CHAPTER 5 FORMULATION OF ACTION PLAN AND MODEL FOR GORGOL REGION

5.1 Issues of the Foum Gleita Project Area

5.1.1 Analysis of the History of the Foum Gleita Project

The important events in Foum Gleita are reviewed to define the background of problems. However, the operation for the entire area has started about 20 years ago in 1990, and hence SONADER no longer possessed the documents of this period, and neither did the farmers. The information was fragmentary, and often the time of the events was not well defined and the description given by the farmers was different from each other. These issues were complicated, and it was difficult to ascertain the veracity of the facts.

Based on these conditions, the Fig. 5.1.1 was prepared, and the chronological table on the left shows important events related to Foum Gleita and the figure on the right shows an image between necessary inputs for irrigated agriculture and cropping areas as its results. Actually, the problems of Foum Gleita were attributed to the fact that the scope of management and maintenance for mid and long term was not sufficient, and the farmers and the government did not play their roles. Then the problems were accumulated, while both of them do nothing.

The figure 5.1.1 shows the real situation of Foum Gleita (left in red) and the idealistic responsibility and results (right in blue). In this figure, the necessary inputs to sustain irrigated agriculture (from the both aspects of hardware and software) is regarded as constant and the inputs should be provided by the farmers or the government and external agencies. Originally, as the image on the right, immediately after the operation of the area started, the farmers should have received sufficient support to strengthen self effort for the future and independent farmers' organization should have been established. The government and external agents should have reduced their support accordingly. In total, all the inputs should have always been provided without omission.

However, in case of Foum Gleita, the farmers were satisfied with the many inputs provided by the government and external agencies until the completion of the facilities in 1990. Therefore, the farmers had relied on these inputs but they didn't obtain sufficient support for self independence. The farmers received irrigated farm area by the way of compensation instead of rainfed farm area which were submerged in the dam reservoir or developed as the irrigated area, but the basic infrastructure facilities were not provided and they were forced to move without being adequately explained about their obligation and future vision in order to do irrigation farming. Therefore, there is undeniable sense that the farmers' dependency on the government became very strong.

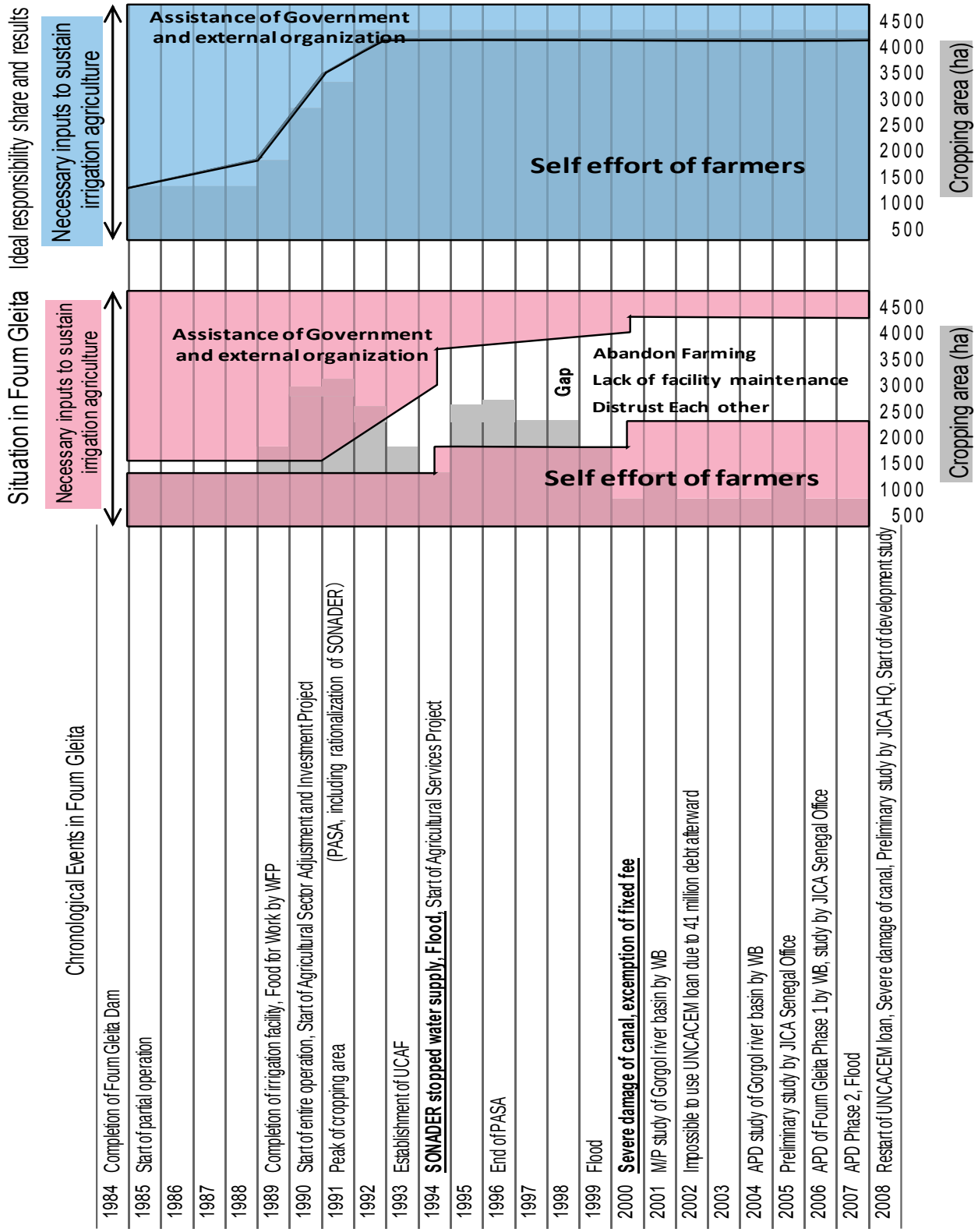


Fig.5.1.1 Past Events and Transition of Foum Gleita

After completion, the project entered into the maintenance phase. SONADER staff and equipment were downsized and the Agricultural Sector Adjustment and Investment Project (Programme d'ajustement du secteur agricole, PASA) accelerated the reduction of government support to farmers (see figure 5.1.2. shown below[1]). While this time, the support to strengthen farmers' organization was provided[2], it could not give them enough impact, and hence dependence of farmers was still strong and they could not establish the independent management system. Since the rate of the fixed fee collection was allegedly not exceeding 50% of the targeted fee, SONADER took severe measures to cut water supply for those who did not pay. Sometimes, the water did not come to the field even for those who paid the fee. Those farmers have abandoned their field and some returned to their home land.

In 1994, as a countermeasure to the increasing number of non-payers, SONADER completely stopped the supply of irrigation water, and this abnormal situation had continued for one year. After that, both the sides discussed to solve the situation and agreed that the fees could be paid by means of labor, but still the collection rate was declining. In 2000, the primary canal was severely damaged and then water supply was stopped. Faced with complaints from the farmers, the MDR has provided the exemption of fixed fee, and since then, the collection has been completely stopped. As shown in the figure, the number of staff of SONADER Foum Gleita is drastically reducing while the budget is almost nothing except the provision for salary of the employees. So even if there are problems in the irrigation facilities, SONADER and the farmers simply cannot respond.

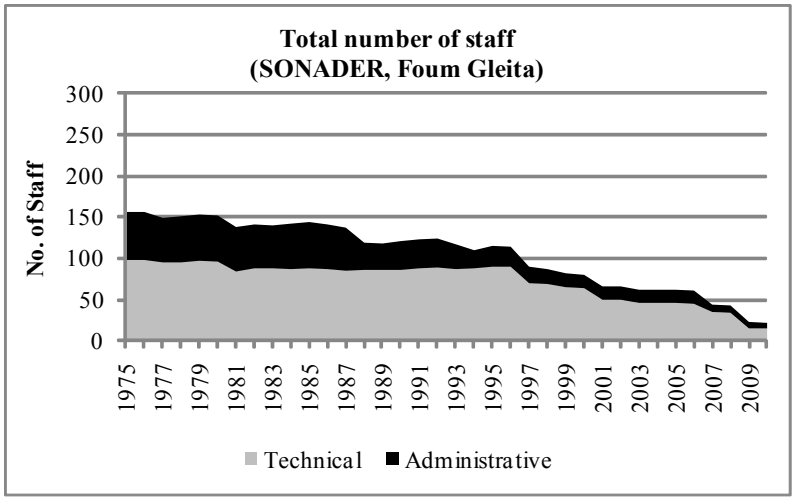


Figure 5.1.2 Decrease of the Number of Staff of SONADER Foum Gleita

Source: Created by the Study Team based on document of SONADER

On the other hand, regarding loans by UNCACEM to UCAF (see table below), the repayment rate before 2002 was very low, i.e., 37% of the total. For the years 2000/2001 and 2001/2002, it was

[1] Source: SONADER. When SONADER was established in 1975, staff of Foum Gleita occupied half of all SONADER staff (270 people). The number includes temporary employees.

[2] In ACOPAM (in English, Cooperative and Organizational Support to Grassroots Initiatives, in French : Appui Coopératif et Associatif aux Initiatives de Développement à la base) supported by ILO from 1985 to 1998, nearly 40 cooperatives and UCAF were established. In Agricultural Services Project by WB, supports were offered such as strengthen of SONADER extension system and management of agricultural cooperatives.

relatively high, but the debt from 1992 and 1993 was too heavy. Although the loans were not available between 2002 and 2007 because of the past debt, the government allowed the farmers to take loans for the 2008/2009 for the agricultural year of 2008. But that was not repaid either, and hence the total amount of debts reached to 64 million UM. This year, the Government has decided for small scale farmers that 1) to cut half of the debt from UNCACEM and interest, and 2) to extend the number of years for repayment, so that the burden for farmers will be reduced. However, the serious situation for farmers has not been changed that it would be difficult to sustain irrigation farming without proper farm management.

Table 5.1.1 Loan by UNCACEM for UCAF

Unit: '000UM

Year	Loan					Payment			Balance	Payment Rate
	Main loan	Interest for back loan	Commission	Others	Sub-total	Repayment	Flood exemption	Sub-total		
92-93									-25,333	-
95-97			-427		-427			0	-25,760	-
98					0	1,383		1,383	-24,377	-
99/00	-5,444	-9,271	-561		-15,276			0	-39,653	0
00/01	-8,697				-8,697	5,970	352	6,322	-42,028	73
01/02	-3,437				-3,437	1,688		1,688	-43,777	49
02-07		3,383		-733	2,650			0	-41,127	0
Sub-total	-17,578	-5,888	-988	-733	-25,187	9,041	352	9,393	-41,127	37
08/09	-22,390				-22,390			0	-63,517	0
09/10					0			0	-63,517	-
Total	-39,968	-5,888	-988	-733	-47,577	9,041	352	9,393	-63,517	20

Source: Etat Financiers, pour les exercices clos 2001-2002-2003, and the Study team based on CERTIF and UCAF data.

5.1.2 Problems and Countermeasures

(1) Outline

Based on the analyzed past conditions of Foum Gleita, the problems identified in the survey and the countermeasures to cope up with the problems are shown in the figure 5.1.3 and 5.1.4 respectively. The structural framework is mentioned in this section, and the details are explained in "(2) Problems and countermeasures."

As a background of problems, malfunctioning of organization has been identified behind the three axes (reduction of cultivated land, low productivity and low selling price). Also the remoteness of Foum Gleita is mentioned as a problem affecting low productivity and low selling price. The

reduced supply of irrigation water led to the abandonment of farmland that was resulting in the reduction of cultivated area. Hence, the function of irrigation which is fundamental condition of irrigated agriculture is not fulfilled. Moreover, the "low productivity and low selling price" are impediment for farmers who barely continue to cultivate and that leads to reduction of their income and declining of their irrigated agriculture in the area, as well as decrease of cultivated area. There is also a risk of flood damage in the project area, which is difficult to control.

On the other hand, the figure 5.1.4 shows possible countermeasures to the problems. Its structure is almost the same as the figure of problems and each item shows the situation by which the problems are to be solved. However, the rehabilitation of project for revitalization of irrigation facilities by the external assistance is added. These countermeasures will promote the return of farmers and recovery of the cultivated area. At the same time, these measures will improve the productivity, selling price and stabilize the income of farmers to reactivate irrigated agriculture in this area.

