflected in the master plan. Through this process, master plan and action plan will be matured in consideration of environmental impact, social risks, etc.

The main outcomes of the Technology Transfer Programs are summarized in the following.

Table 6.2.1 Outcomes of the Technology Transfer Programs

Program	Feedback to master plan/action plan	Outcomes with regards to capacity development	Benefit as development project
1. Improvement of rice cultivation techniques for increasing yield	(1) Participative extension method (Participative Learning and Action; PLA) starting with problem analysis, followed by theoretical lecture and practical training at demonstration, was found effective; (2) Efficiency and cost effectiveness of the extension methods should be examined	Farmers : 140 at four sites ISRA staff: 12 SAED staff: 11	Increase in paddy yield of 140 target farmers
2. Utilization of azolla for reducing production cost of paddy under irrigated field condition	(1) Increase in yield by applying azolla under low level of nitrogen application; 8.4 ton/ha with azolla under 200 kg/ha of urea (2) Highly valuable research although quick yielding effect is not expected	(1) Limited number of participants due to research: 5 staff in ISRA; (2) Through this program, it was demonstrated that the reduction of urea application by 100kg/ha with azolla to maintain yield at maximum level; (3) When the technique is established and extended, the contribution to the farm economy and national economy as well as environment conservation will be tremendous.	
3. Seed multiplication by women's groups in Fatick	(1) Implementing capacity of DRDR was built up. (2) Further examination on seed production and distribution is needed (3) Support to increase agro-machinery is necessary	DRDR staff: 7 SDDR staff: 4 ANCAR staff: 5 PBA staff: 2 ISRA SL: 3 Farmers (11 sites): 581	(1) Increase in income of 581 farmers through 188 ton of paddy production (2) Production of seed of local and improved varieties (3) Capital formation for next farming by selling excessive paddy (4) Creation of employment opportunity by activating farming (5) Strengthening of ties of women's groups

4. Rice Quality Improvement	(1) Price incentive on quality improvement (2) Re-examination of cropping pattern and mechanization to realize the timely harvest (3) Importance of farmers' education (4) Variety selection in consideration of quality improvement (5) Reasonable support to rice millers	SAED staff: 6 Executive of Debi-Tiguette Union: 30 Rice mill operation: 28 Rice mill assembly: 12 Farmers: 315	(1) Sales of milled rice during four months (Feb. to May): 84.5 million FCFA (2) Creation of employment opportunity (878 person-days; 1.63 million FCFA)
5. Marketing Promotion of Senegalese Rice	(1) Examination of the possibility of adding value on domestic rice (2) Market development of domestic rice (3) Needs of domestic rice (4) Quality standard of domestic rice (5) Continuance of production and marketing of SENRIZ	DAPS staff: 3 DAPS temporary staff: 18 ITA staff: 2 Executive of Debi-Tiguette Union: 3	Under examination (interview to rice millers may be conducted)
6. Capacity building of rice yield sampling survey	(1) Importance of the development of agricultural statistics and the capacity development of DAPS staff was confirmed (2) Importance of budgeting for agricultural statistical survey was clarified	DAPS staff: 2 DRDR staff: 3 SDDR staff: 19	Direct benefit to the farmers is not expected, as the program was planned for government officials
7. Re-construction of seed multiplication system in Casamance	Under examination	ISRA ZG staff: 2 ISRA KL staff: 3 SODAGRI staff: 1 Farmers (2 sites): 50	Under examination (data collection being done through couterpart)

Based on the above table, the total number of personnel who participated in the programs was 949, consisting of 90 government staff, 829 farmers and 30 temporary government staff and private sectors.

The detailed evaluation of each program is shown in the following.

Integrated rice cultivation technology improvement program

<table>
<tr><th>Technology Transfer Program</th><th>Feedback to Master Plan</th><th>Contribution to Capacity Development</th><th>Direct Benefit</th></tr>
<tr>
<td>(1) Integrated rice cultivation technology improvement program</td>
<td>
<u>Background:</u>
In the Senegal river valley, high input rice cultivation using agro-machinery, improved seeds, agro-chemicals and high level of chemical fertilizer has been practiced under irrigation condition. As a result, the average yield has reached at over 5.0 ton/ha, which is very much higher than any other rice production areas in the country. The farmers in the area considered to have acquired high skill in rice cultivation as they have been long trained by ADRAO, ISRA and ISRA.

However, despite of high productivity, the farmers are not satisfied with the income, as the production costs account for nearly 70% of the gross benefit. And at farmers' level, the paddy yield of individual farmers varies much ranging from 0.9ton/ha to 9.0ton/ha. While those farmers with high productivity enjoy the high profitability, others with lower productivity find it difficult to repay the production loan borrowed from CNCAS. This large variation is considered to be attributed to the difference in the technical level of farm management practice among farmers.

To improve the productivity of paddy in the valley further, it is important to focus on the farmers with lower productivity, and take measures to improve their yield by addressing the cause of the lower yield

<u>Objective:</u>
This program aims to contribute to the improvement of farm income of the rice farmers, by enabling them to increase yield and quality of rice through the introduction of improved farming practices without increasing costs or with minimum additional costs. Particular attention will be paid to those farmers with the lower yield

<u>Activity and Input:</u>
This program was implemented in the four large irrigation schemes in the Senegal river valley. Major activities in the program were as follows:

(1) Selection of the target farmers
(2) Problem analysis workshop
(3) Theoretical training on improved farming practices for paddy yield increase
(4) Demonstration of yield increase techniques in the participating farmers' field
(5) Evaluation of the program (including yield survey and interview to farmers)
(6) Preparation of activity report and extension materials

<u>Result and Feed back:</u>
The above activities (1) through (5) have been finished, and the program evaluation is on-going. Major outputs are the following:

(1) Problem analysis workshop by target farmers revealed that yield limiting factors could be categorized into two groups: those factors which can be overcome by farmers and others which need external support to eliminate.
(2) Yield increase techniques which were considered possible to be introduced by farmers were lectured on and implemented in the demonstration plots. As a result, average paddy yield in the demonstration plots was 6.8 ton/ha compared to that of other target farmers with less than 5.0 ton/ha.
(3) The farmers of the demonstration plots considered the reasons for yield improvement as improvement of land leveling, application of basal fertilizer before sowing, the use of certified seeds, improvement of weed effect by use of proper amount of herbicides, manual weed, proper water management, etc.
(4) Average yield of target farmers was 10% higher than that of non-target farmers. Adopted techniques and the reason for adoption, evaluation of the adopted techniques, etc. among target farmers are under study.

Major points to be reflected in the master plan or action plan are the following.

(1) The yield increase techniques tried in the demonstration plots were found effective. Follow up works should be made to diffuse the techniques to other farmers in the irrigation areas where the program was implemented.
(2) ISRA, the responsible agency for the implementation of the program, is located in Saint Louis, the river mouth of the Senegal river. In implementing the program especially in inland areas, efficiency will be decreased in terms of cost and time. It might be more efficient to train the extension agents of SAED, and they will transfer the technology in their respective areas.

For enabling farmers to adopt the techniques, proper environment should be provided to assure the stable seed supply and timely provision of fertilizer, etc. The greatest result of this program attained the track record that local rice was sold by the high level retail price, 400 FCFA/kg of whole grain and 250 FCFA/kg of broken rice respectively. It is considered that the validity of a development scenario that the rice sector reorganization started from activation of the rice mill industry by a price incentive was verified to some extent.
</td>
<td>
Participants in the program are the following

<table>
<tr><th>Activity</th><th>Participants</th><th>Person (number)</th><th>Person-days</th></tr>
<tr><td rowspan="2">Problem analysis workshop</td><td>Farmers</td><td>88</td><td>88</td></tr>
<tr><td>SAED field staff</td><td>11</td><td>11</td></tr>
<tr><td rowspan="2">Theoretical training (3 times)</td><td>Farmers</td><td>140</td><td>280</td></tr>
<tr><td>SAED field staff</td><td>12</td><td>34</td></tr>
<tr><td rowspan="2">Establishment of demonstration plots</td><td>Farmers</td><td>105</td><td>105</td></tr>
<tr><td>SAED field staff</td><td>-</td><td>-</td></tr>
<tr><td rowspan="2">Total</td><td>Farmers</td><td>140</td><td>473</td></tr>
<tr><td>SAED field staff</td><td>12</td><td>45</td></tr>
</table>
<u>Farmers</u>
Through the problem analysis workshop, they clarified the constraints which limit the paddy yield, and learned that some of the constraints could be overcome by their own efforts.

The farmers of the demonstration plots realized very high yield by adopting improved techniques learned through the training in the program. They all felt like talk their experience to other farmers. Extension of techniques among farmers is expected.

Other target farmers who participated in the program also learned the theories of the improved techniques and confirmed the effectiveness of the techniques. It is considered that their motivation to introduce the techniques was enhanced.

<u>SAED staff</u>
Those who participated in the program were mainly agricultural advisors assigned to the respective irrigation schemes. They have general knowledge on rice cultivation techniques such as the recommended amount of fertilizer application and agro-chemicals, but sometimes lacks in integrated techniques like the timing of input application and water management. They learned such techniques through the program.

They are expected to assist farmers in obtaining certified seeds and fertilizer on time, as supporters of the farmers.
</td>
<td>
Direct benefit to the participated farmers by the Program is the following:

(1) The average paddy yield of the demonstration plots was higher than that of non-target farmers by 2.4 ton/ha.

(2) Average paddy yield of target farmers in three sites was higher than that of non-target farmers by 10% or 0.4 to 0.6 ton/ha.
</td>
</tr>
</table>

Trial on the utilization of azolla for reducing the amount of nitrogen fertilizer

Technology Transfer Program	Feedback to Master Plan	Contribution to Capacity Development	Direct Benefit
2. Trial on the utilization of azolla for reducing the amount of nitrogen fertilizer		None	None

Background:

Paddy rice is widely grown under irrigation condition in the Senegal River Valley, where many irrigation development projects have been implemented capitalizing on the abundant water resources. The average yield of paddy rice in this area exceed 5.5 ton ha^{-1}, higher than any other areas in the Country. However, the paddy producers have a problem with high production cost, which results in the low income. The application level of nitrogen fertilizer is particularly high, ranging from 133 to 156 kgN ha^{-1}, which is partly responsible for the high production cost.

The reason for the high level of nitrogen application is due to the low recovery rate (20% to 30%) of applied nitrogen, which is said to be attributed to the high volatilization rate of the applied nitrogen in the water. Although the mechanism of the volatilization of applied nitrogen has not clarified fully, it is reported that high water temperature, and high solar radiation partly account for the phenomenon.

Meanwhile, M. Cisse et al. have found through the pot experiment that the yield of paddy as well as its applied nitrogen recovery rate increased much with azolla compared to without azolla under submerged condition. He also revealed through the statistical analysis that improved nitrogen recovery has been attributed to not only each of azolla and nitrogen fertilizer but also interaction of two factors.