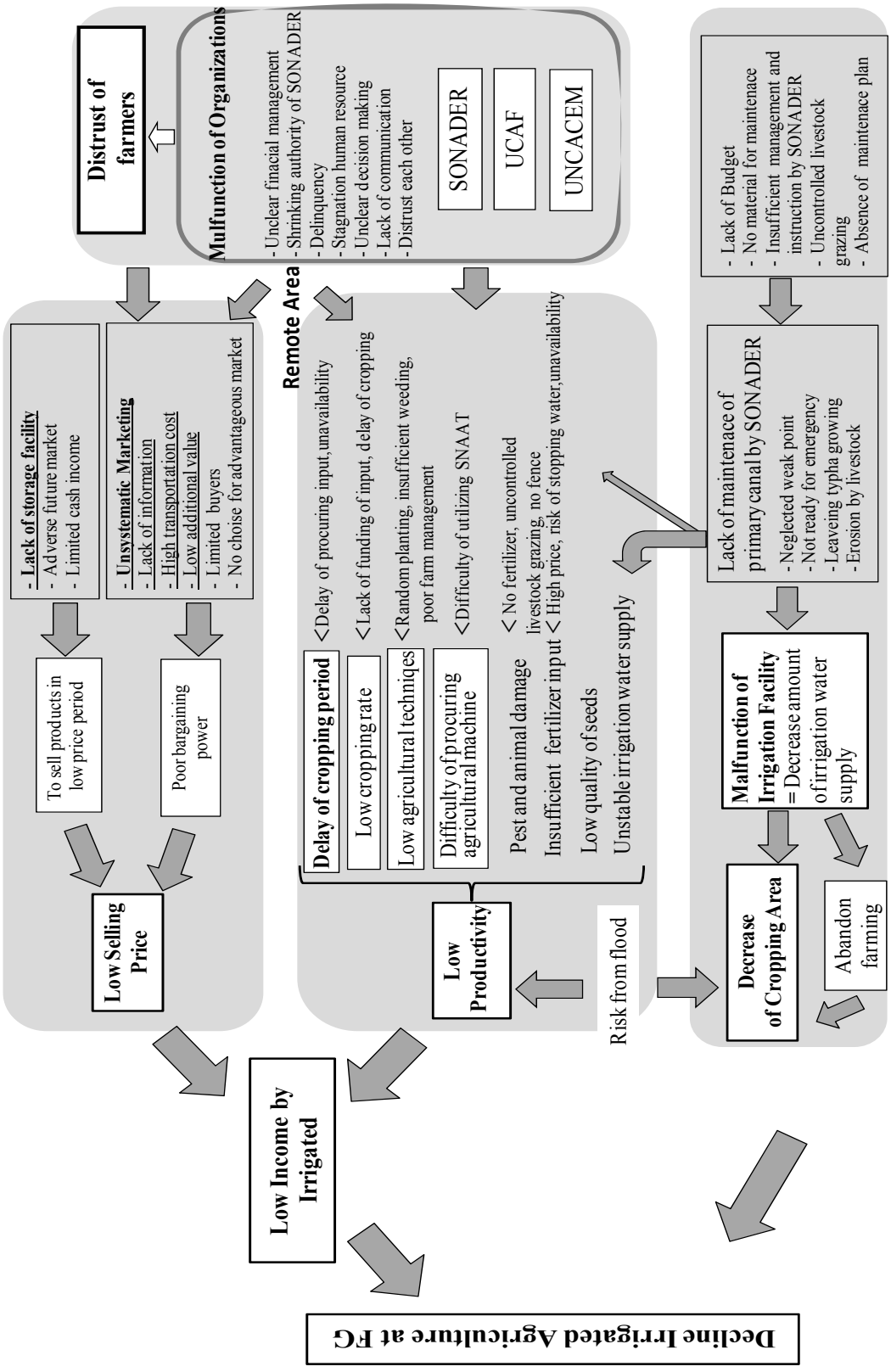


Figure 5.1.3 Problems in Foum Gleita

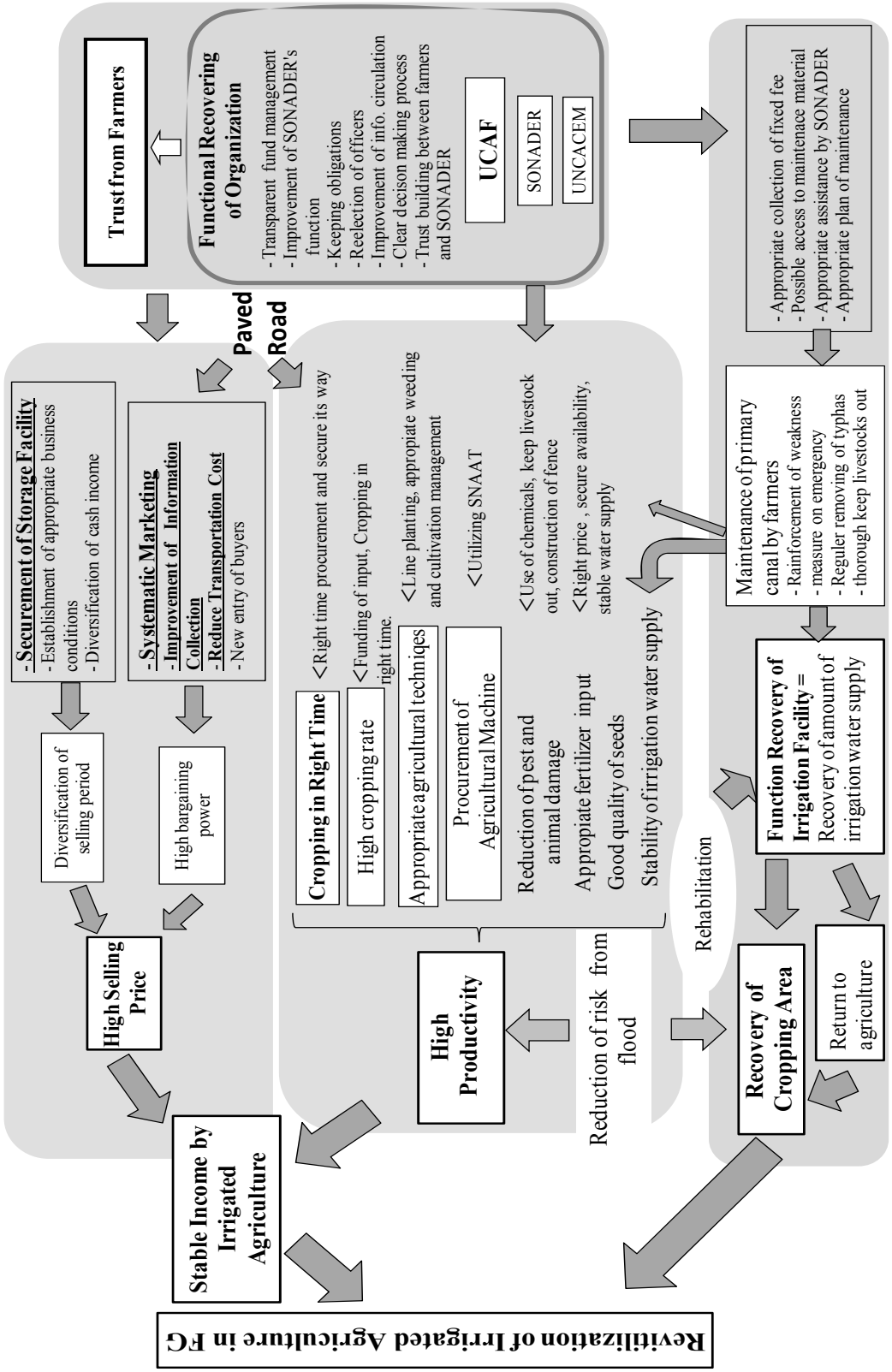


Figure 5.1.4 Countermeasures of Foum Gleita

(2) Problems and Countermeasures

The structure of the problems and countermeasures are indicated in paragraph (1) and the table below explains the details of each item.

Table 5.1.2 Problems and Policy Measures of Improvement

Major items	Minor items	Problems and Present Situation	Policy Measures of Improvement
Recovering ← Malfunction of the organization	UCAF	UCAF was formally established in 1993 by a top-down approach. The main operations were consolidating and managing the UNCACEM loans, operating donated tractors, collecting fixed fee and paying it to SONADER. At first it worked, but due to the increased debt and stopping of loan in 2002, deteriorated tractors and abandonment, and exemption of fixed fee in 2000, the necessity of the organization was lost and it is not functioning today. Besides, it caused distrust among the disgruntled farmers for long time mismanagement. Those who have returned to their original home have had no contact with the UCAF. In this study, to revitalize UCAF, the officials of SONADER and UCAF started to explain and assist for strengthening of the organization and to prepare meetings for all cooperatives.	UCAF should play a leading role to manage the project area by farmers' groups in a sustainable manner, while the role of SONADER was significantly reduced in contrary to the originally planned functions. The process shall first restore the organization, but an agreement on the management system should be made on whether the organization would be one or divided into two for P1 and P2. Then, various measures should be taken in the short term and medium term, such as selection of leaders, clarification of functions of organizations and its members, establishment of transparent financial management, planning and management of maintenance, collection and management of fixed fees, cultivation planning, management of loans for inputs, management of agricultural machinery, procurement and management of agricultural machinery and systematic marketing for products. **Measures**: Strengthening of SONADER and UCAF are also needed. **Risks**: Envisaged risks are; whether the farmers can get out of dependency from the outside; whether the long time distrust would be cleared; whether the supporting agency, SONADER can support the farmers effectively and coordinate among the interests of stakeholders.

Major items	Minor items	Problems and Present Situation	Policy Measures of Improvement
Recovering ← Malfunction of the organization	SONADER	At the beginning of the operation of this national project, SONADER was a large company with many engineers and staff and dealing with input loans. But in 1990, the Agricultural Sector Adjustment and Investment Project (PASA) rationalized SONADER for more efficient management, and a remarkable number of staff moved out. In 2000, the contract program with the government (renewed every 3 years) started and it has been implemented mainly focusing on agricultural development projects with external financial supports. Since the maintenance budget is virtually nonexistent, it has to be covered by fixed fees from farmers. Degradation of Foum Gleita office is remarkable with decreasing of irrigated areas, and hence the sufficient support to farmers became difficult. At the beginning of opening the service, SONADER was in charge of maintenance of canals larger than secondary canals, but it could not manage due to lacking of budget and materials, and transferring the task to farmers' groups was not also possible. So, the irrigation facility lost some functions. The unclear management of the fixed fee has been also pointed out. In addition, it was significant to provide extension services for farmers in the area, but there has been virtually no support. In addition to the above factors, conditions presented by the government before migration was not materialized fully, so farmers distrust to the government is strongly rooted.	Given the current financial difficulties, the government has been pursuing to transfer the management of irrigation facility to farmer organizations. Therefore it is a realistic measure that the UCAF become the main actor and SONADER devotes technical assistance. On the other hand, MDR is reviewing the agricultural strategic paper to improve its policy, due to the pressure by large donors such as WB, and the review includes SONADER's structural change for strengthening and improvement in efficiency and function, such as change of staff, relocation of the headquarters from Nouakchott to Rosso, etc. However, organizations of farmers are not functioning well and it is especially necessary to strengthen SONADER Foum Gleita office which has an important role in maintaining the irrigation facilities, water management, extension of cultivation techniques, and provision of inputs, group marketing, assisting farmers and benefit sharing in terms of financial management. The government should be responsible for the management and operation of the dam, but today the staff and resources are lacking, so this aspect should be also expanded. **Measures**: Strengthening of SONADER is desirable to assist Foum Gleita. The government must consider the importance of the facility and increase staff and resources accordingly. **Risks**: It is important to consider the direction of policy changes with the financial background. The attitude of donors especially WB which has been supporting for a long time in agricultural sector and has enormous influence should be observed.

Major items	Minor items	Problems and situation	Measures of improvement
Recovering ← Malfunction of the organization	UNCACEM	The UNCACEM was established in 1992 based on the UCAF of Development Banks (UCAF des Banques de Developpement, UBD) and took over input loan for farmers, used to be managed by SONADER. Many issues are raised on functioning of UNCACEM, such as limitation of the loan to irrigated rice production, the very high interest (15%), often delayed funding and poor management. In connection with agricultural year 2008, the loans were made available again to groups who even had debts in the past. In 2009, farmers' groups have made direct appeals to the President of Mauritania to draw attention to their misery. Finally, the government promised relief debts for small scale farmers, but till March 2010, this measure has not yet been implemented because the conversion of agricultural policy of the government has not been decided. In the case of Foum Gleita, UNCACEM loans could not be used between 2002 and 2007 because of the past debt. In the case of the loan for 2008, farmers are observing the debt relief policy, so it has not been repaid. The loan could not be used for vegetables production because it is limited to rice production.	As mentioned above, the reform of UNCACEM is also one of the agenda of agricultural policy changes. The details are unknown, but officials of the WB indicated the improvement in the management and expansion of assistance to small scale farmers. To reduce interest, to extend loans to other products and to procure input on appropriate time are favorable to farmers. Regarding reduction of past debt for farmers, it has been decided that the government covers half of their debt and the interest and extends repayment periods. Farmers in Foum Gleita should discuss and carry out the repayment of the past debts and future use of the loan among related officials. However, in the medium term, it is desirable to use internal reserve but not the loan of UNCACEM. **Measures**: It is necessary to improve the performance of the entire UNCACEM, to implement structural reform and to improve the policy, while they are the external conditions for Foum Gleita. In the field, a transparent system with fairness and sustainability must be established for fund and material management. **Risks**: Same as SONADER's case, it is influenced by policies, finances of the government and trends of donors.

Major items	Minor items	Problems and situation	Measures of improvement
Recovering ← Mulfunction of irrigation facility	Lack of Maintenance of primary canal by SONADER Proper Maintenance of primary canal by Farmers←	At the beginning of the operation, SONADER was responsible for the maintenance of primary and secondary canals and farmers were responsible below tertiary canals. However, SONADER could not effectively cope with the aging facility from problems such as repair of weak points, emergency response, cutting cattail, erosion caused by livestock, desiltation of drainage and the lower rate of fixed fee collection. Therefore in the whole area, the amount of irrigation water supply has drastically decreased. It caused decreasing cropping area and abandonment of farming. Even in the irrigable areas, farmers were often strongly affected, which undermined their willingness to cultivate, because of water cut in the middle of cropping season caused by overflow from eroded portion of dike and collapse of primary canal. There is also an indication of mismanagement of fixed fees by SONADER. Subsequently, maintenance of the secondary canals is not satisfactory due to lack of consensus making and poor management of the union(UCAF), although the management of secondary canal has been transferred to the UCAF.	As mentioned in organization section above, irrigation system including main canals should be managed by not SONADER but UCAF from now on. Fixed fee which is the financial source of maintenance is not currently collected, but it is needed to be collected again and to form transparent financial management system. The regular maintenance would focus on cutting cattails. It is important to plan appropriately, to notice in advance and to manage operation properly for effective implementation. In the situation which cannot be covered with routine maintenance, it would be necessary to contract out the works and procure heavy equipment. Until the management of the UCAF will be on track, SONADER should give technical support to the UCAF. **Measures**: It is desirable to provide strengthening of technical assistance to both the union and SONADER for maintenance of irrigation facility. **Risks**: At this stage, almost all farmers intend to pay the fixed fee, but the collection rate is not clear. Whether the current amount of 16,500 UM (6,000yen)/ ha/year is sufficient has not yet been clear.
Recovering ← Mulfunction of irrigation facility	Rehabilitation project	Since the function of irrigation facility lowered to 400 ha currently, it is not possible to restore 1,950 ha of irrigable area with only measures to improve maintenance services.	The decline of the functions of irrigation facility is evident, when agriculture is vital to ensure food security of beneficiaries and increase their livelihood, so the needs of rehabilitation irrigation facility are extremely high and needed. For the government, the rehabilitation work is high priority, because Foum Gleita is the very important irrigation area for the country. **Measures**: The rehabilitation of the irrigation system to restore its functions requires outside assistance. **Risks**: Envisaged risks are; the construction cost is estimated around 1 billion yen; irrigation water cannot be supplied and the area cannot be cultivated during construction (24 months), because the main construction work is done in primary canals.