If the same results above is reappeared in the field conditions, it is possible to reduce the applied amount of fertilizer to obtain the same yield as before.

Objective:

This program aims at examining the effect of azolla on the recovery rate of applied nitrogen fertilizer by the rice plant in irrigated field conditions.

Activities:

The trial was conucted at the Fanay station of ISRA Saint Louis. The following eight treatments have been established combining four level of nitrogen application amount with azolla innoculation and without azolla. The trial was carried out under randomized block design with four replicates. Each plot area was 18 m^2.

Table 1 Treatments of the Trial in Technology Transfer Program 2

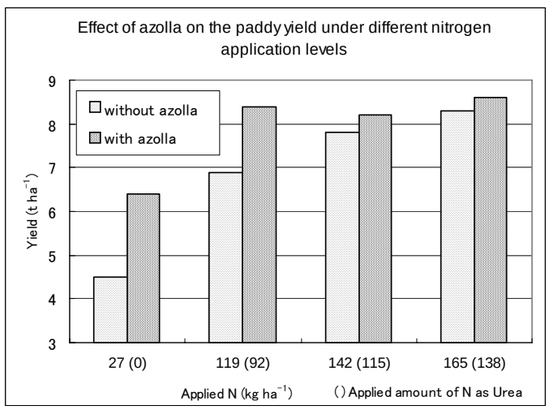
Treatment	TM1	TM2	TT1	TT2	TT3	TT4	TT5	TT6
Urea application rate (kg/ha)	0	0	200	200	250	250	300	300
Applied nitrogen rate (kgN/ha)	27	27	119	119	142	142	165	165
Azolla application	-	+	-	+	-	+	-	+

Note: All the plots were given 150kg/ha of DAP (18-46-0) and 100kg/ha of K_2SO_4 (0-0-45%) at the time of land preparation.

The variety used for the trial was Sahel 202. Seeds were sown at nursery on July 20, 2005. Seedlings were transplanted at 23 days after sowing with planting spacing of 20cm by 20cm (250,000 hills/ha). Azolla was applied with the amount equivalent to 1 ton/ha at five days after transplanitng. Urea was applied at 18 days and 38 days after transplanting. In each time the same amount of urea was applied (50% of the total applied amount in each treatment).

The pH and temperature of paddy water were measured before and after the urea application.

Output:



(1) Paddy yield was improved much with azolla application under low nitrogen application level. The highest paddy yield (equivalent to 8.4 ton/ha) was obtained at 200 kg/ha of urea application under with-azolla condition.
(2) Under without azolla condition, the paddy yield increased gradually upto 300kg/ha of urea application.
(3) From the above, it might be possible to maintain the current yield by use of azolla even if the application amount of urea is reduced by 100kg/ha.
(4) Based on the analysis, it was revealed that yield increase was realized by not only the single effect of azolla and fertilizer, but also interaction between azolla and fertilizer.
(5) It is suggested that nitrogen recovery rate will be improved by modifying the timing and quantity of nitrogen fertilizer application.
(6) The mechanism of the azolla on the improvement of nitrogen recovery will be further examined through nitrogen analysis and yield component analysis.

Based on the above, it is justified that the development of azolla utilization technique and its diffusion be one of the themes to be included in the paddy productivity enhancement program under the master plan. In the development, impact of azolla on the environment should be considered.

For the time being, the application of this technique will be confined to those paddy field where transplanting is practiced.

Possible impact:

Impact of the reduction of nitrogen fertilizer application rate by the introduction of azolla technique is assessed in the following.

(1) Reduction of production cost of the paddy producers

Assuming that the price of urea is FCFA8,000 per 50kg bag, farmers can save FCFA16,000 per hectare, accounting for 5 to 7% of the total production cost per hectare.

(2) Saving of urea consumption in the valley as a whole

Assuming that the total paddy area in the Senegal river valley is 30,000 ha, 3,000 tons of urea can be saved in the valley. It means that 480 million francs could be saved applying the same price of urea as above. This could contribute to the reduction in financial burden of the government and the reduction in the environmental cost including urea manufacturing and transport.

Seed Multiplication by Women Groups in Fatick

(3) Seed Multiplication by Women Groups in Fatick

Feedback to Master Plan

Background:

In Fatick, rice is planted mainly on low-lying land along the Saloum river and its tributaries with a total coverage of 2,000 ha. The paddy yield is about 1.0 ton/ha on average with large annual fluctuation governed by rainfall patterns. In the Region, rice is recognized as women's crop and in many cases produced by group activities. Farming practices are manually done from land preparation to harvesting with traditional implements. Rice varieties are represented by local ones such as Momo、Dhobi, Sekouba、Nazer Sagna、Ndongodjiwar, which are early maturing, drought resistant and higher salt tolerant. Seeds of those varieties are reproduced at farmer level resulting in low purity and low productivity. In recent years, ADRAO introduced Sahel108 to the Region. Although local farmers are motivated to use of seeds of improved varieties such as Sahel 108, seed multiplication is not appropriately done due to limited knowledge and insufficient experiences of farmers except for some supported by NGO.

Objective:

Program 3 aims at awareness creation for use of pure seeds and training for seed multiplication technique suitable for local rice producers mainly of women groups.

Activity and Input:

Program 3 consists of the following five (5) sub-programs.

(1) Seed preservation for traditional varieties (3 ha)

(2) Seed multiplication for improved variety, i.e. Sahel 108 (9 ha)

(3) ADRAO Workshop for the government staff (14^{th} – 17^{th} June 2005)

(4) Monitoring and Evaluation

Result and Feed back:

(1) Proved development potentials for rain-fed rice cultivation in Fatick

Program 3 assisted 11 groups organized by 581 farmers in total with provision of tractor services for land preparation, certified seeds of Sahel 108, urea and herbicide for 68 ha. Land preparation by tractor-drawn disc-harrow was practiced in June 2005. Seeds were directly sown by hands for all the plots of 68 ha by the middle of July 2005. The 2005 rice was fed by sufficient rainfalls, which was started by first shower on 16^{th} June 2005 in Djirol and accumulated to 800 mm (40 days) by 23^{rd} October 2005. The annual rainfalls of 2005 were 200 mm higher than ones in average years. Timely sowing resulted in good harvest, i.e. 188.7 ton of paddy in 56.5 ha (83% of 68ha, the area planed) giving the average paddy yield of 3.3 ton/ha. With this result, farmers as well as the government staff in Fatick were strongly encouraged to direct every effort for improvement of rice cultivation in Fatick.

(2) Government rules and regulations for seed production and distribution

Program 3 expected that all paddy seeds to be produced under Program 3 would be used within communities. However, the seed production was far higher than our expected production. Consequently, farmers were forced to sell their surplus seeds although the distribution of paddy seeds is not common in Fatick. In order to avoid confusions among rural communities, farmers were requested not to sell grains as certified seeds, which are sometimes sold with extremely high prices, i.e. 500 FCFA/kg. It is urgently required to establish the rules and regulations of paddy seed production and distribution as well as training to farmers in Fatick.

(3) Group fund formation for next crop seasons

Timely sowing was the main reason for good harvest in 2005. It was realized by timely land preparation of 68 ha before onset of the rainy season, which enabled to utilize rainfalls effectively for healthy germination and seedling establishment. With this lesson learnt, farmers are strongly encouraged to reserve a part of surplus for procurement of tractor hiring services (25,000 FCFA/ha equivalent to 250 kg paddy/ha) in the 2006 crop season. The experience will also help farmers to understand how important group fund formation is for sustainable rice farming.

(4) Coordination among agencies for successful program operation

Program 3 also proved extreme importance of close coordination among the government agencies, i.e. DRDR, ANCAR and PBA. Farmers appreciated their frequent site visits and qualified services by forms of monitoring, technical advices, follow-up and workshop.

(5) Advantages of line-planting

Use of line-planting method with seeders was introduced to rice farmers in Fatick by FAO/Vietnamese mission. Program 3 recommended applying this practice. Farmers commented that line-planting contributed to reduce heavy workload in weed control and harvesting. Line-planting enable farmers to use rotary weeders. Further field research is required.

Contribution to Capacity Development

The participants of Program 3 are summarized below.

Activity	Participants	Person (no.)	Person -Day
Technical Supports to Farmers Groups in Fatick	DRDR Staff	7	
	SDDR Staff	4	
	ANCAR Staff	5	
	PBA Staff	2	
Seed Preservation of Traditional Varieties (ISRA Fanaye Farm)	ISRA	3	
Seed Multiplication and Trial Planting with Sahel 108	Farmers of 11 GIE Groups	555	
	Farmers of other groups	26	
Total	Government staff	21	327
	Farmers	581	-

Government Staff

- The 21 government staff participated in Program 3 have directed their efforts to train farmers and monitoring nearly on full-time basis. The total inputs amounted to 327 persons*days.
- The workshop for rice farming techniques, variety selection and seed multiplication was held from 14^{th} to 16^{th} June 2005 at WARDA Saint Louis. DRDR dispatched 13 staff from DRDR, ANCAR, PBA and SDDR.
- DRDR staff prepared the training manual for farmers, which was used in the technical workshop for 11 GIE.
- Joint Workshops at three (3) sites in Fatick and 11 GIE Workshops were organized at the end of Program 3 in order to exchange experiences accumulated by individual groups and discuss the farming plan 2006.

ANCAR Staff

The ANCAR staff was also involved in the technical training. Program 3 provided good opportunities to shape up the technical knowledge concerning rice cultivation of one (1) senior staff of ANCAR FATICK and one (1) in Djirol.

Group Leader

Throughout Program 3, the leaders of 11 GIE took full responsibilities for preparation of group meeting, accounting, preparation of farming schedule, receiving farm inputs for DRDR, record keeping for monitoring purposes by DRDR, preparation of answers to questionnaires by DRDR, etc. They also played an important role to settle disputes among group members.

Researchers of ISRA Saint Louis

Program 3 requested ISRA Saint Louis to multiply traditional variety seeds under ideal conditions at the experimental farm in Fanaye. Three (3) researchers maintain the seed farm and harvested 1,800 kg pure seeds of four (4) traditional varieties in addition to ones in Casamance.

Direct Benefit

Direct benefits of Program 3 for poverty reduction are summarized below.

(1) Seeds stock reserved for the 2006 crop season

All the 11 GIE succeeded to reserve seed stock for the 2006 crop season at the rate of 100 kg/ha. It is recommended to continue the seed preservation and purification for traditional varieties.

(2) Food security and income generation at individual farmer level

Each group allocated 18 tons of paddy for seed stock and the remaining 170 tons for their consumption (140 tons) and sale (30 tons). Each member obtained 250 kg of paddy for home-consumption. The income by selling 30 tons of paddy is estimated 4.5 million FCFA.

(3) Expansion of arable land for paddySoils are low-lying land are generally too high to plough by traditional implements, e.g. Kobi. In contrast, mechanical harrowing by tractors broke hard surface soils and allowed farmers to expand their planting area in this crop season. Most of these farm lands will be arable in the next crop season, too.