Major items	Minor items	Problems and situation	Measures of improvement
Farmer's Return to the farming← Farmer's Abandonment of farming		Farmers, who abandoned irrigation farming, said that a major cause of the abandonment was the lack of water for irrigation. In addition, they raised also malaria and low quality of drinking water, or some said that the original purpose of some people was just to obtain food aid. However, many of them lost their original villages due to submerge in dam or development of their land, so they live in the area with rainfed agriculture and livestock grazing, although they had to give up irrigated agriculture. About 30% - 40% of original farmers seem to have left the area.	To address the main cause of abandonment of irrigated agriculture is to restore the functions of the irrigation system. Regarding malaria, it is necessary to improve measures for prevention and care. Drinking water will be improved through the proposed project planned by the Ministry of Hydraulic and Planning starting 2010. Dishonest migrants should be eliminated through strengthening conditions distribution and mobility of land. Those who returned to the original lands still stick to the irrigated plot, so land distribution must be implemented carefully. **Measures**: It is necessary to have rehabilitation work with external assistance, the work of water supply and improved sanitation by the concerned bodies, and strengthening and adapting the conditions for entitlement of the right of land use, that will require coordination with other government bodies. **Risks**: The rehabilitation project for recovery of the function of irrigation facility is a prerequisite for farmers' settlement. Farmers, whose villages exist far from the project area, may request severer conditions.
Low Productivity High productivity←	Delaying of Cropping season Right time of← cropping season	At Foum Gleita, it is difficult to obtain fertilizers and seeds, which often arrive late, so cropping starts also late. Such delay causes a loss of appropriate weather and effective cropping schedule, and those decrease the productivity.	**Measures**: To improve productivity, it is necessary to ensure the fertilizer and seed supplies and to cultivate right time. The on-going road project is a contributing factor. **Risks**: Means of procurement are affected by distribution channel. It is necessary for farmers to understand the advantage of agriculture according to timely schedule.
	Low Cultivation techniques Proper Cultivation ← techniques	Productivity is low because of random transplanting, inadequate weeding, and inappropriate timing of fertilizing.	**Measures**: Mentoring of appropriate farming techniques by SONADER and others are needed. **Risks**: Currently farmers are working virtually without machines, so techniques requiring heavy labor force may not be applicable.

Low Productivity ← High productivity	Difficulty of Agricultural machines procurement → Procurement of machinery	Since Foum Gleita locates far froms Rosso and Kaédi, where the production is intensive and agricultural machinery are concentrated, it is difficult to use machinery. In 2008 farmers rented machinery from the SNAAT, but they could not use it in 2009, because they did not pay rental fees.	**Measures**: SONADER should support to establish a stable system to procure agricultural machinery from SNAAT, through reimbursement of unpaid rent by farmers and setting an antenna office of SNAAT. **Risks**: The collection of unpaid amounts will not be easy, and the timing of open of the antenna SNAAT is unknown.
Low Productivity ← High productivity	Damage of Pest and disease → Reduction of damages	Generally, farmers hardly use chemicals, so plants are fragile against pest and diseases. The invasion by livestock continues, because pastures are not regulated and there is no fence. Almost half of the crops are eaten away by birds in the worst case, although many farmers protect their crop before the harvest. Damages caused by the rats, wild pigs and other wild animals are also reported.	Improvements are required. But there is no more cost effective method than chasing birds by man power. **Measures**: SONADER should advise farmers for the pest and disease control with appropriate quantity of chemicals. For grazing livestock, it will be useful to prohibit entering and to construct fence. **Risks**: When productivity is low, costs are relatively high, so it's hard for farmers to invest in chemicals. It is not easy to regulate livestock breeders.
	Appropriate input of fertilizer	At Foum Gleita, input of fertilizer is lower than the desirable amount, so the productivity is much lower than other areas. The causes of low input are relatively high price of fertilizer comparing to the income, the difficulty of supply, and loss of investment mind of farmers due to rampant water cut.	To get a correct productivity, input of appropriate quantity of fertilizer is essential. Therefore it is necessary to lower the price, and to stabilize products procurement and water supply. **Measures**: To restore the functions of the irrigation system is needed to stabilize water supplies, and it is desirable to have an assistance to stabilize fertilizer supply. The on-going road project is a contributing factor **Risks**: The rehabilitation project for recovery of the function of irrigation facility is necessary. Market price of fertilizer is the external factor.
	Poor Quality Seed → Proper quality of Seed	The poor quality seeds bring about low germination rate and irregular growth, and that causes productivity decrease.	Improvements are required, but other areas using the same seeds have higher yields. Productivity should be increased also by other means. **Measures**: Diversification of procurement means, internal production of quality seeds, selection methods of high quality seeds should be supported. **Risks**: The price of seeds on the market is an external constraint, so price escalation may affect severely.
	Unstable Irrigation water supply → Stability of water supply	When water is cut during cropping season because of the breakage of deteriorated irrigation facility, it causes production loss which lowers productivity. This actually occurs frequently in recent years and suffers farmers.	**Measures**: To restore the irrigation system, it is essential to carry out rehabilitation work. **Risks**: The rehabilitation and restoration of irrigation facility are prerequisites for the stability of water supply.

High Selling price ←Low Selling price	Marking period at low selling price Diversification of marketing period←	Farmers in the area rarely have the opportunity to earn cash income and many of them are in debt. They have to sell their product just after the harvest, low price season. It is allegedly said that there are still high interest future trading, which is disadvantageous for farmers, though it is decreasing. Since, they have no warehouse, they have no way to shift the sales periods.	It is necessary to shift harvest time, to recommend saving, to use financial institutions with lower interest rate like UNCACEM, and to improve trading conditions. **Measures**: An assistance would be desirable to enhance the managerial capacity of SONADER and farmers' organizations. **Risks**: Improvement of cultivation techniques are required to delay the cropping calendar and it is unclear that farmers' character may accept the saving. It is important to know how far UNCACEM services can be improved and how far traders can take the risk of delinquency.
	Poor Price Bargaining power Strong price bargeining power←	There are many reasons, but it is pointed out that supplying quantity is not controllable and the bargaining power for selling price is weak, because systematic marketing is not established. Isolation of the project area is also a negative factor, which heightens transport cost and limits the approach of wholesalers. Although some farmers collect market information by mobile phones, information gap is obvious. Insufficient transport means limit marketing places. Those also lower the bargaining power for selling price.	Various countermeasures are required, such as to strengthen the organizational capacity, to improve marketing value through formulation of product center, to strengthen information collection and to secure transportation means. The on-going road project is a contributing factor. **Measures**: A technical assistance would be desirable to enhance the management capacity of SONADER and farmer organizations. **Risks**: The rehabilitation works are prerequisites for product center formation, so it will be difficult to achieve it in the short term.
Access		Foum Gleita is located 100 km from Kaedi in two hours by car. Even the main road was not paved and the road from the main road to the villages is not properly constructed, so it was often blocked in the rainy season. Transportation in the neighboring towns is rare, and prices are higher than in Kaedi because transportation cost is added. Difficult access conditions affect the supply of inputs including agricultural machines as well as conditions of selling price.	**Measures**: In 2007, a road construction project was started by EU, which includes the paving between Kaedi and M'bout and the local road to Foum Gleita dam. In March 2010, some of the site was completed including paving. When it is fully completed, it would take one hour to Kaedi, and be used throughout the year, and that greatly improves the conditions of access. **Risks**: The completion of the project was planned in 2009 before the rainy season, but it seems to be not possible even before the rainy season of 2010.

5.2 Basic Policies of the Action Plan

In response to countermeasures discussed in the previous section, "5.1 Issues of Foum Gleita Project Area", basic policies to formulate A/P for revitalization of irrigated agriculture in Foum Gleita are explained hereinafter. In the previous section, three axes, function recovery of the irrigation facility, high productivity, high selling price and a backbone of those, function recovery of organization were prioritized. Function recovery of organization and irrigation facility, included in strengthening of the farmer's cooperatives/ SONADER is an essential issue to develop in the project

area. To increase high productivity with farming technology is important as same as it and to secure better marketing price is also necessary factor to improve farmer's livelihood. According to those issues, the tasks to be focused in A/P are shown as below the table. Each item are explained at accordance with the priority.

Table 5.2.1 Basic Policies for Formulation of A/P

Necessary countermeasure	Tasks to be focused in A/P	Reasons
Function recovery of organizations	Strengthening farmers' organization	Farmers' organizations should be responsible for operation and maintenance of the areas from now. Currently they are not functioning virtually, but formation of proactive and independent farmers' groups would connect to operation and maintenance of irrigation facility, obtaining agricultural inputs and systematic marketing. Therefore, strengthening farmers' organization is essential.
	Strengthening of SONADER	Farmers' cooperatives are the main actors of irrigated agriculture, but function recovery of farmers' groups requires external assistance, so strengthening of SONADER, which support farmers, is an important issue.
Function recovery of irrigation facility	Necessity of function recovery of irrigation facility	Even though 2,000 ha of irrigated area have already developed, it is not able to cultivate in the entire area because of declining function of primary canal. For farmers in this area, it is essential to restore irrigation facilities to provide basic infrastructures.
High productivity	Improvement of farming techniques	For sustainable irrigated agriculture in the area, it is necessary to improve income of farmers. To achieve that, improvement of agricultural productivity is required, and improvement of farming techniques of farmers is necessary to achieve that, so it should be focused.
High selling price	Marketing assistance	For improvement income of farmers, as well as productivity improvement, marketing improvement is also necessary. Therefore, marketing assistance should be focused.

5.2.1 Strengthening of Farmers' Organization

From now on, the main actor responsible for irrigated agriculture in Foum Gleita is organizations of beneficiaries of farmers. Initially, living environment of farmers was changed by construction of the dam and irrigated area, so that they have received massive aid and compensation from the government and they accepted those offers as the compensation. However, the financial constraints of the government and the change of a policy from overprotective manner to more independence of farmers led to reduction of government assistance. As beneficiaries, farmers did not fulfill their obligations and responsibility, and neglected the condition getting worse. Therefore, irrigated agriculture in Foum Gleita fell into malfunction. To improve this situation, farmers should have ownership as beneficiaries, change their mind to gain more autonomy and form organizations, which could rationally manage and democratically make decision. However it passed about 20 years, since many organizations had been established, and 10 years has passed since their function stopped, so the revitalization is not easy.

There are two kinds of farmers' organization, agricultural cooperatives and unions. The strengthening of these organizations was promoted through the verification study. The cooperatives are small units, but many. Therefore, it is difficult to know the actual conditions, but most of them are not active and do not have clear rules. During the verification study (pilot projects), five cooperatives related verification field received assistances such as training of organization, revising internal regulations through consensus building and holding a general meetings. As the result, in addition to achievement at verification field, the cooperatives became active. Directions to strengthen cooperatives for further development are listed below.

Table 5.2.2 Directions to Strengthen Cooperatives

Issue	Details
Extension for other cooperatives	The main theme of cooperatives support in this study was the verification trial and there was limited time, so just five cooperatives were focused on to support. At the stage of the real implementation, the assistance for organization should be offered to all cooperatives (45 male and 49 female). For the moment, cooperatives actually cultivating in the irrigated area should be targeted, while the assistance would be offered to cooperatives abandoned farming, at the time of rehabilitation.
Formulation of annual plan	Basically, it is planned to cultivate twice a year in rainy and hot dry seasons, which starts in July and February respectively. To follow this plan, work period of procurement, cultivation, harvest and shipping, and operation and maintenance work of irrigation facility should be planned in general meeting. The collective works should be studied for plowing and harvesting, which require a large workforce in a short period.
Holding board meeting and general meeting	The board members meets once a month to control and monitor the annual plan, to cope with various problems, to discuss and decide a general meeting, if necessary. Decisions will be communicated to members soon. A general meeting will be held at least twice a year before the cropping season to discuss the annual program, the various problems and personnel. Minutes of a meeting shall be recorded and kept properly.
Financial management	There is an accountant in cooperatives but in recent years fixed fees are not collected, and the input loan has been used only for the 2008-2009 season. In reality, the funds are managed by the union, but in cooperative level, the list of members, distribution and statement of accounts must be maintained in a transparent manner, so officers should receive training.
Joint responsibility	To ensure beneficiaries' obligations, the joint responsibility of each cooperative should be clarified. As regards the payment of expenses and the duties, all members will control each other's obligations within the cooperative, so that cooperatives fulfill their obligations.
Penalty	It should be familiarized that strict penalties are applied to members, who don't fulfill their obligations.
To secure land mobility	For farmers, the land is the most important property for production, but it is not possible to ensure the sustainability of the project area, even though some farmers do not fulfill obligations, they can get free ride. So it is necessary to secure land mobility for maintaining the productivity. In the current regulations, Land Use Committee (consisted of UCAF and SONADER) can take away the farming right, for the abandoned land and failure of payment (of irrigation fee). But in reality there is almost no application of this rule. Since this is a matter of life or death for farmers, it is necessary to establish affair system..
Response to disaster	Most farmers do not have strong economic foundations, and it is difficult to cope with flood damage or unusual diseases. Once they are confronted such problems, they enter a vicious circle. It should be discussed to establish an audit for exemption in case of natural disasters, to systematize the existing spirit of volunteerism, and to establish a reserve system of internal fund.

On the other hand, the union(UCAF) was dormant for a long time. However, influenced by the different activities of the study team, and moved by the necessity of repayment on loans, it resumed activities. Although UCAF previously managed the loans, equipments (e.g. tractors), and the collection of fixed fees, in recent years it did not work practically, because of freeze of fixed fees collection and input loans, and decrease of cultivated area and farmers. Therefore, in the verification study, the study team supported UCAF to review its internal regulation, explanation meetings to cooperatives, and preparation of a pre-general meeting. As a result, a positive sign is observed for the future, but fruits are not yet tangible. The process through awareness-raising is important to reform UCAF, so it takes long time and continuous support is needed. So the following issues should be solved to strengthen UCAF.

Table 5.2.3 Directions of Strengthen of Union

Issue	Detail
Re-election of board members	Considering the past environment, it is unrealistic to blame Union officials for the overall responsibility for the failure. But it is not deniable to accuse them for lack of efforts. It is necessary to publicize the information and to re-elect leaders through democratic process. Moreover, it is important to make a rule for dismissal even during their terms, in case of incompetence or failure.
Formulation of annual plan	Coordinating all the programs of cooperatives, an annual plan should be formulated for the timing of management of procurement, cultivation, harvesting and shipping to materialize two seasons cropping at the right time, through a general meeting. For efficient operation of the entire project area, it is desirable that the union deals with agricultural machinery.
Implementation of board members' meeting/ general assembly	Same as cooperatives, a board meeting once a month and a general assembly at least twice in every year should be held to discuss the annual program, various problems and personnel. The minutes of meetings will be recorded and kept. Decisions will be communicated to members as soon as possible.
Financial management	The Union is solely responsible for the management of funds (fixed fees, loans, profits from sales), so it is necessary to ensure transparency in accounting with the control of a third-party audit and periodic reports. In case of Senegal, there is a third-official party to audit the union's finance and to contribute securement of transparency. It is worth discussing its application in Foum Gleita.
Role of external affaires	The Union is responsible for the loan of UNCACEM, contract making for maintenance works over a certain size, discussion and requests to external agencies, etc. Therefore all members should know the commitments and processes, and persons in charge should carry out tasks with mutual control.
Rewards to managers	At one time a director, an accountant, and a store keeper received a monthly salary. This is necessary for the smooth implementation of works, but considering workloads, the amounts should be decided through consensus.
To secure land mobility	It is necessary to secure land mobility for maintaining the productivity, and if irrigated land is not used correctly, the Land Use Committee (comprised of SONADER and UCAF) should give a fair judgment. It is necessary to establish a fair system.
Response to disaster	Audit and exemption systems should be established in order to respond quickly to natural disasters, and it should be discussed to systematize the existing spirit of volunteerism and to establish a reserve system of internal fund.

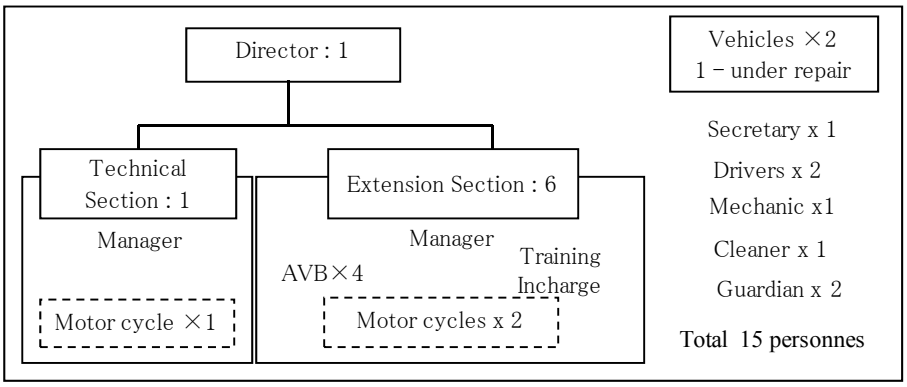
Issue	Detail
Marketing	As the result of the farmers' economy survey has shown, proper marketing is one of the essential issue to do farming by self-reliant manner. Ideas to improve farmer's income should be considered through buoyed GIE, who does not practice today, circulation of market information and storage improvement for selling price increase.
Utilization of agricultural machinery	The SNAAT[3], under the Ministry of Rural Development, is equipped with many agricultural machines to provide their service to farmers. The public cooperation has no more than a year, so its tasks and its structure is not fixed, but it may offer services to Foum Gleita. The utilization of the SNAAT is expected.

5.2.2 Strengthening of SONADER

In principle the operation, maintenance and management of the Foum Gleita project should be carried out by the farmers union, where as in the recent years, this organization has been dormant for several years. It will be difficult to develop an independent management system in a short period, since SONADER has always been providing instructions to the farmers' cooperatives and the union. Therefore, enough support should be provided to SONADER, and at the same time, it is also necessary to strengthen the role of SONADER.

According to the information obtained on the history of SONADER, when the dam was constructed, the Foum Gleita SONADER office had nearly 150 staff including those responsible for environment and health. In 1990, after starting of the project, SONADER became responsible for the operation and maintenance of facilities, it became a relatively smaller office, both in its structure and its activities (as shown in the Fig. 5.2.1.) Furthermore, with the decline of the functions of irrigation facilities, the cultivation area was reduced to one-fifth of the total area (400 ha). Besides, the irrigation charges have not been collected, and the union cannot pay back the loans, and therefore the service to be provided by SONADER Foum Gleita has become limited.

[3] Sociéte Nationale des Améenagements Agricoles et de Travaux (SNAAT),head quarter is under MDR such as SONADER is located in Rosso. It was established to provide agricultural mechanic service to farmers in January 2009. It is equipped number of agricultural machinery and heavy machinery.



*3 motor cycles were provided by JICA Study

Figure 5.2.1 Organization Chart of SONADER, Foum Gleita

While monitoring and management of Foum Gleita dam and control of water discharge quantity of the dam is one of the major tasks of SONADER, provision of extension services to the farmers is also another major task of SONADER. However, at the present situation, SONADER Foum Gleita is not provided with enough staff and facilities to manage the project area.

In order to activate the project area, the support services need to be provided by SONADER including the maintenance of irrigation facilities, the expansion of extension services and administration activities of farmers' organizations. Presently, only one full time technician is managing the Foum Gleita dam, but considering the importance of the dam, it is necessary to increase the number of employees. Besides, the possibility of assigning staff to assist them in their task should also be considered. There is also a need to provide the facilities for mobility to facilitate their work. Under these circumstances, and based on our hearing survey with SONADER, the organizational staff of SONADER is planned as shown in Fig.5.2.2. During the rehabilitation stage, this issue should be discussed more concretely, and SONADER Foum Gleita should be strengthened accordingly.

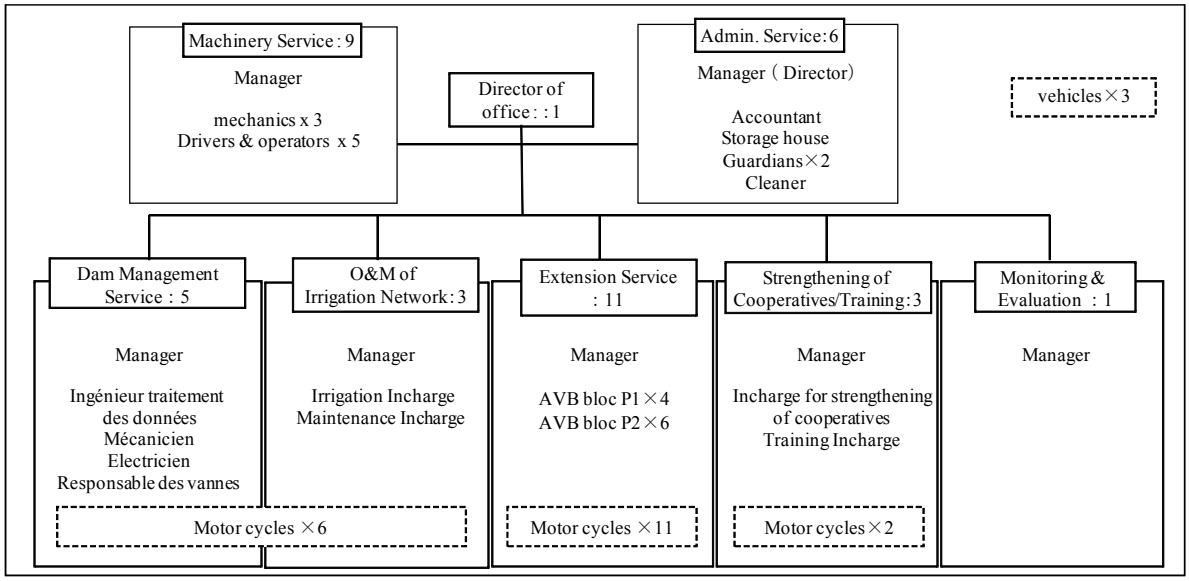


Figure 5.2.2 Proposed Organization Chart of SONADER Foum Gleita

Since monitoring and evaluation is an important activity of SONADER, it is also included in the plan. Basically, for each service, a service manager and technicians need to be employed, and whenever necessary, an engineer or an irrigation technician shall be hired from a private consultant. Moreover, agents (assistants) can be hired to perform maintenance services of both hardware and software aspects such as water master to manage water in the secondary canals, extension assistants to assist the technical support of the cooperatives, and training assistants to strengthen organization when the cooperative is organized, and assistants for the evaluation and monitoring of selected farmers, whose role is to collect the results of all cooperatives. These assistants shall be supervised by the employees of SONADER. Regarding the provision of agricultural machinery, SNAAT will be very effective. It was created one year before, but its organization and functions are flexible. The cooperation which can be provided by SNAAT shall be decided in the future during the rehabilitation considering the fact that SNAAT has enough equipment and facilities. SNAAT head office considered it positively supporting Foum Gleita project area.

5.2.3 Necessity of Function Recovery of the Irrigation Facilities

As mentioned above, for vitalization of the irrigated area in Foum Gleita, it is essential not only to revitalize the organizations but also to rehabilitate the function of the irrigation facilities for realization of revitalization of the whole area (1,950ha).

(1) Present Condition

Senegal River basin is the only area, where can be expected stable agricultural productions in Mauritania. It is positioned as a target area in proceeding PDIAIM, supported by World Bank. In that region, Foum Gleita irrigation area was the biggest gravity irrigation area in the country, and

construction of irrigation facilities was completed as a national project with the large scale dam as water resource in 1990. However, as mentioned above, the government didn't provide enough support to farmer's organizations for independence and kept reducing their support. As the results, organizations malfunctioned and didn't maintain the facilities. Therefore, embankment of canals was deteriorated and canals were invaded by typha, so that capacity of water flow was dramatically fallen. Today, consequence of the decrease of water discharge, only 1/5 area can be irrigated. Moreover, recently there is the risk of collapse of the weakened parts of primary canals (to see below) at any time, and neither SONADER nor the farmers have the means to intervene, so that there is a constant risk to lose the opportunity of harvests in case of collapse. In fact, a part of primary canal collapsed in 2000 and 2008, and the government directly supported, but a lot of days were necessary to irrigation, so that harvest has been decreased dramatically. The farmer's correspondence to such a risk by diversification of the crops and limiting their investments made them go into a vicious circle of continuous reduction of the productivity.

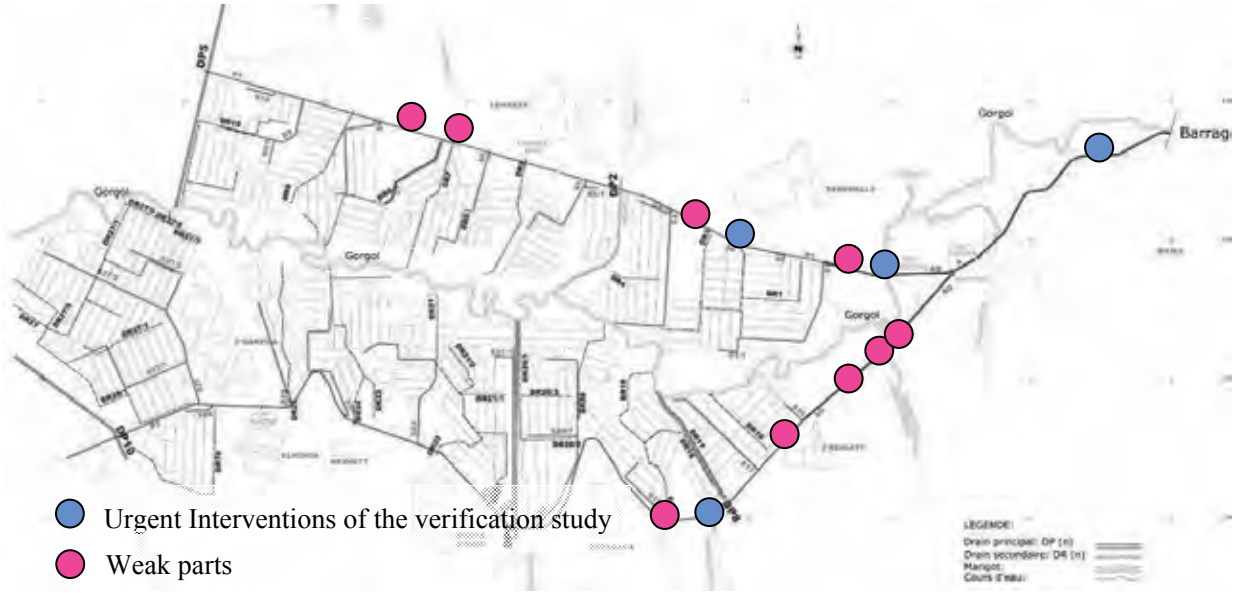


Figure 5.2.3 Parts of the Weakened Primary Canals

Source: Prepared from the interview of the responsible SONADER

(2) Needs of the Beneficiaries

For the farmers cultivating at present, the restoration of the functions of the irrigated area of Foum Gleita is indispensable for the farmers to avoid significant risks and to sustain continuous cultivation. Almost all interviewed farmers, who does not cultivate now, answered that they will restart to cultivate, if irrigation water will be supplied constantly, because main reason of giving up cultivation was the lack of irrigation water. For the local farmers, whose main activities are rain-fed agriculture and livestock breeding, the irrigated agriculture is valuable resource in the economic and food security point of view because of steady harvests. Therefore former farmers argue that farmlands

should insistently be restored to themselves. So, for the beneficiaries, restoration of the functions of the irrigation facilities is a matter of life and death, that is why the needs of a rehabilitation project are high.

(3) Responsibility of the Beneficiaries in Rehabilitation Project

The rehabilitation project is greatly justified from the view point of the beneficiaries' needs, as mentioned above, but it is necessary to consider the farmer's responsibility in case of implementation of the project. The effectiveness of projects doesn't last, if they rely entirely on the government and don't carry out their responsibility as ever. Therefore maintenance of the tertiary canals and their field should be performed with farmer's responsibility.

The result of the verification studies showed that it was possible for farmers to repair primary canals partially and to maintain the secondary canals. However, it is quite impossible to repair manually larger canals than secondary because it is insufficient for repairing up to the condition that can last for long time use only by weeding and small desiltlation and some heavy equipment are necessary. And as shown in Figure 5.2.3, many weakened points of primary canals are upstream, and about half of them are on the diversion points above water sharing. However, cultivating farmers irrigate only one fifth areas of 1,950 ha. Therefore it is impossible to repair primary canal only by that manpower, and also, impossible to assign these works to non-cultivating farmers at present.

On the other hand, at the time of the verification study, a women cooperation (Bedr) requested strongly to add a demonstration plot for them, but the plot had not been cultivated for a long time and was covered by bushes. That is why the study team rejected their proposal once. However, they employed men for weeding of that field and they worked by themselves also, so that it had become again arable and the study team accepted their request. This indicates that it would be quite possible that farmers themselves maintain the tertiary canal and other facilities downstream, if they are actively involved.