In general, low-lying lands are not suitable for upland crops such as maize and millet but for wet-land rice. Program 3 proved that rice is exclusively advantageous crop on low-lying lands. It is recommended elders of communities to support women's rice farming although troubles arising from land ownership often hinder them.

Rice Quality Improvement Program

(4) Rice Quality Improvement Program

Background:

It is very important and urgent matter to improve quality of local rice, and to increase profit of rice producing farmers and rice millers. To create the awareness of the quality improvement mind in rice producing farmers and rice millers are being demanded.

Comité Interprofessionnel du Riz (CIRIZ) consists of CNCAS, rice millers, rice traders and rice producing farmers with SAED as leader. CIRIZ adjusts paddy purchasing price from farmers, rice milling charge of rice millers and retail price of the milled rice every year in order to secure the profits of the concerns mentioned above. (In this season, it is roughly fixed as, producers' price of the paddy is 90FCFA/Kg and price of the milled rice is 175FCFA/Kg. And rice milling charge of the modern rice mills is 12FCFA/Kg on paddy and 11FCFA/Kg on paddy at primitive rice mills in villages.) However the manipulated prices, which are not connected with the quality of milled rice, are disincentive all the sectors concerned to improve the quality of rice.

Objective:

The objects are following three points, which are focusing rice producing farmers and rice milers, connect with Technical Transfer Pogram-5.

(1) Market price of milled rice is influenced and decided by its quality. This Program verifies the profit of rice millers will increase when the quality of the milled rice will be improved.

(2) Management and control of paddy quality is very important in order to increase the quality of milled rice. To be understood for rice producing farmers and rice millers that, milling yield and head rice ratio should be greatly affected by moisture contents of paddy.

(3) In order to raise up sustainable production capability of the high quality milled rice which has high market value, this program will concentrate the technical transfer to advanced farmers and rice millers.

Activity and Input:

This program has been implemented at Debi-Tiguet area. Outline activity and input are as follows.

(1) In order to produce high quality rice, rice mill having its capacity of 0.5ton on paddy per hour, has been newly installed. (November, 2005)

(2) To supply high quality rice to SENRIZ Campaign (Program-5). (December, 2005)

(3) To transfer high quality rice processing technologies. (The end of December, 2005 to the end of February, 2006)

(4) To process high quality rice continuously. (To be expected up to the end of May, 2006)

Result and Feed back:

(1) Importance of Price Incentive for quality control of milled rice.
While implementing of this program, price of the head rice was 340FCFA/Kg and broken rice was 190FCFA/Kg at the gate of rice mill. (Retail price of each was 400FCFA/Kg and 250FCFA/kg).
By these high level of rice price, incentive for quality control of paddy producing farmers have been increased extremely. Following efforts have been continued by the Debi-Tiguet farmers,
(1) Separation of head rice and brokens, Re-separation by difference of the size grain.
(2) Especially for head rice, effort of manual selection to remove colored grain, have been continued.

(2) To realize mechanized rice cultivation system appropriately, which aims to improve milling yield and head rice ratio. To develop of rice reaper locally.
As a result of this program, it has been cleared that milling yield is 60% and head rice ratio is 40% both on average.
Head rice ratio milled in January was about 40%, however it decreased to about 20% in February drastically because of excessive drying. Though delay of harvesting and/or lack of storage technology are one of main cause of decrease of paddy quality, it is difficult to improve them without price incentive. It is important that all concerns own jointly the value of development of the reaper locally.

(3) Necessity of education program for farmers
During this program, 4 units of grain moisture meters were lent to the farmers. Farmers positively measure the moisture contents of paddy before harvesting. By these data, co-relation between moisture contents and milled rice quality can be traced in each paddy field.
The number of paddy producing farmer is written on each rice bag. By that number, inventory control of milled rice can be done easily.

(4) Difference of rice quality by the variety, which should be considered at the stage of agricultural experimental research and paddy seed production.
As a result of this program, it has been found out that, head rice ratio of SAHEL variety is comparatively low, and both milling yield and head rice ratio of IR1529 is higher. From this result, it should be considered former variety selection and its distribution..

(5) How to assist rice millers

Rice millers do not participate this program directly. However it has been informed that some rice millers have already started to increase quality control of milled rice, because of the increase of rice prices. It is important to respect company effort of each rice millers, and also administrative assistance is requested to guarantee the free competition between each rice millers.
(For example, reconsideration of CIRIZ, support of paddy purchasing fund, reduction of import duty for rice milling machinery, etc.)

Participants in the program are the following

Activity	Participants	Person (number)	Person-days
Technical transfer to Rice producing farmers	SAED staff	5	10
	UNION staff	30	80
Rice Production	Farmers of UNION	215	-
Monitoring in farm	SAED staff	1	8
	UNION staff	3	24
Rice mill plant installation	Installation engineers from St. Louis Farmers of UNION	12	240
Plant operation (Operation training)	Operation manager	1	39
	Main technicians	3	117
	Common labors	6	215
	Guard	2	34
	Women for light work	15	144
	Sub total	27	549
Plant operation (Actual operation work)	Operation manager	2	46
	Main technicians	3	138
	Common labors	6	276
	Guard	2	53
	Women for light work	15	156
	Sub total	28	669
Total	Gov. staff (SAED)	6	18
	Farmers and private company staff	315	1,452

SAED Staff

In order to control the paddy quality at the stage of paddy production, SAED staffs trained the farmers of UNION from the sowing season to the harvesting period. More than 200 farmers participated in this program, and as a result, most of farmers could carry out the multiplication of the production.

However, SAED staffs had not enough recognition of importance for control of moisture contents of paddy, almost of all moisture contents of received paddy at the rice mill were quite low. In spite of this program is aiming to improve the rice quality, occurring of these problems were much disappointed. These situations should be improved in near future.

[Note] Before 1996, SAED was executing total rice industry such as, production, processing and distribution of rice. However after changing the policy for rice sectors by the Government, SAED was not concerned in rice marketing directly, except purchasing of rice by the Government or International organizations.

Farmers of Debi-Tige UNION

1) The awareness for quality control of the paddy production of farmers has been improved.

2) Capabilities of operation, maintenance and managing of rice mill were increased remarkably.

3) Capability of inventory control was increased.

Direct benefits to Debi-Tige UNION and farmers by the Program are the followings:

(1) UNION will process 160 tons of paddy monthly from February to May, 2006. It is estimated that expected sales volume of milled rice will be 384 tons, and total sales volume will be 84.5million FCFA.

(2) Number of Debi-Tige residents who were employed by this program (common labors, guards and light workers mentioned in the left table) is 878 person-days in total, and total wage is 1.63 million FCFA.

(3) While implementation of Technical Transfer Program-5, Study team has sold 30 tons of high quality local rice (SENRIZ) to about 10 traders at Dakar, Thiés, Touba, St. Lois and Tambacounda. Debi-Tige UNION could take over the marketing channel, which is the very important advantage for the UNION.

(4) 5 transportation tracks were supplied to the UNION by Japanese General Grant Aid in 1996. 3 tracks were repaired by using spare parts (about 2 million Japanese Yen) which were procured and supplied by this Study Team. By utilizing these tracks, UNION can transport the rice by themselves and it will save huge amount of transportation cost. Actual transportation cost from Debi-Tige to Dakar is 22 FCFA/Kg by transporter in St. Louis.

In-direct Benefit

SENRIZ is distributed at highest price level of local rice at present. Appearance of SENRIZ made rice millers a good opportunity to consider improvement of rice milling and investment to rice machinery.

Campaign for improvement of image on local rice

(5) Campaign for improvement of image on local rice

Background:
The quality of majority of local rice in Senegal is low due to contamination of many impurities and bran and un- homogeneity of grains. The low quality of local rice weakens the competitive power with imported rice in the market. Moreover, since the availability of local rice in the market is restricted, the notability of domestic rice is very low.

Objective:
The main purpose of the technology transfer program 5 is to impress consumers with new good image of local rice and tap new market for local rice through the production and sale of rice which meets consumers' needs. Additionally, this program has other several purposes namely, to give traders an incentive to sell more local rice, to give producers a will to produce more paddy, to give rice millers a volition to improve the quality of rice.

Activity and Input:
This program includes the extensive activity from grasp of consumer needs to a selling promotion as follows.

(1) Market research (410 interviewees) on rice quality was carried out, the result of research clarified consumers' needs to rice quality and expectation of consumers for local rice. Based on the information, the product realization of the quality rice which the market want is accomplished through the activity of program 4.

(2) For the purpose of the improvement in image of local rice, the new brand SENRIZ was established and the event for promotion was carried out in the independent space in Dakar anticipating the propaganda effect by the mass media. (23 December, 2005)

(3) In view of the discrimination against the imported rice of which information is not offered, and the quality information (variety name, milling date, etc.) of SENRIZ was described on the rice bag.

(4) Following Dakar, SENRIZ was advertized in Sun Louis, Touba, Kaolack, Thies, and Tambacounda, and new markets for SENRIZ were opened. The Debi-Tiguet union succeeded the established market.

(5) The DAPS staffs and enumerators were transferred technology on the "evaluation grit method" and the "Analytic Hierarchy Process" which are the new market research technique which can catch consumer confidence more logically.

Result and Feedback:

(1) The price level of local rice
The greatest result of this program attained the track record that local rice was sold by the high level retail price, 400 FCFA/kg of whole grain and 250 FCFA/kg of broken rice respectively. It is considered that the validity of a development scenario that the rice sector reorganization started from activation of the rice mill industry by a price incentive was verified to some extent.

(2) The necessity for continuous production and sale of SENRIZ
It is necessary to position SENRIZ which played a important role as a driving force for the improvement of rice quality proper in a master plan. It is important to prepare a environment under which rice millers and farmers organizations that can observe a decree or rule on quality of rice can get permission to produce and sale SENRIZ. However, the person or organization who produce and sale SENRIZ will not be obtained spontaneously. It is considered that it is realistic to encourage as a partner the Debi-Tiguet union which was trained through the program 4.

(3) Consideration of Program for continuous monitoring and improvement
Continuous monitoring is carried out to the distributors of SENRIZ. Moreover, the questionnaire survey to consumers of SENRIZ is on going. Through monitoring to consumers, evaluation and request about quality of SENRIZ, for example "Although it is delicious just after cooking, the taste turn stale after it get cold.", " It is delicious, however it is not economy due to require a lot of oil.", "SAHEL 108 is more delicious than other varieties." and "I want know the chemical composition of the rice." has been obtained. The obtained information should be made full use to improve the quality. Furthermore, it is expected to be taken into consideration in the quality of rice of a paddy breeding through the feedback to agricultural research.