The typha also invades the reservoir of the dam, so that it will be difficult to eradicate after the rehabilitation, and it grows about 3.5m high in 6 months even if it is cut. Of course it is necessary to cut typha in the usual maintenance works, but it will be essential to concrete-line a part of the diversion canal to reduce the maintenance work in the middle and long term, because the diversion canal is located in most upstream, far from the cultivated field, the number of beneficiaries is not limited, and target area is also large. Moreover, the typha is used as roofs in the area. In Rosso, tests to make charcoal from the typha have been conducted, and it can become income source for farmers. Therefore it is important to continue to study the use of typha.

(4) Irrigation Area Outside the Project Area

The study team listed all farmers who irrigate outside the project area by taking water from the primary canal with a siphon using a hose (refer to ANNEX 13 for detail). The point is that among 132 farmers and groups (cultivating 155ha), who irrigated outside the irrigation project area, 60% possess a plot in the project area. As they do not have any water in their plots inside the project area, they cultivate outside the project area along the main canal, where access for water is good. They expressed the intention to go back the project area if water is supplied to plots. At the time of the rehabilitation, SONADER and the union should meet them to get a consensus and the cultivation will not be done anymore outside of the project area after rehabilitation.

(5) Prospect of Farmer's Return to the Farming

In this study, the study team conducted survey for all plots' farming right holders, and confirmed their present address. It is important factors to evaluate a prospect whether farmers, who left farming, return or not.

At the beginning of operation, the list of farming right must have been made, but currently only part of it is remaining. So, faming right holders were surveyed by using receipt for fixed fees from 1988 to 1993, the initial period of operation. According to the result, the number of plot was 3,908, and farming right holders were identified for 84% of plots. Among them, present addresses of 95% were made clear. Current resident is classified with four zones, such as "Inside" (within few km from the project area), "Near" (within 15km), "Not far" (former villages in M'bout before dam construction or around) and "Far". Urban cities, Kaedi and Selibaby and so on, are classified with "Far" zone in this study. Classification of the zones is shown in the Figure 5.2.4.

Table 5.2.4 Current Resident of Farmers with Farming Rights

Zone	No.	Rate	
		Partial	Cumulative
Inside	1,543	49%	49%
Near	617	20%	69%
Not Far	817	26%	95%
Far	154	5%	100%
Total	3,131	100%	

The result is shown in the right table. According to the result, a half of farmers are living in "Inside", so that immediately they can start farming. Farmers who live "Near" are 20% and they also can restart farming without problems. Farmers who live in "Not far" are one fourth. They gave up farming in Foum Gleita due to lack of water and returned to their original villages, from where they emigrate with dam construction: Lemsseguem, M'bediatt, Tekwebra in the east of M'bout Province. Farmers living "Near"/"Not far" cultivated rice with farming huts around the project area. The distance is not serious of obstacle, when they restart farming, and even now they are sensitive about information of the project area.

In this way, there are no big obstacles for farmers living in "Inside", "Near" and "Not far" zones to go back farming. And they show clear interest of re-farming, when irrigation facilities will be

rehabilitated. Only 5% of farmers who live "Far" from project area couldn't get a connection, but totally it is very few. Although 8% of the framing right holders were confirmed dead, usually their right was taken over by their relatives and families. Thus utilization of farmland will be expected.

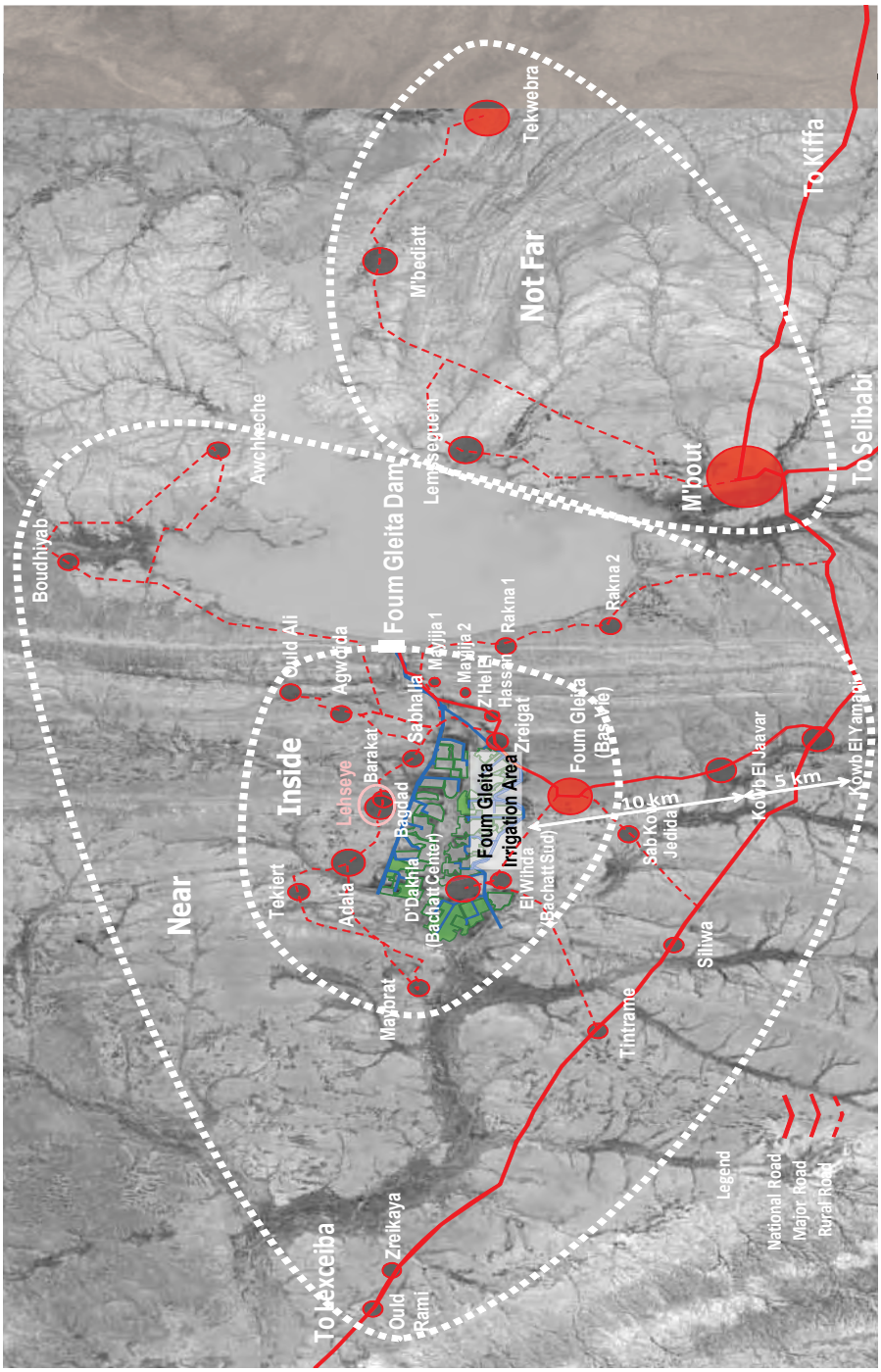


Figure5.2.4 Resident Zone of Cultivation Right

5.2.4 Improvement of Farm Management

The improvement of farm management technology shall focus on removing the constraints of farm management by adapting the policies as mentioned below. While it is necessary to implement all the farm management policies in stage by stage, the priority shall be given as mentioned below.

1) Delaying of the cropping schedule
2) Extension on cultivation technology
3) Availability of farm machinery

(1) Delaying of the cropping schedule

Cropping schedule at the right time is recommended by research organization such as CNRADA, though it is caused the decreasing of yield at present situation, because of out of the schedule. The problem of procedure of the loan and delaying of input procurement is caused of delaying of the cropping schedule. Generally, the inputs for rainy season rice are not affordable for farmers, and then mostly famers borrow money through the union of cooperatives. Farmers can purchase their inputs such as seeds and fertilizer. However the previous loans could not be repaid because of flood, the union is not entitled to borrow any new loan. For this reason, farmers can't be accepted the loans from the union, they depend on private money lenders. It takes much time to arrange funds and inputs so that cropping schedule will be delayed. That is the reason for the decreasing of yield.

The delaying of the cropping is limited the possible cultivated areas to affect the next season cropping. To decrease cultivated ration is occurred low yield. In the beginning of 1990's after the rehabilitation, cultivation has been carried out in all the 3seasons (rainy, hot dry, cool dry), and about 50% of the area is cultivated in hot dry season, and cold dry season respectively. Even in recent periods, farming is done in all the three seasons, even though the cultivated ration is going down extremely, and the same area is utilized only in a few famers.

The problems mentioned the above, it is important to acquire the inputs appropriately along with the cropping schedule in order to avoid the delaying of cropping. If the financial problems of the cooperatives are solved, and the farmers become eligible to borrow the loan from UNCACEM, the farmers can buy the inputs on time, and carry out the rice farming as per the farming schedule. At the same time, it is proposed to cultivate 2 crops (Rice-rice of rice-vegetables) in two seasons in a year as planned A/P for improving the cultivated ratio. SONADER should properly guide the farmers union so that 200% of cropping pattern can be achieved regularly in the Foum Gleita project area.

(2) Extension on Cultivation Technology

Although the farmers in Foum Gleita area have been practicing agriculture for more than 20 years since 1985, very little training is provided for them through demonstration farms, field visits to

advanced farms etc.. Besides, the next generation has already started to be involved in the farming, but they have not received any training on farming except some guidance received from their parents. Presently, less than 500 ha area is cultivated in Foum Gleita area, and more than 50% of the project area has not been cultivated for more than 10 years period. Hence these farmers who will start cultivation after the rehabilitation of the project are not aware of the latest cultivation technology and the farming practices.

Presently, the farmers in Foum Gleita are practicing sub-optimal farm management practices such as using of poor quality of seeds, minimal land preparation, non-application of phosphate fertilizer, poor fertilizer management, poor transplanting, no drainage after maturity and delayed harvest, and these practices ultimately result in poor yields. According to a WARDA research (WARDA Annual Report, 1999), it was found out that the potential for rice production in Foum Gleita is much higher than one would assume from the existing farmers' performance. By practicing optimum farm management practices, the farmers of Lexeiba project area are obtaining an yield of 6-7 t/ha (hearing survey of Lexeiba farmers union), where as the average yield in Foum Gleita project is less than half of these yields, although few farmers manage to obtain more than 4 t/ha.

In the verification trials of the Study, new cultivation technologies have been experimented for both rice, and vegetable cultivation instead of the existing methods followed in the Foum Gleita project area. For eg. line transplanting method was tried instead of the random planting, and was found that it was very effective for weeding purposes which would finally result in a better yield. Similarly ridge and furrow planting was experimented for vegetables instead of the normal flooding method of cultivation. It also resulted in a much better yield of vegetables. These kinds of new cultivation methods should be verified, and should also be extended to the farmers.

Therefore, the farmers in Foum Gleita project area should be given suitable training on farming technology by conducting demonstration farms by SONADER, and field visits to advanced farms such as Lexeiba project area.

(3) Availability of Farm Machinery

Because of the non-availability of machinery, all the farm operations including ploughing, transplanting, harvesting etc. are carried out manually in Foum Gleita area. These activities not only require heavy labor but also consume time. Besides, child labor is also used for some works such as transplanting, which results in poor yields. Therefore, farm machinery should be made available for the farmers.

5.2.5 Marketing Support

The marketing support shall focus on removing the constraints of marketing by adapting the

policies as mentioned below. While it is necessary to implement all the marketing policies in stage by stage, the priority shall be given as mentioned below.

1) Establishment of storage facilities for food grains and vegetables
2) Introduction of marketing information network
3) Introduction of cooperative marketing
4) Improvement of transport facilities
5) Improvement of facilities for value addition

(1) Establishment of Storage Facilities for Food Grains and Vegetables

Presently in Foum Gleita, there is no storage facility for storage of food grains and vegetables. Therefore the farmers are forced to sell their farm products immediately after harvest irrespective of the demands in the market. Especially in the case of vegetables such as onions, if they can be stored for a few months, they can be sold at much better prices than during the normal harvest periods.

Therefore, if storage facilities can be established in the project area, it will be helpful for sorting of the vegetables and to preserve the produces for some period of time before marketing.

(2) Introduction of Marketing Information Network

Presently, the market information is obtained individually by the farmers through their contact sources in major cities. However, their contacts are limited, and hence they cannot obtain the market information, especially the prices in various cities. A marketing information network shall be established at the union, who shall obtain the market information from the cities, and also by contacting the relevant government departments. The market information shall also be communicated regularly to the farmers' cooperatives.

(3) Introduction of Cooperative Marketing

Presently, the marketing of farm products is done mostly by the individual farmers. By practicing cooperative marketing, the farmers can attain a better price by saving in collective transport, and also by selling to the appropriate market whose information can be obtained by the marketing information network mentioned below. The unions for the male cooperatives and the women cooperatives shall be responsible for food grains and vegetables respectively

(4) Improvement of Transport Facilities

Presently, the transport of food grains and vegetables are carried out by hiring of private vehicles or by public transport. However, these facilities are insufficient, and expensive. Sometimes, the products are not sufficient enough to hire private vehicles, and even transporting of vegetables

from the farms to the nearby markets such as Bas vie is a problem for the farmers. If the farmers union would become capable of arranging the transport facilities, it would be highly beneficial to the farmers for transporting food grains and vegetables.

(5) Improvement of Facilities for Value Addition

Presently, there are only a few value addition facilities such as rice mills, and the farmers are selling their paddy without milling. There is a price difference of 1.5 to 2 times between the milled rice and un-milled rice. If more value addition facilities are available in Foum Gleita project area, the farmers can attain a better profit for their rice. Similarly, no value addition facilities for vegetables are available in the area. If such facilities can be established in the future, the farmers can sell their produces at much better prices.