(4) Importance of cooperation with the food technology research institute of MOI (ITA)
The information about the recipe of the local rice and the recipe in consideration of the rice variety difference, which the consumer needs is quite limited. However, "Improvement of the Quality and Valorization of Rice Produces in the Valley of the Senegal" of which ITA takes the lead includes clarification of the feature of paddy varieties and formulate proper recipe and cooking method for local rice. It will be necessary to promote expansion of local rice consumption through the cooperation with ITA.

(5) Establishment of a SENRIZ standard, and Formulation of Certification and Guarantee System
Although there are quality standards of rice in Senegal, it is not applied to local rice in the present condition. While SENRIZ is recognized, it is necessary to establish the quality standards of local rice and to formulate the system for certification, guarantee and control of SENRIZ in future. For that purpose, it is indispensable for MOA to cooperate with a Quality Standards Association and the Department of Commerce (quality and consumption office). Since it is indispensable to protect the benefit of a consumer, it will be necessary to make reference in the master plan

(6) The Countermeasure for Maintenance of Prices and a Stable Supply of Rice
It was confirmed that the market want local rice which has stable quality, supply and price the year around through this program. In order to establish the system for stable supply through the year, many efforts are needed from the planting to the post-harvest (for example, review of repayment period of CNCAS credit, the diversification of variety, extension of double cropping, construction of a storage facilities, etc.). It is important to approach from the agricultural support system.

Participants in the program are the following

Activity	Participants	person (number)	Person-days
Consumer's needs survey	DAPS staff	3	30
	enumerator	18	404
Sales promotion	Farmers (DTU)	3	9
Product development	ITA staff	2	20
Total	Government officer	23	427
	farmers	3	9

DAPS staff
In this program, questionnaire surveys which utilized the "Evaluation Grit Method" and the "Analytic Hierarchy Process" for the purpose of grasping a consumer's needs over rice cleaning were carried out. As a part of this survey, the technology transfer on method of marketing research to the DAPS staffs and enumerators was performed through the lecture and on the job training. They could experience not only the technology transfer of research method but also "product realization" which is the result of marketing research. SENRIZ is the production which realized the rice quality which the consumer desires. It is meaningful that they have experienced "product realization."

Enumerator
While enumerators were bewildered by new methods for interview survey of at the beginning, they were improved by a daily meeting, lecture and training and could grasp consumers' needs systematically. They made effort to improve investigation accuracy, such as correcting a mutual questionnaire or reconfirming and most of them could master the new methods.

ITA staff
From a sense of solidarity of sharing the same purpose of the improvement in quality of local rice, animated discussion were done between JICA Study team and ITA staffs. The ITA staffs came to recognize that it is important for improvement of rice quality to start not only with an improvement of rice mill technology but also with a rice breeding and to establish name value of local rice through the argument. Furthermore, they recognize the necessity for cooperation between Department of Industry and MOA.

Debi-Tiguet Union
It was big impact to witness the scene where their products were soled with high price as high quality local rice SENRIZ in front of them. During the technology transfer activity on marketing skill as a part of the program, the president of the union took the lead and sold SENRIZ aggressively. It is evaluated that their consciousness reform was done judging from this fact. They should work hard for improvement of rice quality in view of importance of keeping rice quality wished by consumers and reliance.

Direct benefits acquired from this program are as follows.

(1) Until now, only a few company, such as ECORICE or CNT supply limited amount of high quality local rice. When local rice is recognized and a market is expanded with this program as a turning point, it is expected that participation of a new enterprises and competition between the other companies will arise, and the rice sector will be activated. As a result, it is expected that benefit will be brought to a consumer in the point of improvement in quality and a stable reasonable price.

(2) In this technology-transfer program, the study team wholesaled 30t of SENRIZ(s) to about 10 companies in Dakar, Thies, Touba, Saint Louis, and Tambacounda. It means that the market establishment which was the biggest subject of Debi-Tiguet Union was attained through succession of this market and SENRIZ brand.

(3) The campaign in an independent space was publicized to the Senegal whole country by four newspapers and three television broadcasters. The contents which all the media reported were favorable contents to sales promotion of SENRIZ and local rice. Although quantitive evaluation is difficult, it is judged that the effect of the improvement image for the local rice performed through these mass media was greatest. In case of the business talk from Tambacounda and Ziganshawl, the information from television had become the opportunities.

Capacity Building of Rice Yield Sampling Survey

(6) Capacity Building of Rice Yield Sampling Survey

Feedback to Master Plan

Background:

DAPS takes basic responsibility for agricultural statistics of the nation since year 2000. The agricultural statistics are prepared for 11 regions and 33 departments by joint efforts of DRDR and SDDR under the control of DAPS. Planted areas, unit yields, productions and farmers' grain stocks for rainy season crop are verified by annual statistical survey, while farm family members, livestock, farm inputs and agricultural implements are surveyed every third year. Questionnaires filled by SDDR are collected and analyzed by DAPS. Most of enumerators are temporarily engaged with these activities on three-month contract basis. The survey equipments and instruments used for the survey were introduced in the previous census in 1998. They are too old to ensure high efficiency and accuracy in survey results.

Objective:

Program 6 aims at capacity building of DRDR senior staff, DAPS staff attached to DRDR and SDDR staff including enumerators in Saint Louis Region.

Activity and Input:

Program 6 focused on improvement of survey techniques for area measurement of farm plots and yield sampling survey through the following activities.

(1) Problem analysis of the 1998 census and countermeasures to improve survey accuracy
(2) Improvement of survey manual and questionnaires on June 27-30 2005 and On-the-job training (OJT)
(3) Monitoring of performance of the statistical survey after the training program, i.e. 1st monitoring on July 19-22 2005 and November 17-25 2005.
(4) Evaluation workshop on December 12 and 13 2005.

Result and Feed back:

(1) Improved survey methodologies and instruments

The survey methodologies introduced are summarized below.

No.	Nouveaux instruments	Instruments actuels	Questionnaire	Avantage des nouveaux instruments
1	Boussole à collimateur de visée	Boussole	Area measurement	Nord magnétique lisible sans délai Amélioration de précision pour détecter la direction avec efficacité
2	Indicateur DME laser	Ruban métrique de 50m	Area measurement and crop yield	Mesure instantanée d'une distance de 0,3 à 150 m dans des conditions sans obstacles tels que les cuvettes et les fosses Peut mémoriser jusqu'à 20 mesures et calculer le total des mesures
3	Calculatrice scientifique	La même	Area measurement	Les mêmes qu'avant
4	Humidimètre	Rien	Crop yield	Pas d'humidimètre jusqu'à présent mais introduction d'une méthode de mesure de l'humidité pondérale du paddy et d'ajustement du poids du paddy a 14 % de l'humidité pondérale.
5	Balance électrique (1-2000g)	Balance à ressort de 5kg (25-5000g)	Crop yield	L'échelle minimale est améliorée en passant 25 g à 1g en termes de précision de l'évaluation du rendement
6	Convexe (5,5m)	Rien	Crop yield	Permet déterminer un carre de rendement pour mesurer sa distance diagonale

The techniques with new instruments were generally suited to current knowledge of the participants in the TOT workshop. They commented that the technical training should be held every year. They also expressed their anxious about endurance of precision instruments under the natural conditions.

(2) Verified constraints around the agricultural statistics survey

Program 6 provided particular opportunity to all the stakeholders to get together and discuss the constraints against the agricultural statistics survey. The participants in the workshop pointed out that more understanding about current constraints against the agricultural statistics survey is required among the government in order to improve its budgetary situation. DAPS are not well-known among the government.

(3) Urgent necessity in improvement of working conditions of enumerators

The technical guidance is provided to enumerators in end June to early July, when DAPS recruits enumerators with three-month employment agreement. Their morale is generally low due to such reasons as heavy workloads, poor assistance by the government to enumerators, poor cooperation by sample farmers and employment conditions with low salary and no housing supports.

Contribution to Capacity Development

The participants in Program 6 counted for 28 staff consisting of six staff from DAPS and DRDR and 22 staff from SDDR.

Activity	Participants	Staff (no.)
TOT (4 days)	DAPS、DRDR	6
	SDDR and Enumerators	22
1st Monitoring (4 days)	SDDR and Enumerators	22
2nd Monitoring (4 days)	SDDR and Enumerators	22
Evaluation Workshop (2 days)	DAPS、DRDR	6
	SDDR and Enumerators	22
Total	DAPS、DRDR	6
	SDDR and Enumerators	22

The total participants in Programs accounted for 454 person/days

DAPS staff

Two C/P for the Study participated in Program 6. The head of the statistical department of DAPS fully supported Program 6.

DRDR Staff

The director of DRDR Saint Louis and his senior staff in-charge of the agricultural statistics continuously joint Program 6.

SDDR Staff

Three SDDR office dispatched 22 staff including 10 enumerators to Program 6.

SDDR	Chef de SDDR	Chef de Bureau Stat	Enumerators		
			Full time	Contract	Total
St. Louis	1	1	2	3	5
Dagana	1	1	2	4	6
Podor	1	1	2	3	5
Total	3	3	6	10	16

Direct Benefit

The direct benefits are improvement of technical level of the staff in Saint Louis, which will contribute to the statistic survey of the Region. Moreover, Program 6 generated more benefits in enhancement of close relationship between the central government, namely DAPS, and the regional agencies, i.e. DRDR and SDDR, by sharing the views in the constraints and hopes. Program 6 finally summarized the following problemsof DAPS to be solved in short or med/long strategies.

(1) Short-term

Problems	Outline
Poor logistic support	a. Not enough survey tools allocated to enumerators b. Poor social welfare condition to enumerators c. Not elaborated working schedule for survey including vehicle arrangement d. insufficient contract period to complete Q6 survey
Low working motivation	a. Poor working condition (salary, allowance, delay of payment, poor logistic support, etc) demoralize the enumerator's on statistical survey work. b. Poor coordination by SDDR office
Confidence of statistics data	a. Due to poor logistic support to enumerators technically and materially, survey outputs are not confident.
Insufficient Capacity building program	a. Due to insufficient budge of DAPS, training of enumerators is not thoroughly done.
No feedback to local office (DRDR, SDDR)	a. DRDR and SDDR do not receive any result of their survey for the annual statistic service from DAPS.
No statistics for the dry season crops	a. There are many farming activities along Senegal river during the dry season, but no survey for statistics service made by DAPS.
No publication of any annual statistics report	a. no publication of annual statistics report since 2001 due to insufficient of DSA budget
Poor monitoring activity	a. Only 1 to 2 times per each department in the campaign due to insufficient of DSA budget b. Unable to grasp each SDDR carrying out the annual statistical survey properly or not. c. Intercommunication is very weak.
Insufficient budget	a. Min of Finance allocates the budget for statistics service to DAPS b. The allocated budget is forced to be shared by a whole DAPS activities. c. DSA is confronted with crucial limitation to implementing the annual statistics service

(2) Medium-Long Term Problems

Problems	Outline
Non decentralizatio n system	a. No activity budget allocated to DRDR, and SDDR b. No data processing and compiling systems of statistical data in the local government (DRDR, SDDR)
Not unitary statistics service	a. Several stakeholders involved in statistics service of agriculture sector b. Different method is adopted by each stakeholder. c. No inter-communication each other
Gap between users and suppliers	a. High demands of the community rural basis of statistical data from many users (NGOs, donors, local government) b. Only departmental basis data is supplied.

Reconstruction of seed multiplication system in Casamance

(7) Reconstruction of seed multiplication system in Casamance

Items to be integrated into the Master Plan

Background:

The system of agricultural services in Casamance, that is to say in Kolda and Ziguinchor regions has deteriorated a lot because of the long conflict this area experienced. Seed preservation and multiplication continued on a small scale only. They were even stopped sometimes. A workshop gathering the concerned government body in Casamance was held in February 2005 at DAPS (Dakar) to identify problems and constraints both regions are confronted with. It turned out that seed deterioration is one of the main causes of rice farming bad yield.

The average rainfed rice farming in Casamance is only one tonne per ha or so. It is obvious that this low yield can be improved through an appropriate use of chemical fertilizers. However, rice farmers in Casamance have a negative attitude towards modern rice farming techniques. Under these circumstances, a fast extension of modern rice farming techniques including the use of chemical fertilizers and agricultural machinery may cause confusion among producers. On the contrary, it is essential to promote production intensification to face the high rice demand we will be confronted with in the future. So, it is quite reasonable to make the first steps towards the reorganisation of rice production in Casamance by reinforcing the potential of existing seeds.

In June 2005, DAPS explained the purpose of the study's technology transfer programme to governments agents from Kolda and Ziguinchor. The meeting concluded that reinforcement of the organised seed multiplication and distribution system must be the first step of the agricultural assistance rice farmers in Casamance must receive. A project proposal was formulated by DAPS and CRZ (ISRA).

Objectives:

The purpose of programme 7 is to provide technical monitoring regarding pre-basic and basic seed multiplication in order to reconstruct the multiplication system in Kolda and Ziguinchor regions.

Activities:

Activities of the programme are as follows :

(1) Workshops for Programme 7 formulation and monitoring in Kaolack and Tambacounda
(2) Participation in the joint workshop of all agencies in charge of implementing the seven technology transfer programmes
(3) Seed preservation (basic seed multiplication) in ISRA plot, Kolda (CRZ).
(4) Technical monitoring for rice farmers with a view to production of R2 seeds
(5) Visit to demonstration plots in order to motivate the other farmers.
(6) Seed multiplication training for rice farmers' groups
(7) Improvement of SODAGRI and ISRA's seed stocking stores
(8) Presentation of results by concerned structures in Casamance

Results :

(1) Seed multiplication system by all local actors, NGOs, and government The system will be led by ISRA/Djibélor.

The conflict intensification in Ziguinchor region led to the closure of ISRA Djibélor. CRZ (Centre de recherche zoologique **[Zoological Research Centre]**) of Kolda has been taking charge of both regions in Casamance following the abovementioned closure. ISRA is still carrying out minimum researches on plant farming. This programme enabled ISRA to resume its activities in its Djibélor station for pre-basic seed multiplication. Pre-basic seed production was 252kg.

ISRA put 75kg pre-basic seeds at the disposal of IDECOM in Anambé basin. IDECOM managed to produce 6.000 kg of basic seeds in total. In Ziguinchor region, PROCAS, a programme supported by the German cooperation, and an NGO called Entente de Diouloulou are taking charge of R1 seed multiplication. Seeds produced under the programme were examined and certified by DRDR in Ziguinchor and Kolda regions along with seed distribution were entrusted to ANCAR in both regions. In addition to seed multiplication, demonstration plots were established Ziguinchor region by another NGO, called GRDR. This helped motivate local rice farmers.

It must be pointed out that the programme enabled us to confirm the very close collaboration between actors of the rice sector in Casamance.

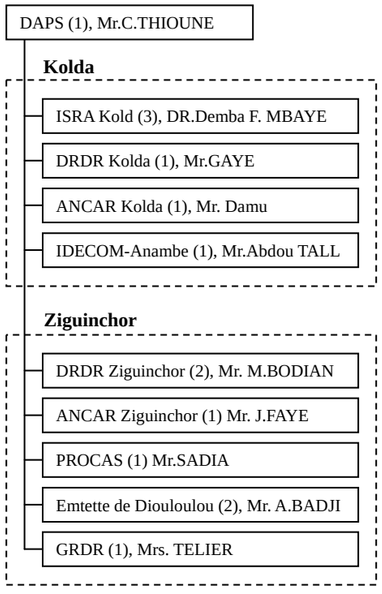
(2) Revalorization of varieties preserved in Casamance

In the Senegal River valley, more than 90 % of rice sown surface area use Sahel varieties, IR1529 and TCS-10. However, varieties introduced by projects in Casamance are still preserved there until now; and taking into account the future diversified Senegalese demand, varieties preserved in Casamance (they break less, are more adapted to off-season crops, and salinization, etc.) will be precious sources for rice production in Senegal

Capacity building contribution

Activities planned by the JICA Study Team in Casamance were postponed because of security problems in this area. This programme was implemented through cooperation of concerned partner bodies coordinated by DAPS. The JICA Study Team indirectly supported activities of the aforementioned programme.

Participants in the programme are as follows : 1 person from DAPS (M. Thioune), 6 persons from Kolda, and 7 persons from Ziguinchor, that is 14 persons in total. The implementation organisation of the programme is indicated in de figure below



Figures between brackets indicate the number of.participants. Names of Directors, heads or staff of each concerned structure are indicated in the list.

The 14 abovementionned members participated in this programme for six months and a half, that is, from August 2005 to January 2006.

Direct benefits

The following rice varieties were cultivated under this programme.

Table : Sown varities for seed multiplication

Unit : kg Nbre.	Varieties	Pre-basic-seeds By ISRA	Basic seeds bay IDECOM	By Entente de Diouloulou	
				Basic seeds	Seeds R1, R2
1	144B9	11			
2	DJ11-509	4		2	
3	DJ12-519				24
4	DJ8-341				67
5	BW248-1				29
6	Tox728	5			
7	Tox128-1			2.5	
8	DJ684D	10		5	
9	ITA123	5		6	
10	BG90–2	10		5	
11	IR1529	15		8	74
12	Rock5	40		19.5	
13	WAR77	10		5	84
14	WAR1	15		8	33
15	Sahel 08	10		5	
16	IRAT10			5.5	
17	Basmati	-	-	5	
Total		135		76.5	311

This programme enabled the production of 252kg of pre-basic seeds by ISRA research centre located at Djibélor, 6.000 kg of registered seeds (R1) by Entente de Diouloulou which is an NGO. Those seeds will be used for the seed production during campaigns to come.

More than 70 rice farmers have participated in the programme.

A meeting gathering concerned bodies was held in February 23rd, 2006 at DAPS. Seed production quantity, the number of farmers who participated in the programme were specified on that occasion.

6.3 Lesson and Learn obtained through the Activity for Quality Improvement in Quality and Development of market of local rice

6.3.1 The Basic Strategy of the Improvement in Quality and Development of Market of local Rice

The technology transfer programs 4 and 5 were carried out in order to investigate the actual condition of the rice market in Senegal. For that purpose, a quality rice which satisfied consumer's needs were designed and produced first, and then an improvement in image of local rice were done and activity for development and expansion of market of the quality local rice were performed. Furthermore, it was also the important purpose to transfer technology and know-how to the successor who inherits the experience of the study and produces and sells the high quality local rice. The lesson and learn from both programs is quite important and helpful, when the Senegal government try formulating the framework of the administration for support of rice sector. The basic strategy of both programs is as follows.

The basic strategy of the improvement in quality of local rice, and development of the market

The Local rice which bring high value to farmers and rice millers
To produce rice which keeps comfortable price level for farmers and millers

The Clarification of the image of quality rice expected by consumers
To clarify the required caracteristic by consumes through the marketing research

The Realization of products
To optimize facility and technology which enable to produce "thr realization of products" of the expected rice

The Discrimination from imported rices
To design special brand and logotype which deeply impress as local rice

The Appeal to the Nation
To advertise the scene of an event led by the Gopvernment through the mass media

The development of the suitable market for limited supplyof rice
To develop markets which consist of wholesalers as special agents

6.3.2 Process for development of market of local rice and experiences through the activities

(1) Requirement for marketable local rice

The result of analysys of marketing survey which covered 410 households in 5 areas clarified the requirement of rice quality expected by consumers. The necessary condition for produce of quality local rice were set based on the information and handed to technology transfer program 4.

- To produce whole grain which has high value as much as possible.

- To divide broken brains according to their size and commercialize separately (The sorter should be equipped for the purpose.)
- To produce cleane and clear grains by complete milling
- To reduce colord grains and impurities as much as possible.
- To commercialize each variety separately, not mix different varieties.

(2) Production of the Milled Rice

Harvest and threshing were carried out in due time and rice stocked in good conditions when implementation of this programme was ongoing. Those activities made it possible to get better quality paddy and milled rice and increase milling yield as well.

That result was the fruit of efforts made by a team of rice producers who used high post harvest technologies. Under those circumstances, Débi-Tiguet UNION was chosen as implementation site for this programme.

Paddy excessive drying turned out to be one of the most important factors that have a negative impact on milled rice quality.