5.3 Details of Action Plan

5.3.1 Overall Outline

Basically, the Action Plan consists of the five basic policies, explained in "**5.2 Basic Policies of the Action plan**", and includes other necessary schemes. On the whole, it is necessary to undertake the rehabilitation works for irrigation facilities at first due to urgency, in order to secure irrigation water as basis of agricultural production. Since farmers won't have access to water during the construction work, food support will be provided, same as when the area was developed, and fertilizer, seeds and agricultural machinery (if necessary) will be also provided before the completion. As a technical support, it is important to strengthen the organization of SONADER and the union(UCAF), when this study will be completed. After the rehabilitation, it will be easier for SONADER to lead to extension and maintenance of the irrigation facility by farmers' groups, and irrigated agriculture of the project area will become autonomous. Basic policies of the Action Plan and actual projects are indicated below. Projects are detailed in the chapter 5.3.2 below, and their outlines are explained here.

Table 5.3.1 Basic Policies of the Action Plan and Proposed Projects

Proposed projects	Basic Policies				
	Support to farmers groups	Support to SONADER	Necessity of function recovery of irrigation facility	Improvement of farming techniques	Marketing support
Rehabili. project of irrigation facility			O		
Technical support project	O	O	O	O	O
Input support project	O			O	
Project of agricultural machinery	O			O	
Agricultural extension activities	O			O	O
Maintenance of irrigation facility	O		O		

The strengthening of farmers' organizations is carried out in all projects, except for the rehabilitation project. Although it will be implemented in the follow up for technical support after this study and the extension activities of SONADER mainly, it should be taken in account for all the projects, because the autonomous organizations are the foundation of all activities. The strengthening of SONADER is carried out in the technical support included in the follow up after this study and SONADER strengthen itself through practice in extension activities conducted at after rehabilitation. The function recovery of irrigation facilities is carried out in the rehabilitation project and activities for independent maintenance by farmers group will be conducted in the project for technical support and activities for maintenance of irrigation facilities. Agricultural improvement is supported for improvement of productivity in the technical support project, input supporting project and agricultural machinery supporting project and extension activities. And for marketing support, it is necessary to support in the sale season diversification in extension activities and strengthening of the capacities of price negotiation in the technical support project.

The A/P to activate irrigation farming of Foum Gleita is shown below, considering the points mentioned above.

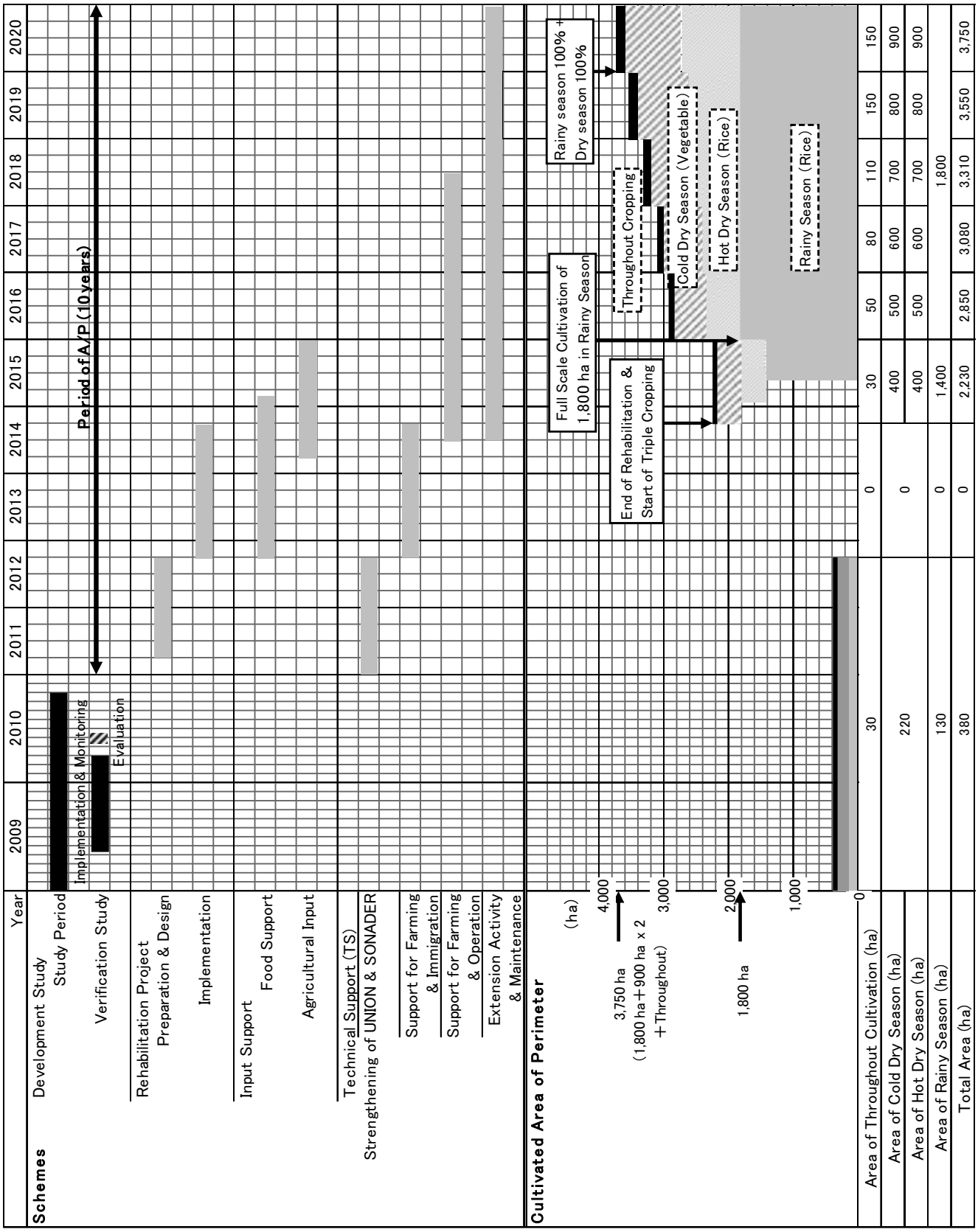


Fig.5.3.1 Procedure of the A/P

In our program, A/P will be implemented to 10 years from 2011 with objective of 100% of the harvest both in rain season and dry season at the final year. For that target, first of all, it is important to implement the rehabilitation of the irrigation facilities as early as possible. In the project, a soft component would be provided to support for appropriate maintenance with development of circumstances. In addition, food support to farmers, who cultivate currently, is planned. Moreover farmers who have not cultivated for long time will be able to restart agricultural activities in an independent way by input support at the end of the rehabilitation of the irrigation facilities.

Besides, a technical support will be put in place with the rehabilitation of the irrigation facilities to support the reinforcement of the union's and SONADER's organization by completion of the rehabilitation, then after rehabilitation, concerning mainly the maintenance, farming and the marketing. The completion time of the rehabilitation project is assumed in late of 2014, and then the irrigated area in the rainy season is expected to increase gradually, because the farmers near the project area will immediately begin the cropping after the end of the project, on the other hand, the former cultivators living further will make sure that the irrigation facilities functions correctly. So it is speculated that it takes two years to start production activities in the whole project area. The rainy season cropping will be practiced on the whole project area during the technical support. It is assumed that the improvement of yield of the rainy season and the area expansion of dry season continues, and 100% cropping of the dry season is achieved in five years by the effect of the technical cooperation. After the technical support, the improvements should continue under the initiative of the Mauritanian government, with a regular monitoring of outside development partners.

5.3.2 Rehabilitation of the Irrigation and Drainage Facilities

(1) Basic Policy of the Rehabilitation of Irrigation and Drainage Facilities

In the initial stage of the Action Plan (A/P) for 10 years from 2011 for vitalization of agriculture in Foum Gleita Irrigation Project, SONADER is expected to implement the rehabilitation work immediately after the completion of the present Study in accordance with the results of the study in APD (Etude d'Avant Projet Detaille) Phase I and II completed in 2006 and 07, respectively through assistance by the World Bank, and the results of the present Study. The basic concepts for formulation of the rehabilitation plan are enumerated as under:

- To revitalize irrigated agriculture on the 1,950 ha (reduced to 500ha or less recently) in order to effectively use abundant storage capacity of 400 million m^3 of the dam reservoir.
- To extend the irrigation area from the 1,950 ha to 3,600 ha through development of downstream area (1,650 ha), when SONADER succeed in revitalization of the 1,950 ha in the A/P for 10 years.
- To recover canal capacity in order to satisfy the water requirement for double cropping of rice

per year through rehabilitation of principal and primary canals for 3,600 ha and secondary and tertiary canal for 1,950 ha based on the original design concept employed in 1983-89.

- To retrieve the original canal sections completed in 1984-89. However, a comparison study will be made for the principal canals between Scenario A: reinforced concrete lining is provided after retrieval of the original canal section; and Scenario B: reinforced concrete lining is provided after completion of reduced economical canal section re-designed by the improved roughness coefficient of the lining.
- To apply maximum farmer's participatory approach so as to realize as much as possible maintenance works including the same for principal and primary canals by the farmer's cooperatives in future.

The Project aims at revitalization of the irrigated agriculture through rehabilitation of the existing facilities and, therefore, does not require to acquire some sites for new works, since 200 m wide land along the outside of the principal and primary canals belongs to SONADER.

(2) Irrigation Plan

a) Irrigated Area

Irrigated area in APD II is planned to cultivate 1,170 ha of rice, 195 ha of sorghum and 195ha of vegetables, in total 1,560 ha in the rainy season and 195 ha of rice, 390 ha of vegetables and 195 ha of sorghum and maize, in total 780 ha in the dry season. However, at the completion in 1984, design discharge was planned for the double cropping of rice (see APD II), and design discharge of the facilities was calculated under the following conditions.

① The design discharge for the secondary and tertiary canals was based on the irrigated area of 1,950 ha.
② The design discharge of principal and primary canals was calculated for concerning of expansion of irrigated area in 3,600 ha.

b) Calculation of the Design Discharge of Irrigation Water

The design discharge for principal and primary canals are shown in APD II, however, the same for secondary canals are not shown. Therefore, ETo and design discharge were estimated referring from APD II and basic values in previous section 3.6.4, Penman-Monteith program issued by FAO (applied by SONADER) and other available data as detailed in ANNEX 4. The calculation of gross water requirement in the study report for Irrigated Agriculture for Lower Delta in Senegal River was also referred. Considering the gravity irrigation system which requires lower irrigation efficiency compared with pump irrigation, efficiency of as low as 65% was applied to the earth canal in Foum Gleita. Thus, the design water discharge (gross water requirement or diversion water requirement) of

10.7 m3/sec was obtained for 3,600 ha, which correspond 3 lit/sec/ha.

In case of 3,600 ha, the design discharge for only principal canal AD was estimated at about 8% higher discharge from the discharge shown in APD II, however, other estimated discharge are all slightly lower than the discharge shown in APD II (acceptable).Initial plan was considered validity. In case of already developed 1,950 ha, there are sufficient allowance for all canals. Based on the above calculation, the irrigation canal system diagram was, thus, prepared as presented in ANNEX 4.

(3) Rehabilitation Plan of the Irrigation and Drainage Facilities

a) Rehabilitation of Principal and Primary Canals

The present major problems of the existing irrigation facilities of principal and primary canals can be represented by deterioration of canal dike damaged by livestock, and significant reduction in canal discharge capacity mainly due to densely proliferated typha and bushes. This countermeasure is summarized the following 2points.

① As to repair the dike, removal of sediment deposit in the canal and re-embankment of the canal dike is required referring from the on-going rehabilitation in PPG. The volume of the rehabilitation earthwork was estimated from the drawings in APD II with some corrections based on the preliminary topographic survey results in the Study. Steel wire net and barbed wire fence with a total length of 45 km along the periphery of the irrigation area will be planned to install for protection of the canals. The location of principal canal with concrete lining and rehabilitation of primary canal are shown in accordance with the location of the fence in the following figure:

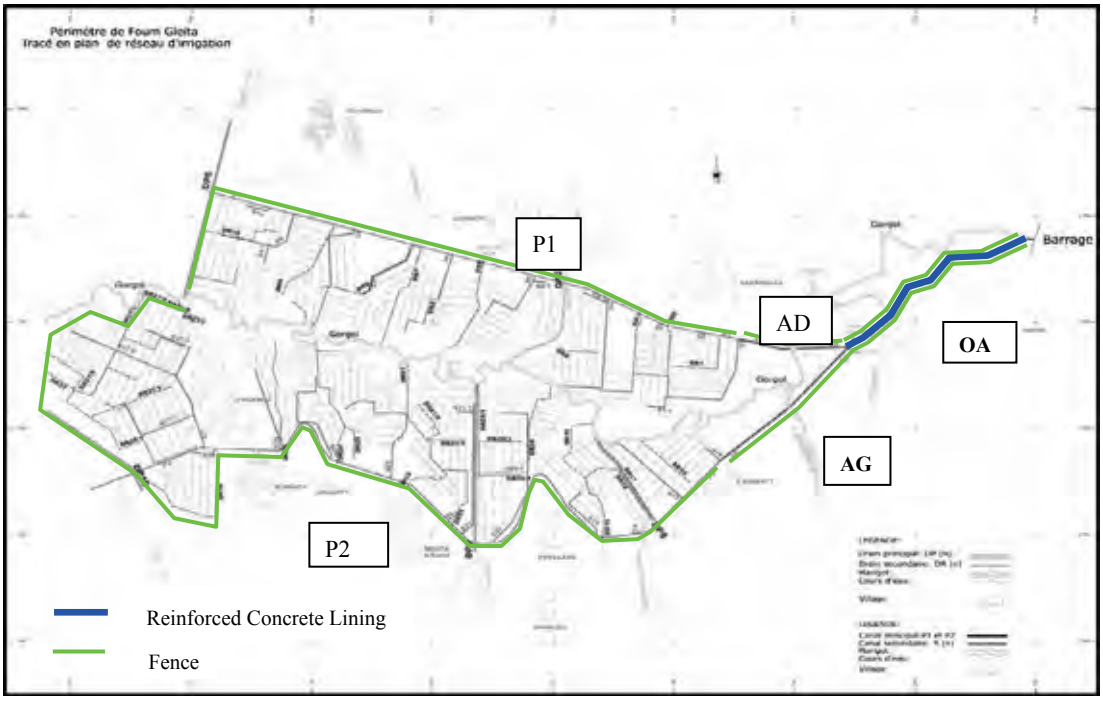
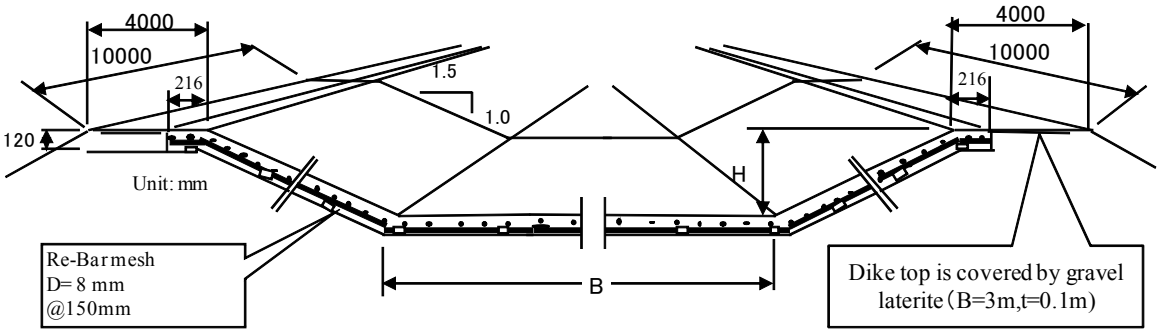


Figure 5.3.2 Fence and Lining

② Proliferation of typha and bush (mainly toufelhenne) can be effectively protected by reinforced concrete lining on the inside of the canal and protection sheet under the concrete joint. However, the lining is planned only for the OA, AD and AG principal canals in accordance with the period of A/P.