① Paddy and milled rice moisture content② milling yield (total percentage of milled rice from paddy) and ③ head rice percentage (head rice percentage to total milled rice) were measured lot by lot. Measured elements are as follows:

Table 6.3.1 Measured elements in Programme-4

Measurement place	Measurement period	Note:	Measured elements	Persons in charge of measurements
1) Paddy field	(1) when harvest is ongoing		Paddy moisture content	SAED staff
	(2) when threshing is ongoing		Paddy moisture content	SAED staff
2) Paddy field	(3) Once in the paddy field	A	Paddy moisture content	Rice mill manager
			Paddy weight	Rice mill manager
	(4) Before milling process	B	Paddy moisture content	Rice mill manager
			Paddy weight	Rice mill manager
	(5) During milling process	C	Weight of impurities	Rice mill manager
	(6) During milling process	D, F	Bran weight	Rice mill manager
	(7) During milling process	H	Weight of fine broken rice	Rice mill manager
	(8) During milling process	I	Weight of large broken rice	Rice mill manager
	(9) At the milling end	J	Head rice moisture content	Rice mill manager
			Milled rice total weight	Rice mill manager

Note：Circled letters indicate measurement points in the following diagram

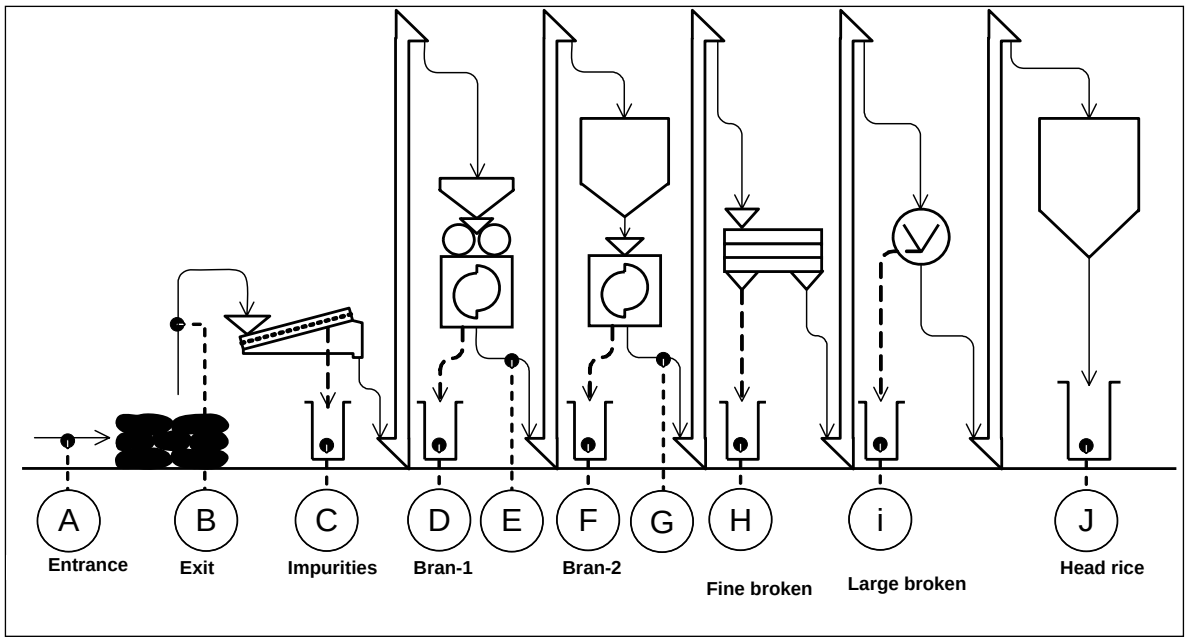


Fig 6.3.1 Rice mill diagram and data collection points

Producers and rice millers participated in the programme implementation. This enabled them to understand mechanisms leading to high loss rates in the post harvest process and the necessity to control paddy production phase in order to get better quality milled rice.

1) Paddy moisture content study

Moisture content was measured when harvest and threshing were ongoing.

Table 6.3.2 Paddy moisture content measured in the rice mill

	Dates	Nber of samples	Average moisture content
when harvest is ongoing	Nov 29th, 2005 to Dec 18th, 2005	215	12.2%
when threshing is ongoing	Dec 9th, 2005 to Dec 20th, 2005	50	11.1%

Moisture content of many samples was below the threshold that is appropriate for processing (about 14 %) when harvest and/or threshing is ongoing. This confirms difficulties faced by farmers in implementing appropriate post-harvest process in the dry season.

2) Moisture content and weight study in paddy fields

Some 50 tonnes of paddy were bought from 50 producers and processed.

Processed volume, milling yield, and head rice percentage of each variety are indicated in Table 6.3.3. (Details are mentioned in Table 6.3.4)

Table 6.3.3 Processed volume, milling yield, and head rice percentage of each variety

Variety	Processed volume (Tonnes)	Milling yield	Head rice percentage
Sahel 201	25	61.2%	35.9%
Sahel 202	18	58.5%	44.9%
IR 1529	7	62.2%	48.9%
Total / Average	50	60.4%	40.2%

Note: Milling yield = Total milled rice (Head rice + Large broken rice + Fine broken rice) / (Paddy –Impurities)

Head rice percentage = Total milled rice (Head rice + Large broken rice + Fine broken rice)

Correlation between paddy moisture content and milling yield of each variety is indicated in Figure 6.3.2. and correlation between paddy moisture content and head rice percentage of each variety is indicated in Figure 6.3.3.

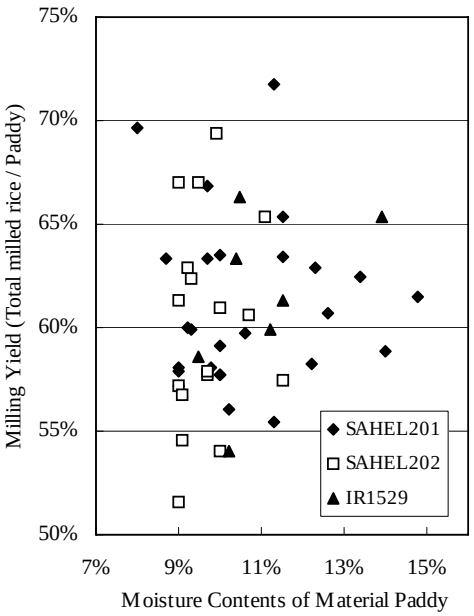


Fig. 6.3.2 Correlation between paddy moisture content and milling yield

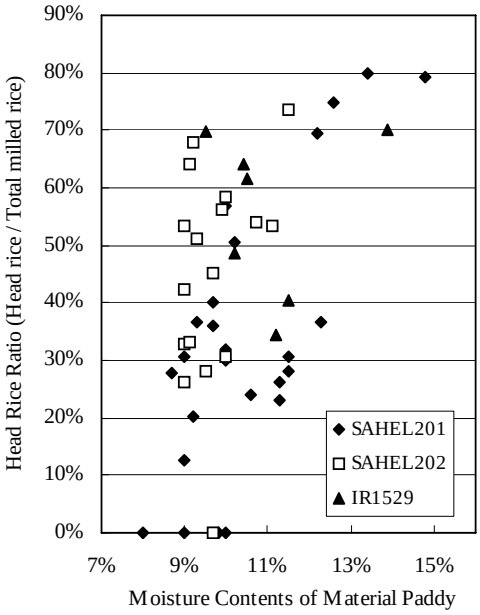


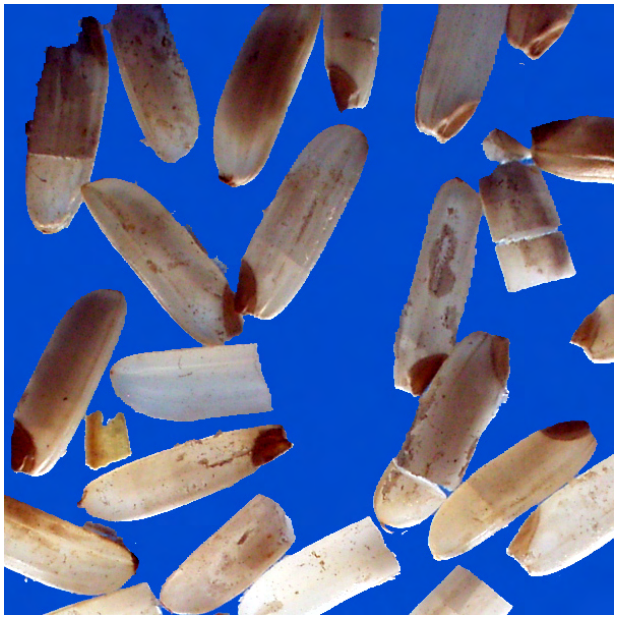
Fig. 6.3.3 Correlation between paddy moisture content and head rice percentage

3) Discussions on causes of rice quality deterioration

Impact of variety types on moisture content and broken rice rate

As aforementioned, a lot of paddy breaks because of late harvests and additional dryness it undergoes following of long exposure to sunlight. But broken rice rate depends on concerned varieties. Programme 4 revealed that Sahel varieties break more than IR 1529. Photos below show paddy samples without husk before milling.

Sahel 202



IR1529

Sahel varieties were selected by WARDA to satisfy Senegalese people who prefer broken rice. Consequently, it is quiet natural that those results should be achieved. However, head rice value added is recognized by Senegalese consumers. Their preference may change in favour of varieties with less broken rice. Some rice millers have already been selectively collecting IR 1529 variety which breaks less than Sahel ones. TCS-10 variety has a low rate of broken rice. Its high rate of head rice partly contributes to the high profitability recorded by some rice millers.

Extraction of coloured rice and impurities

This rice colour seems to be due to insects, bacteria or parasitic fungus, and high sunlight heat. We noticed that extraction of coloured rice grains and impurities (husks, straws, stems, and herb seeds, etc.) increases rice value in the market. That is to say it is important to deal meticulously with rice all along production chain; that is, from paddy fields to rice mills via storage. Programme 4 employed village women to extract manually coloured grains and impurities. Incomes generated by sorted rice are higher than labour costs paid to aforementioned village women.

Table 6.3.4 Detailed Information of Paddy and Rice collected through Technology Transfer Program-4