Dimension of Reinforced Concrete Lining



Scenario A							
Canal name	Canal length	Bottom width B	Dike heightH	Crest width	Lining thicknes	Slope	Re-bar dia.
Principal canal	m	m	m	m	m		mm
OA	3781	8.0	2.99	4.0	0.12	1: 1.5	8.0
AD	1821	3.5	2.56	4.0	0.12	1: 1.5	8.0
AG	3005	3.0	3.22	4.0	0.12	1: 1.5	8.0

Scenario B	
Bottom width B	Lining thicknes
m	m
5.0	0.10
2.5	0.10
3.0	0.10

Other figures are same as Scenario A

Figure 5.3.3 Reinforced Concrete Lining of Principal Canal

The rehabilitation of the principal canal dike consists of clearing and grubbing of typha and bushes, stripping, bench cut and re-embankment with compaction. The dike crest width of the principal canal was proposed to widen from the 2.5 m of original dimension to 4.0 m considering the advantages of adopting larger equipment in number of equipment, rehabilitation period, economy, etc.

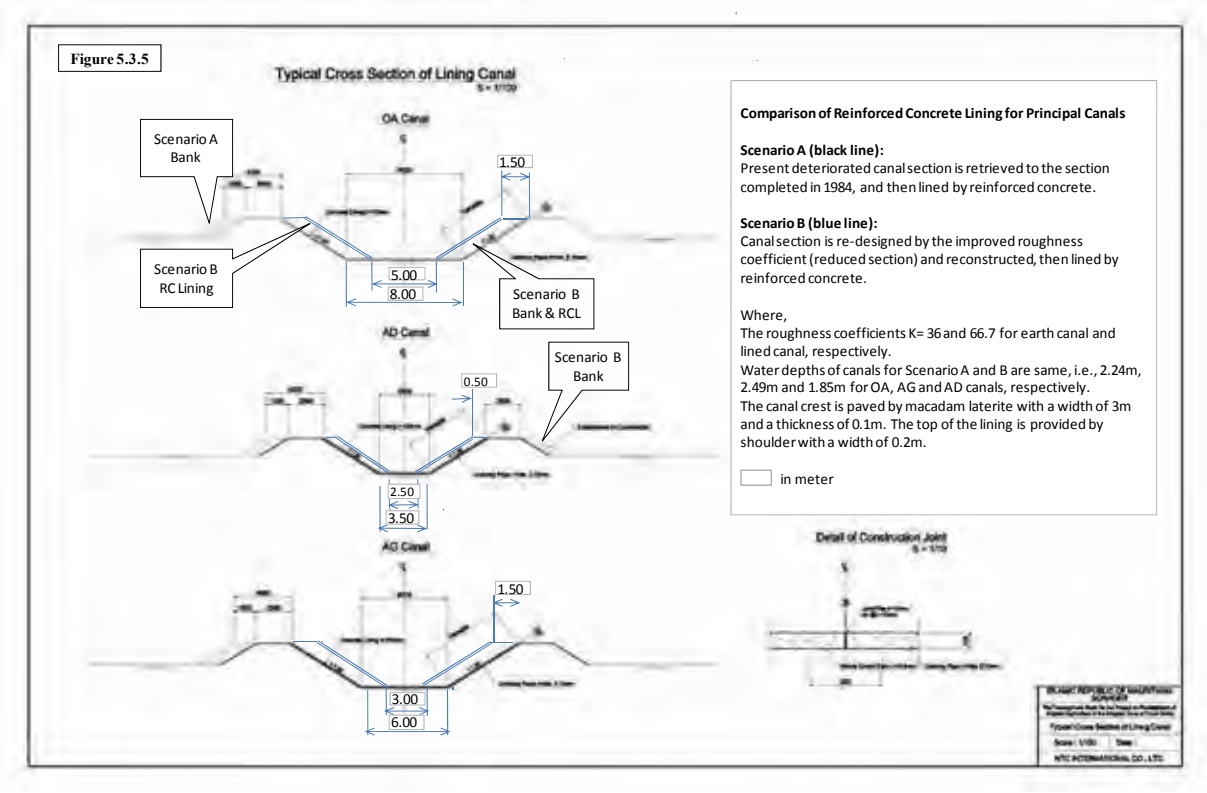
Main features of Scenarios A and B can be summarized as below:

Main features	Scenario A	Scenario B
oss section of principal canals (isting earth canal is proposed to be ed by reinforced concrete :RC).	Canal cross section is retrieved to the original section completed in 1984, then RC lining is provided.	Canal cross section is reduced in accordance with the higher velocity considering improved roughness coefficient of RC lining.
ttom width of the rehabilitated canal A, AD and AG	8.0m, 3.5m, & 6.0m	5.0m, 2.5m & 3.0m
ngitudinal section	Elevation of canal bottom & dike crest, and longitudinal gradient are same for both Scenario A & B as shown in Table A4.2 (same as original design).	
ickness of lining concrete	0.12 m	0.10 m
ldditional width of the dike crest	1.5m, 1.5m & 1.5m for both outsides of OA, AD and AG canal, respectively	1.5m, 0.5m & 1.5m for both outsides of OA, AD and AG canals, respectively and 1.0m for both outsides of AD canal
nit price of reinforced concrete to be plied to the preliminary cost estimate	UM 130,000/m^3 (latest price estimated by SONADER)	UM 106,200/m^3 (updated price estimated on the basis of APDII and ongoing PPG)
timated total cost of rehabilitation	MO 5,259 million	MO 4,220 million

The standard cross sections of the above OA, AD & AG canals for Scenario A & B are illustrated hereunder.

The result of the estimates under the above conditions reveals that Scenario B is economically advantageous than Scenario A with a balance of UM 1.0 billion. Scenario B is thus recommended economically in cases where rehabilitation is carried out by the reinforced concrete lining. However, since the cost of reinforced concrete lining occupies as high as 32% of the total rehabilitation cost, and in cases where these principal canals are rehabilitated only by earth canal without reinforced concrete lining, cross section of Scenario A should be applied.

Typical cross sections of the principal canals of Scenario B are attached in ANNEX 4.9.



There are various canal related structures for principal and primary canals. The necessary rehabilitation works are enumerated from the upper stream as follow:

- Repair of hydraulic system, rust removal, re-painting of the intake radial gate and repair of stop-logs and hoisting device.
- Provision of a drainage box-culvert at the immediate downstream of the beginning point of the OA canal.
- Rust removal and re-painting of stop logs for partituer.
- Repair of road bridge/aqueduct by earthwork, concrete, gabions for principal canal .

- Repair of the cavities, leakage and scouring on the primary canal P1. Repair of the diversion structures to secondary canal intakes.
- Repair of the diversion structures to secondary canal intakes from the primary canal P2.
- Clean the cross culverts along principal canal OA and primary canal P1 and P2, and excavate downstream drainage canal.

According to the survey of the downstream shaft on the SF7 siphon in February 2010 and SF9 in May 2010, it seems that the siphons are not a lot silted up (same conclusion as suggested by APD II).

b) Rehabilitation of the Secondary and Tertiary Canals

The secondary canals have bottom widths of 0.6 to 1.2 m and the tertiary canals of 0.4 m. The concrete structures of these small canals are in good enough condition, and, clearing & grubbing of typha & bushes, stripping, excavation and embankment can be undertaken by farmer's participatory approach without substantial topo-survey.

In order to confirm the terminal facilities such as secondary and tertiary systems, we selected the oldest secondary canal network of S9 and S27/1 (the opening of the network in 1984). The survey results of the entire length of the two networks showed that the structures were in relatively good state and can continue to be used under periodical participatory maintenance (Refer to ATTACHMENT of ANNEX 4). This cost is included in the project cost.

c) Rehabilitation of the Farm Road and Field

The farm roads are in relatively good state except some sections filled with bushes (refer to APD II). They will be cut under the farmers' participatory approach and the farm roads will be also negotiable. At the site of the siphons and the aqueducts, concrete causeway (submersible bridge or radier) were installed but they are invaded by marsh or sediment so that they don't function. The sand will be removed at the time of works on the drains to make all of them functional again.

The plots need not to be consolidated nor leveled. They will be leveled with a tractor at the time of the cultivation works as ploughing and puddling, or the plot will be divided by field dike, if the plot is with considerable slope. These works are not part of the project at present.

d) Rehabilitation of the Drains

Removal of sediment deposit from the drainage canals is required, in particular at the downstream of cross structures (siphon, aqueduct, box culvert) with major irrigation canals. This removal work shall be required once in every 3-5 years as regular maintenance in order to control sedimentation. The sediment in the cross culvert will be naturally scored by the sediment removal of

the downstream of the culvert.

e) Miscellaneous Works

Miscellaneous works consist mainly of various types of concrete, re-bar, water proof mortar, stone masonry, some of construction machineries and manpower as shown in the proposed bill of quantities.

f) Urgent Additional Works

As additional works which has not been planned in APD II, according to this study, the works have higher emergency and it needs to carry out the rehabilitation work as a part of project area are shown the following items.

- Repairing of the Radial gate –

From Principal canal OA of Dam to a radial gate is a intake of irrigation water. Water proofed plug and parts is sever damaged and leaked without any maintenance and repairing at the beginning of setting up. At the same time, the hydraulic gear system for gate opening never functions. Steel made structure is a few damaged, so that the water proofed plug and parts, hydraulic gear unit and pipe works are only repaired.

-Installation a Concrete box culvert to cross Principal canal OA -

Close to the Primary canal OA, surface runoff water doesn't lead to the principal canal properly in heavy rain, so that runoff water flows the primary canal OA directly and the canal is eroded. Much sediment is conveyed to inside of the canals is occurred (2008 rainy season). To protect this, the concrete culvert is equipped to discharge Surface runoff water into the Gorgol river with crossing the canal.

- Repairing the Siphon SF7-

Joint part of this siphon and earthen canal was collapsed currently (2008 rainy season), and that leaked part is eroded a basement of the concrete canal attachment with the siphon, and it is almost seriously collapsed. Filling concrete and repairing of the earthen canal with joint concrete is urgent works, so it will be implemented.

- Wire fence construction –

Main cause of damaged of the earthen canal is invaded animals for drinking and transaction. To protect this, wire mesh fences which have reinforced steel or concrete poles are installed around the principal canals and primary canals. (The installation range is referred to figure5.3.2 as mentioned above.

-Construction of the drinking water for animals-

If the fences for the protection of the canals are installed, the problem of provision of drinking water for animals is occurred. As countermeasure for this problem and drinking facility for animals which farmers have, drinking place such as water tank will be constructed outside of the fences. Installed area is diversion gate (25 places), from primary canals to secondary canal. It is possible to consider installing drinking place which animals can access to water lower than surface of reserved water. Drinking place is attached with the inside of the canal. In case of this, some large premise will be prepared around the canals. It is considered as examination items at stage of the detailed design.

- Construction of Communal laundry –

Families in project area is utilized the primary canals as communal laundry at the moment. Even this situation is caused of damaged canals. On the other hand, communal laundry is necessary to women and children to use stably. Communal laundry made of concrete will be constructed in order to protect the canals and to wash clothes securely close to the canals. It is planned around each village (12places).

g) Dam Related Structures

The irrigation water diversion from the reservoir is directly controlled by a radial gate installed at the immediate downstream of the tunnel and conveyed to the principal canal OA In order to rehabilitate the radial gate, the sluice gate (stop log) and hoisting device (malfunction due to ill design) installed at the immediate upstream of the radial gate has to be repaired. Therefore these works have been included in the proposed project.

The dam is equipped with other related facilities such as intake structure in the reservoir, effluent facilities to Gorgol river and power-generating facilities etc. All are old and require either to be repaired or to be replaced, but they are not included in the component of the proposed project.

Although the dam was not included in the scope of the present Study, the Study Team conducted preliminary site survey of the dam and diagnosis on the basis of the request of SONADER. The results are indicated in ANNEX 14 and are summarized as the concrete arch dam and the foundation are sufficiently rigid, solid, water tight and stable. Quite less and acceptable leakage was observed. However, the dam related facilities are all deteriorated due to lack of maintenance, in particular, all of the hydraulic equipment are malfunction and need to be repaired or replaced.

(4) Priority of the Rehabilitation Works

The priority of the rehabilitation works is indicated in APD I. The work priority of rehabilitation is in principle assigned to irrigation and drainage facilities in upper stream area (from

principal canal, primary canal, then, secondary and tertiary canals). The irrigation canals are given higher priority than the drainage canals. It seems acceptable because rehabilitation works on the smaller scale works be undertaken on the participatory approach with the cooperatives of farmers.

There are some facilities which were fatally damaged after completion of APD II study additional work is proposed, however it is given with the highest priority. Facilities mentioned in item "(3) **f) Urgent Additional Works"** above.

The highest priority work is rehabilitation of siphon SF7 in the proposed project. The priority of the reinforced concrete lining of the principal canals was determined with SONADER to carry out from OA, AG, then AD, and its distance is far from villages and farmland.

(5) Schedule of the Rehabilitation Works

The duration of the construction scheduled proposed by the APD II is of 24 months, but the extension staffs of SONADER expected that it be shortened the most possible, because during the rehabilitation works the irrigation water supply will be in principle stopped. On the on-going PPG I project area works stops 15 months. Accordingly, the present Study also proposes after review the duration of the irrigation water stopping at 15 months. With such a program it will be necessary in peak time of the rehabilitation works, about 20 shovels (backhoe with 0.8 m^3 backet) and many of other heavy equipment should be mobilized, which is deemed to be the limited space of the construction site.