Ref. No.	Producers		Variety	Date of Planting	M.C of Paddy								M.C of Rice		Recovery Rate (%)	Rate of Whole Grain (%)
					Harvesting		Threshing		Storage		Just before milling					
	Farm-No	Name			Date	M.C(%)	Date	M.C (%)	Date	M.C (%)	Date	M.C (%)	Date	M.C (%)		
003	53	Cheikh M. Ba	SAHEL201	27-Jul-05	29-Nov-05	17.7%	16-Dec-05	12.6%	20-Dec-05	12.0%	22-Dec-05	11.5%	22-Dec-05	L	65.3%	30.8%
004	27	Mamadou Gueye	SAHEL201	22-Jul-05	4-Dec-05	12.5%	13-Dec-05	11.7%	20-Dec-05	11.0%	22-Dec-05	10.0%	22-Dec-05	L	59.2%	32.0%
005	28	Makmoudane Gueye	SAHEL201	22-Jul-05	4-Dec-05	15.3%	14-Dec-05	12.3%	21-Dec-05	9.0%	22-Dec-05	9.0%	22-Dec-05	L	57.9%	30.6%
006	45	Gora Ndiaye	SAHEL202	26-Jul-05	4-Dec-05	12.5%	10-Dec-05	10.8%	21-Dec-05	9.1%	23-Dec-05	9.0%	23-Dec-05	L	67.0%	53.5%
007	54	Pape Sall Ndiaye	SAHEL202	27-Jul-05	29-Nov-05	13.4%	12-Dec-05	11.0%	21-Dec-05	9.1%	23-Dec-05	9.1%	23-Dec-05	L	54.6%	64.2%
008	87	Ousseynou Sall	SAHEL202	22-Jul-05	4-Dec-05	11.2%	19-Dec-05	10.6%	21-Dec-05	9.7%	23-Dec-05	9.0%	23-Dec-05	L	61.3%	42.4%
009	90	Abdourahmane Sall	SAHEL202	23-Jul-05	4-Dec-05	10.5%			21-Dec-05	9.8%	0-Jan-00	0.0%	26-Dec-05	L	62.3%	51.3%
010	91	Fall Sall	SAHEL201	24-Jul-05	4-Dec-05	10.3%	19-Feb-05	10.2%	23-Dec-05	9.9%	0-Jan-00	0.0%	26-Dec-05	L	69.7%	0.0%
011	40	Abdoukarim Gueye	SAHEL201	22-Jul-05	4-Dec-05	13.9%	14-Dec-05	12.5%	26-Dec-05	11.4%	27-Dec-05	10.0%	27-Dec-05	L	63.5%	56.7%
012	132	Cheikh Gaye	SAHEL201	?	14-Dec-05	10.6%	14-Dec-05	10.8%	26-Dec-05	11.7%	27-Dec-05	10.0%	27-Dec-05	L	57.7%	0.0%
013	131	Cheikh Kane	SAHEL202	29-Jul-05	14-Dec-05	11.9%	14-Dec-05	13.0%	26-Dec-05	9.9%	27-Dec-05	9.0%	27-Dec-05	L	51.6%	32.8%
014	129	Ndiouga Teuw	IR1529	29-Jul-05	14-Dec-05	10.6%	14-Dec-05	10.8%	26-Dec-05	10.0%	28-Dec-05	11.5%	28-Dec-05	11.9%	61.3%	40.3%
015	130	Moussa Kane	IR1529	21-Jul-05	14-Dec-05	11.1%	14-Dec-05	11.1%	28-Dec-05	10.0%	29-Dec-05	11.2%	29-Dec-05	L	59.9%	34.3%
016	133	Ousmane Kane	SAHEL202	21-Jul-05	14-Dec-05	11.2%	14-Dec-05	11.2%	26-Dec-05	11.0%	29-Dec-05	10.0%	29-Dec-05	L	54.0%	30.7%
017	169	Baka Fall	SAHEL202	25-Jul-05	13-Dec-05	11.6%	19-Dec-05	10.8%	27-Dec-05	9.2%	29-Dec-05	9.0%	29-Dec-05	L	57.2%	26.3%
018	170	Yakhya Fall	SAHEL201	26-Jul-05	13-Dec-05	11.4%	20-Dec-05	10.2%	27-Dec-05	9.5%	30-Dec-05	9.0%	29-Dec-05	L	57.2%	0.0%
019	161	Modou Wade	SAHEL201	27-Jul-05	3-Dec-05	12.7%	17-Dec-05	11.9%	27-Dec-05	L	30-Dec-05	12.3%	30-Dec-05	L	62.9%	36.7%
020	215	Farra Diagne	IR1529	19 to 29 Jul-05	29-Nov-05	14.8%	13-Dec-05	12.5%	28-Dec-05	9.7%	30-Dec-05	13.9%	30-Dec-05	L	65.3%	70.1%
021	205	Pape Diagne	SAHEL202	19 to 29 Jul-05	5-Dec-05	12.0%	13-Dec-05	11.4%	28-Dec-05	9.3%	30-Dec-05	9.7%	30-Dec-05	L	57.7%	45.3%
022	203	Moustapha Diagne	SAHEL201	19 to 29 Jul-05	29-Nov-05	10.0%	14-Dec-05	9.5%	28-Dec-05	9.7%	31-Dec-05	11.3%	31-Dec-05	L	55.4%	23.0%
023	209	Magueye Diagne	SAHEL201	19 to 29 Jul-05	5-Dec-05	11.1%	13-Dec-05	10.5%	29-Dec-05	9.3%	31-Dec-05	11.3%	31-Dec-05	L	71.8%	26.3%
024	210	Pape Sene	SAHEL201	19 to 29 Jul-05	5-Dec-05	12.2%	16-Dec-05	10.4%	29-Dec-05	9.1%	2-Jan-06	10.0%	2-Jan-06	L	57.7%	30.1%
025	204	Djakha Cisse	SAHEL202	19 to 29 Jul-05	29-Nov-05	13.7%	12-Dec-05	11.5%	29-Dec-05	9.1%	2-Jan-06	10.7%	3-Jan-06	L	60.6%	54.1%
026	206	Malick Diagne	SAHEL201	19 to 29 Jul-05	29-Nov-05	11.1%	15-Dec-05	10.3%	29-Dec-05	15.1%	3-Jan-06	12.6%	3-Jan-06	L	60.7%	75.0%
027	214	Birane Top Diagne	SAHEL201	19 to 29 Jul-05	29-Nov-05	11.2%	16-Dec-05	10.4%	29-Dec-05	14.3%	3-Jan-06	0.0%	3-Jan-06	L	61.5%	79.4%
028	208	Cheikh Diagne	SAHEL201	19 to 29 Jul-05	29-Nov-05	11.1%	13-Dec-05	11.5%	29-Dec-05	9.6%	4-Jan-06	13.4%	4-Jan-06	9.5%	62.4%	79.7%
029	44	Mamedoune Gueye	SAHEL201	23-Jul-05	4-Dec-05	11.3%			31-Dec-05	11.0%	4-Jan-06	10.6%	4-Jan-06	L	59.7%	24.0%
030	207	Mouhamedine Diao	SAHEL201	19 to 29 Jul-05	29-Nov-05	10.7%	14-Dec-05	11.0%	31-Dec-05	9.8%	4-Jan-06	10.2%	4-Jan-06	L	56.1%	50.5%
031	46	Mboka Diop	SAHEL202	22-Jul-05	1-Dec-05	12.7%	10-Dec-05	11.9%	2-Jan-06	10.9%	4-Jan-06	12.2%	4-Jan-06	L	58.3%	69.6%
032	47	Mouhamed A. Ndiaye	SAHEL202	25-Jul-05	1-Dec-05	16.3%	13-Dec-05	13.0%	2-Jan-06	L	5-Jan-06	11.5%	5-Jan-06	L	57.5%	73.6%
033	31	Birahim Diagne	SAHEL201	20-Jul-05	30-Nov-05	12.9%	16-Dec-05	11.5%	3-Jan-06	10.9%	5-Jan-06	9.7%	6-Jan-06	L	66.8%	36.1%
034	55	Mouhamed Sall	SAHEL202	28-Jul-05	4-Dec-05	13.0%	14-Dec-05	11.4%	3-Jan-06	9.0%	6-Jan-06	9.7%	6-Jan-06	L	57.9%	0.0%
035	41	Rabany Diop	SAHEL202	22-Jul-05	1-Dec-05	11.4%	13-Dec-05	10.9%	3-Jan-06	9.1%	6-Jan-06	9.1%	6-Jan-06	L	56.8%	33.2%
036	117	Alioune Fall	SAHEL201	26-Jul-05	30-Nov-05	11.7%	13-Dec-05	10.2%	3-Jan-06	L	6-Jan-06	14.0%	6-Jan-06	10.3%	58.9%	18.2%
037	113	Mouhamedoune Fall	IR1529	20-Jul-05	30-Nov-05	10.4%	9-Dec-05	10.1%	3-Jan-06	9.9%	7-Jan-06	10.4%	7-Jan-06	10.0%	63.3%	64.0%
038	106	Alioune Sarr	SAHEL201	20-Jul-05	30-Nov-05	12.2%	17-Dec-05	11.2%	3-Jan-06	L	7-Jan-06	8.7%	7-Jan-06	L	63.4%	27.9%
039	51	Matar Bara	SAHEL201	28-Jul-05	4-Dec-05	11.3%	17-Dec-05	10.1%	4-Jan-06	8.9%	7-Jan-06	9.2%	7-Jan-06	L	60.0%	20.2%
040	43	Birahim Sarr	IR1529	23-Jul-05	4-Dec-05	13.9%	17-Dec-05	11.8%	4-Jan-06	9.6%	7-Jan-06	10.2%	8-Jan-06	L	54.0%	48.6%
041	105	Ismaela Diaw	SAHEL201	20-Jul-05	30-Nov-05	13.6%	9-Dec-05	11.8%	6-Jan-06	L	8-Jan-06	11.5%	8-Jan-06	L	63.4%	28.1%
042	122	Babacar Diaw	SAHEL201	20-Jul-05	30-Nov-05	10.9%	18-Dec-05	9.8%	6-Jan-06	9.5%	8-Jan-06	9.7%	14-Jan-06	L	63.3%	40.0%
043	88	Babacar Sall	SAHEL201	24-Jul-05	4-Dec-05	10.2%	19-Dec-05	9.6%	6-Jan-06	9.7%	14-Jan-06	9.8%	14-Jan-06	L	58.1%	0.0%
044	34	Dieye Ndiaye	SAHEL202	26-Jul-05	30-Nov-05	14.4%	13-Dec-05	11.8%	6-Jan-06	9.0%	14-Jan-06	10.0%	14-Jan-06	L	61.0%	58.5%
045	30	Abou Diagne	SAHEL202	24-Jul-05	4-Dec-05	12.4%	14-Dec-05	11.3%	7-Jan-06	L	14-Jan-06	9.5%	14-Jan-06	L	67.0%	28.1%
046	29	Atoumane Dieye	IR1529	26-Jul-05	4-Dec-05	18.2%	13-Dec-05	12.9%	7-Jan-06	11.3%	15-Jan-06	10.5%	15-Jan-06	L	66.3%	61.7%
047	104	Djadji Diack	SAHEL201	20-Jul-05	30-Nov-05	10.0%	14-Dec-05	9.7%	7-Jan-06	L	15-Jan-06	9.3%	15-Jan-06	L	59.9%	36.5%
048	35	Alioune Ndiaye 1	SAHEL201	22-Jul-05	4-Dec-05	13.7%	13-Dec-05	11.0%	7-Jan-06	L	15-Jan-06	9.0%	15-Jan-06	L	58.1%	12.7%
049	166	Ousmane Fall 1	IR1529	21-Jul-05	5-Dec-05	11.9%	19-Dec-05	11.1%	15-Jan-06	9.5%	16-Jan-06	9.5%	16-Jan-06	L	58.6%	69.8%
050	172	Mouhamedine Teuw	SAHEL202	26-Jul-05	3-Dec-05	12.8%	20-Dec-05	11.2%	15-Jan-06	9.0%	16-Jan-06	9.9%	16-Jan-06	L	69.4%	56.1%
051	174	Abdou Khadre Teuw	SAHEL202	23-Jul-05	13-Dec-05	12.2%	19-Dec-05	9.9%	16-Jan-06	10.9%	16-Jan-06	11.1%	16-Jan-06	L	65.3%	53.5%
052	175	Moussa Fall	SAHEL202	21-Jul-05	13-Dec-05	11.0%	19-Dec-05	10.4%	16-Jan-06	8.8%	16-Jan-06	9.2%	17-Jan-06	L	62.9%	67.7%

(3) Consideration of a Brand Name and Package Design

Although the amount of local rice is limited, they are available in the market. The package designs of them pale in comparison with those of imported rices.

As one of the activity of the Technolosy Transfer Program 5, favorable and attractive brand name and package design for quality local rice were produced in order to draw a sharp line between local rice and imported rice. It is expected that the effect of them contribute to arousing consumer interest of local rice. The important points to be considered for creation is as follows.

Table 6.3.5 Consideration of Brand Name and Package Design

Items	Result of Consideration
Brand Name	The strategy of creation of brand name is an advertisement of new image of local rice to consumers. Instead of variety names, SENRIZ which means "our rice and your rice" was selected as the brand name which is symbolic of local rice and easy to read and remember.
Logo	The basic concept of the logo mark was simple and attractive design. The design which put the character of SENRIZ on the Senegal national flag was adopted.
Information on the Products	A name of variety, a place of production, harvest time, milling time, type of grain (whole or broken grains), contact address and a part of technical cooperation by JICA are specified as the information for customer on the back side.
Contain	A plastic bag containing 2kg for whole rice and a plastic sack containing 25kg for broken rice are adopted.

The fact that the Senegal consumer is highly interested in the freshness and the safety of local rice is one of the highlight points which became clear by marketing survey. As product information such as a name of variety, milling date, a name of producer is mentiond on the rice package in Japan, it is possible to make a complaint about the something wrong of the products. In order to distinguish local rice and imported rice, it decided to specify product information in the back of the above-mentioned package.

Package of SENRIZ (front side)
(The mark on the upper right is meant to advertise new rice.)

Package of SENRIZ (back side)
(In a rice mill factory, check marks are put into the applicable column of the product information.)

(4) Price Setup

According to the price survey on 16 December, 2006, prices of imported whole rices were from 312 FCFA per kg to 500 FCFA per kg, and these of imported broken rice were from 210

FCFA per kg to 260 FCFA per kg. Since the quality of SENRIZ was in the level equivalent to imported rice and had a big advantage in freshness, the retail prices of SENRIZ were set as the same leve as the imported rice.

Table 6.3.6 Prices of SENRIZ

Type of Rice	Price（FCFA/kg）	
	Wholesale	Retail
Whole Rice	350	400
Broken Rice	200	250

(5) Advertizement Campaign

With the intention of advertisement of SENRIZ by mass medias which cover whole country, the event was held in the following way.

Table 6.3.7 Outline of SENRIZ Promotion Event

Description	Outline
the date and time	23 December, 2005 from 9:00 a.m. to 5:00 p.m.
Official Guest	Japan side: the Japanese ambassador to Senegal, the Manager of JICA Senegal office Senegal side: the vice minister of MOA
Participating organization (exhibiution)	DAPS, SAED, ITA, ODAGRI, ISRA and ADRAO
Cosponsor	ARM, ANCAR, CNCAS, FNPRS and Debi-Tiguet Union
Mass media	4 newspaper processing companies, 3 television stations and 2 radio stations
The number of sale of rice (2kg bag)	Whole rice: 130bags and Broken rice: 340bags
Tools for advertizement	Pamplet (2,000nos, Ref. Attachment 2), T shirts and caps
Participation of food maker	Free distribution of the yogurt confectionery using rice

This event was the most important advertizement campaign on development of market of SENRIZ. Inquiries and the orders to SENRIZ were received from the rice traders in Tambacounda and Kazamansu after the event. Farmers and rice millers do not have the means and fund to promote their products. It is verified that by influence to the mass media by the government, the image of domestic rice improves and it contributes to sales promotion. In the future, continuous influence by the government is expected.

(6) Development of market

Development of market of SENRIZ was started from January 6, 2006. The door to door sales promotions were done to the major tradors in Dakar, Sun Louis, TS, and Touba. The number of handling traders of SENRIZ has passed ten as of February, 2006. The posters for promotion shown as Attachment 2/2 were supplied to the SENRIZ distributive traders, and they are put up on walls or windows at front of the shops. Meover, the Debi-Tiguet union which inherits SENRIZ production and sale was introduced to the traders.

The following experiences were accumulated through activity of development market for

SENRIZ.

1) Prudent correspondence of trader
   Even if they are wholesalers with a comparatively big scale, the first trading volume was several tens of kilograms as a trial purchase. They started full-scale dealings, after evaluating the trend of the consumer in their shops. It is common for traders to take a policy prudent in this way.

2) The limit of cash transaction
   Since "the cash and carry system" was adopted, the case where negotiation becomes abortive, and the cases where discount was required occurred frequently. This system is not suitable for traders without funding ability in particular.

3) The special agent oriented business model
   Although negotiations with the big rice importers were also done, the limited amount of SENRIZ was an obstacle to the importers who trades to the order of 1,000 tons per month. Since the amount of supply of domestic rice is limited, it will be necessary to establish the business model in which producers trade with the special agents corresponding to the amount of supply.

(7) Evaluation to the quality of SENRIZ

The farmer of the Debi-Tiguet union who supplied the paddy used as the material of SENRIZ experienced that it was possible to produce quality rice from their paddy and the rice was saled at high price. This experience made them brace up the volition to production increase of paddy and to improvement quality of rice. They produce and sell SENRIZ, receiving technology transfer and support from the JICA study team now. On the other hand, although there was an inquiry about the permission of using the brand of SENRIZ from a rice miller, there is no big motion or reaction. Since the activity includes technical and marketing aspect related company secrets of the rice millers, it is presumed that they watch the situation calmly and follow good examples.

The questionnaire survey to traders and consumers is being carried out. While questionnaires have not been collected yet, the evaluation to SENRIZ brought by traders and customers until now is as follows.

1) Evaluation by consumers
   - Although the flavor is good just after cooking, flavor will be lost if it gets coold.
   - It expands more after cooking.
   - Although a flavor is good, oil is needed more than ported rice.
   - Sahel 108 has a flavor better than other varieties.
   - Even if it gets coold, the flavor will return after re-cooking.

2) Evaluation by traders
   - The chemical component of SENRIZ should be specified on the package.
   - The quality of SENRIZ is equivalent to imported rice.
   - The general information on a recipe and others should be prepared for customers.
   - 5kg and 50kg packages should be add.
   - Although it is high quality rice, it is considered that a price equivalent to imported rice is slightly high.（Major rice importer）

CHAPTER 7 RECOMMENDATIONS

Local rice has faced severe competition with imported rice after liberalization of the rice sector in 1996. Imported rice currently occupies 80% of the national rice demand. It is apparent that increased rice production is a basic condition for improvement of self-sufficiency ratio of rice in Senegal. However, it is crucial to improve both grain quality and price conditions of local rice. It is recommended to direct more efforts to enhance post-harvest and marketing techniques. The rice sector of Senegal will be able to produce and distribute local rice of higher competitiveness against imported rice.

Food security can be established by integration of the efforts of the government, private service providers, and producers. The government is expected to take responsibility for creating the business environment for the private service providers and producers to encourage their activities to the maximum level.

(1) Encouragement of rice millers

Firstly it is recommended to make several efforts to enhance the competitiveness of local rice against imported rice. More investment in rice mill plants is needed. However, quality control of paddy on-farm and during storage is also essential. The value-chain between producers and rice millers will ensure quality control throughout the process from paddy to milled rice. The Master Plan pays particular attention to rice millers.

As a part of the Study, a set of new rice mill machines equipped with a length sorter was introduced afresh, and this proved that the quality of domestic rice could be markedly improved with proper processing technology using a suitable type of rice mill. A favorable brand name for local rice, namely, SENRIZ and an attractive package design for the quality local rice was produced to draw a sharp distinction between local rice and imported rice and SENRIZ was sold in the market on trial. It was proved that local rice could sell at a price which is equal to imported rice with an adequate sales promotion campaign. This series of activities was an event of great significant for the Senegal rice sector. It is strongly expected that the results will impact on rice millers, who are the key players for activation of the Senegal rice sector.

However, the majority of rice millers are small businesses with a shortage of funds. It is necessary that the government makes a strong commitment to extend investment to rice millers in order to improve their activities. Especially, it is urgent to reduce the import tax on rice milling equipment and increase medium and long term loans for capital investment and short term loans for purchase of paddy by CNCAS. It is also important to provide guidance on management and human resource development to rice millers systematically. In this context, it is required that donors continue synthetic and integrated support in cooperation with each other.

(2) Region-wise development strategy

The Master Plan attaches development priority to the Senegal River valley, where some 70% of local rice is produced. Well-balanced development programs among paddy production, post-harvest and rice marketing will be promoted in the valley. However, special attention will be paid to the regional differences between irrigation farming systems of the valley, i.e. Dagana in the lower valley, where commercial rice production dominates, and Podol and Matam in the mid to upper valley where rice is produced mainly for home-consumption.

Such regional differences should be taken into consideration when the development strategy for the Valley is discussed.

Rain-fed farming is more common in Kolda, Ziguinchor and Fatick Regions, where rice is a traditional crop and produced at a subsistence level. Rice in these regions is more important from a food security point of view, although productivity is low and fluctuates considerably from year to year. Establishment of sustainable rice farming systems is urgently required. Investment in farm inputs should be carefully optimized taking the risk of rain-fed farming into consideration.

Rice farming in Fatick is practiced to a very limited extent. Although production is lower than other regions, rice is an important crop for women. Therefore, the development strategy should also address gender issues. Traditional varieties with a shorter growth period and high salt tolerance are broadly sown. High yielding varieties should carefully be introduced taking the advantage of the traditional varieties into consideration.

The rice demand of Senegal will reach one million tons in 2015, which is five times more than the current rice production. To increase the self-sufficiency ratio, improvement in rice production systems is essential.

(3) Crop credits and distribution of farm inputs

The technical review is required to improve the CNCAS crop credits. Since the validity of CNCAS crop credits is fixed at the end of February for all borrowers, i.e. rice producers, substantial amounts of rice grain are released to the market when repayments are completed. As a result, producers often face lower prices and reduced profits. The service network of CNCAS is not fully extended to all rice producing zones of Senegal. It is recommended to review the advantage of micro-finance (MEC).

Timely procurement of farm inputs is one of the most crucial issues for producers. In 2005, farmers experienced significant delays in procurement due to delays in import transactions. It is recommended to study the current system of importing farm inputs by the sole agency, i.e. SENCHIM, monopolized with their import.

(4) Analysis on import tax

The import tax for rice is governed by agreement among member countries of UEMOA and ECOWAS. The government takes responsibility for benefits of not only rice producers but also consumers. High-level political decisions are required to raise import taxes. It is recommended to continue the study for optimization of import taxes on rice from the viewpoint of benefits to producers.

(5) Coordination of the rice sector

The Study was carried out under the initiative of DAPS, Ministry of Agriculture, Rural Water Supply and Food Security. However, valuable information was often provided by maintaining close relationships with other agencies under the Ministry of Industry and Ministry of Commerce. In order to promote the development of the rice sector, it is strongly recommended to set up coordination among all agencies concerned. The forum will provide opportunities to exchange the views of all agencies and ensure efficient development activities.

In addition, the rice sector of Senegal has been developed by obtaining a wide range of assistance from international organizations, donor countries, and NGOs. They have accumulated knowledge and experiences in various areas and technical fields in which the

government support to producers is not always sufficient. It is recommended to utilize external inputs effectively for development of the rice sector to the maximum level.