The Rehabilitation work schedule is, thus, depicted as under (the detail schedule for major canals are presented in ANNEX 4). This proposed schedule reveals that the rehabilitation works for 3 principal canals need 9 months for completion. Rehabilitation works for P1 & P2 primary canals are planned to start at 10 months after commencement of substantial work (excluding preparatory works) and to permit to resume irrigation water supply from the dam at 15 months from the commencement of the substantial works.

In the joint meeting with SONADER and cooperatives, they requested only provision of drinking water by water truck, if this project is implemented. It must be included in the plan as a temporary works together with a water distribution from Gorgol river to the existing pump station for drinking water at the center of P2 primary canal.

Schedule of Rehabilitation Work (In case of Full Plan)

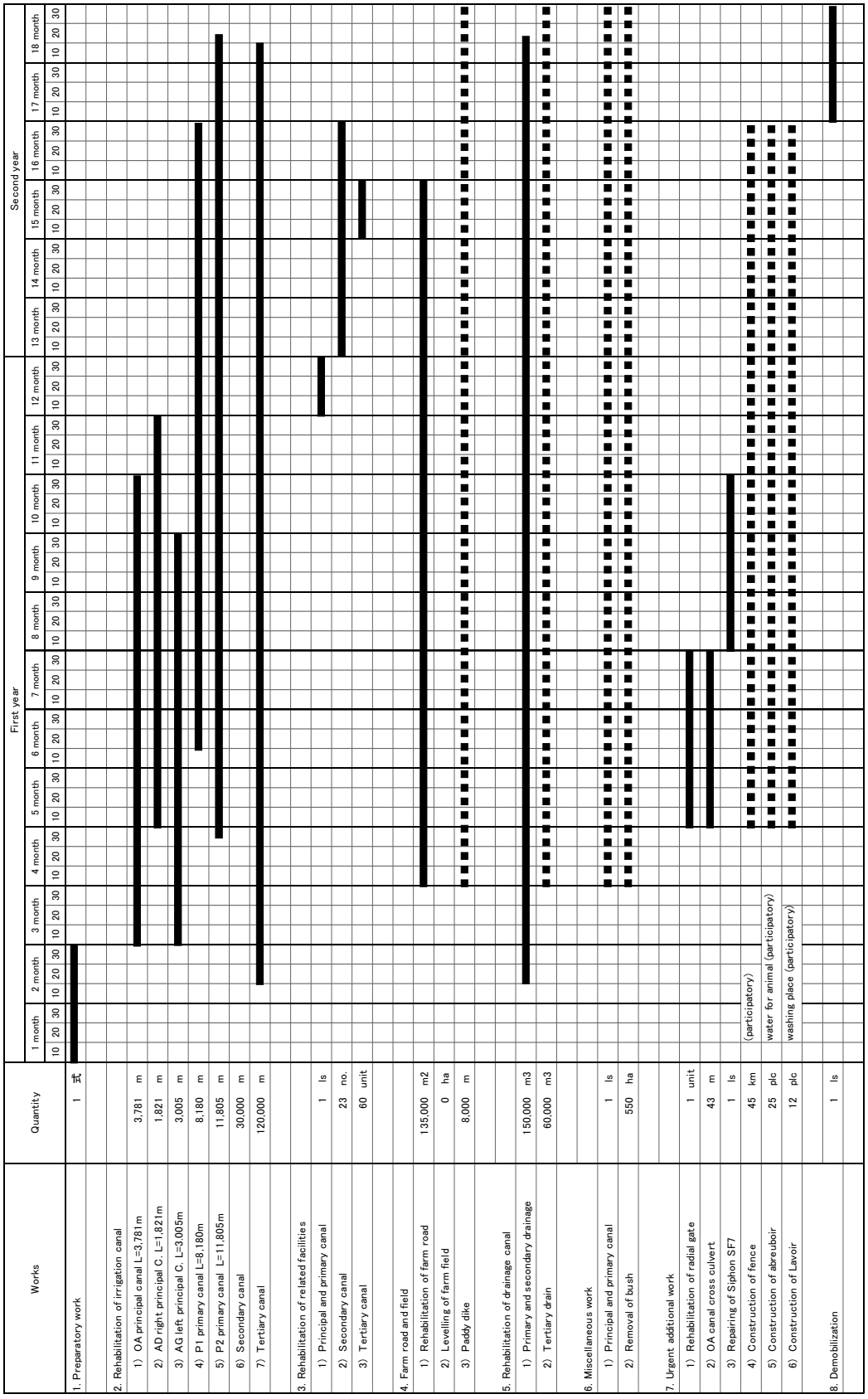


Figure 5.3.4 Construction Schedule for Rehabilitation Work

(6) Cost estimate for Rehabilitation Work of Irrigation and Drainage System

a) Premises for Cost Estimate

The financial cost of the proposed rehabilitation work is estimated on the basis of the following conditions:

- The rehabilitation works are carried out by the Contractor under a contract. The works of principal and primary canals will be conducted mainly by the Engineer and SONADER. Works at the level of the secondary and tertiary canals and plots will be conducted mainly by the Engineer, SONADER and the farmer's cooperatives and union.
- Earthwork volume was obtained from the bill of quantity in APD II with necessary correction on the basis of the supplementary topo-survey conducted by the Study Team. Reinforced concrete lining of the principal canal (Scenario B) is designed and determined the dimensions as lining thickness of 10 cm, re-bar diameter of 8 mm and re-bar interval of 15 cm.
- On the basis of APD II, the cost of construction of site office and O&M office, detailed survey, setting out, supply of equipment, furniture, office consumable are included in the preparatory works. Supply of drinking water by water truck to the farmers (4500 person x 5ltr/day for 15 months= UM 38.5 million) which are proposed by extension officers in the meeting with the union is added.

The unit prices have been determined on the basis of APD II (Foum Gleita, beginning of 2007) and on the unit prices of the tender price of the PPG1 project area (beginning of 2009), considering the increase of the prices on the data of the IMF and the consumer price index of the statistic office of Mauritania: it was 18% from 2007 to 2010.

b) Financial Price of Full Rehabilitation Plan

The financial price of rehabilitation cost at the beginning of 2010 is estimated and summarized below. The total cost of full rehabilitation plan excluding physical contingency, tax and custom duty was estimated at 4,220 million UM.

Table 5.3.2 Financial Price of Full Rehabilitation Cost

No.	Works (categories)	Costs (mUM)
1	Preparatory work (preparation, temporary construction, management, mobilization)	241.2
2	Rehabilitation of the irrigation canals	3,147.1
3	Rehabilitation of the related structures	123.8
4	Farm roads, plots	84.4
5	Rehabilitation of the drains	151.0
6	Miscellaqneous works	177.9
7	Additional urgent works	294.5
	Total	4,219.9
	Physical contingency (+10%)	

Source: SONADER 2007

(7) Economic price of Full Rehabilitation Plan

The economic price of the full rehabilitation plan was estimated on the basis of the following conditions:

- The economic price of the full rehabilitation plan was estimated in foreign currency and in local currency portions. The proportion of foreign currency portion employed in the every category of works in APD II is used in the present estimate.
- Economic price of the foreign currency portion is equal to the financial price of the foreign currency portion.
- As to economic price of local currency portion, APD II adopted 0.85 of the conversion factor to non-skilful labour and 0.9 to other local currency portion. In the present study, an average conversion factor of 0.875 was adopted to all rehabilitation works.
- Physical contingency of 10% was distributed to each work category.
- Price contingency (or future price escalation) is not included in the economic price.
- From the view point of project economy, it can be deemed that the rehabilitation cost of the principal and primary canals will be allocated by the existing 1950ha and the downstream 1650ha to be developed in future. Therefore the total economic cost for 2 cases will be estimated to compare the project economy, i.e., (1) Unallocated case : the total economic rehabilitation cost is borned by only 1950ha; and (2) Allocated case : the total economic cost is allocated to 1950ha with a proportion of 1950ha/3600ha/

The economic price of rehabilitation cost is summarized as under.(The detail is referred to ANNEX4.) The economic price of rehabilitation cost except physical contingency and excluding tax and custom duty was estimated at 4,332.3 million UM for Unallocated case.

Table 5.3.3 Economic Prices of Full Rehabilitation Cost (Unallocated: mUM)

No.	Works (category)	First financial year	2nd financial year	Total (mUM)
1	Preparatory work (preparation, temporary construction, management, mobilization)	230.4	25.6	256.1
2	Rehabilitation of the irrigation canals	2,569.7	642.4	3,212.1
3	Rehabilitation of the related structures	99.6	24.9	124.6
4	Farm roads, plots	52.9	35.3	88.2
5	Rehabilitation of the drains	94.7	63.1	157.8
6	Miscellaqneous works	111.5	74.4	185.9
7	Additional urgent works	184.6	123.1	307.7
	Total	3,343.5	988.8	4,332.3

The economic price of rehabilitation cost except physical contingency and excluding tax and custom duty was estimated at 2,870.7 million UM for Allocated case.

Table 5.3.4 Economic Prices of Full Rehabilitation Cost (Allocated: mUM)

No.	Works (category)	First financial year	2nd financial year	Total
1	Preparatory work (preparation, temporary construction, management, mobilization)	230.4	25.6	256.1
2	Rehabilitation of the irrigation canals	1,513.2	378.3	1,891.6
3	Rehabilitation of the related structures	99.6	24.9	124.6
4	Farm roads, plots	52.9	35.3	88.2
5	Rehabilitation of the drains	94.7	63.1	157.8
6	Miscellaqneous works	111.5	74.4	185.9
7	Additional urgent works	100.0	66.7	166.7
	Total	2,202.5	668.3	2,870.7

(8) Operation & Maintenance Cost

According to APD II (2007), the operation & maintenance cost consists mainly of removal of sediment deposit of canals, clearing of typha and bushes, maintenance of related structures, farm roads, drainage, terminal facilities and plots, and other O & M costs, which is deemed to be acceptable, and adopted to the present study after slight adjustment and price escalation. The annual O & M cost was, thus, estimated at UM 57 million for 1,950 ha (29,000 UM/ha) for financial price and UM 49 million (25,000 UM/ha) for economic price.

It is expected that SONADER will promote self-reliance of famers step by step, to increase the ratio of maintenance by famer's cooperatives and Union, then to focus on the support of the technical and management sectors. However, there were a director of civil engineer, mechanical

engineer, 5 water masters, they operated the dam and canals. In case of starting the proposed project, it is necessary to recover its system immediately.

(9) Monitoring & evaluation

During the implementation of A/P, monitoring and evaluation shall be carried out periodically to check whether its contents and schedule are appropriate. This is an indispensable process to achieve an efficient progress of the implemented project. The following tasks should be considered to conduct such monitoring and evaluation:

- Preparing a manual for monitoring and evaluation;
- Identifying information needed to conduct monitoring and evaluation;
- Establishing a system and allocating staff to guarantee a good quality of monitoring and evaluation;
- Surveying the situation of the project area on the issues such as the quantity of agricultural production and the use as well as the degree of spread of agricultural techniques;
- Developing the capacity of staff in charge of and organizing seminars on monitoring and evaluation.

To include expected costs of these tasks in the cost of implementing the project, a value that is equivalent to 3% of the estimated cost of rehabilitation work was assumed to cover such costs. This value was divided into several portions and added to the cost of A/P during its implementation.

5.3.3 Technical Cooperation Project

(1) Outline of Needs of Technical Cooperation Project

Even though the rehabilitation is conducted and is recovered function of water supply, and activation of the rural area is temporarily increasing, it may lead to the decline of the area again. Before re-establishing the functions of the water supply by rehabilitations, it should improve the supervising ability of SONADER, and it is necessary to regain farmers' trust in this area to restore the function of union at the level with achieving the purpose of establishment of union, at the same time, to promote the impartial resettlement program. It will be expected that farmers can participate in the maintenance work actively and autonomously, and they will be able to establish their system with cooperation. Moreover, to manage their smooth and vital faming after rehabilitation, it is considered that farmers should practice possibly the improved farming technologies with the problems concerned farming.

However, in this study, it is the direction to need stagnant union change into being transparency and trust by farmers. Therefore, the study team and SONADER implemented reform of union at the field. If the support will be finished, motivation of farmers and cooperatives may go down

despite their motivation is going up at present. For avoiding this situation, when the study will complete, it will be strongly expected to implement the follow up program.

From this point of view, it is expected the following period (terms) as technical cooperation project with adjustment the timing by related to this study and rehabilitation works. Specific support project in each period is shown the follows.

- Supporting period of the follow up
- Period by the completion of the rehabilitation works
- Period for after rehabilitation

(2) Technical support (soft aid)

The main elements and terms of the technical support are proposed the below.

(a) Supporting Period of the Follow up

— Necessity of Reform or Re-establishment of New Union —

In this study, the reinforcement of the organization was carried out to re-select executive members who lost trust farmers. As the result, the union and a high committee was re-established of each P1 and P2. However it is essential to do a capacity building for sustainable management so that they are luck of operation and management ability based on their experiences. It is necessary to be supported by SONADER, and administrative function is weaken at the SONADER office at the moment. Therefore, after completion of this study, it is continuously needed to improve the management ability of the union and to strengthen the number of personnel in the SONADER Foum Gleita office.

(b) Period by Completion of Rehabilitation Work

—Support for the Union and Farming Instruction of SONADER—

Though new union will be established, it is prospected that the regulations about the roles of structured department, authority, and terms are necessary to be modified and adjusted through farming activities. It is essential for management of organization to collect and utilize the irrigation charge based on activities of the union. Other activities are interesting on farmers with farming at present, like repayment through the union, procurement of fund, farming activities. And this is important for them to be started their activities as a preparation; therefore it is necessary to support them on the technical aspect.

—Resettlement Support Project—

The majority of the farmers who settled on the project area of Foum Gleita have left and

didn't cultivate anymore. To increase the agricultural production efficiently it is necessary to activate the quick return of the farmers in their farms. The program should be planned by SONADER of the government of Mauritania because candidates to the return will be selected according to organize complicated stakes.

The agriculture farms are the properties of the state of Mauritania, SONADER is in charge of them, and the farmers to wishing to work get it a right of use. After the rehabilitation of the network a large number of farmers should come back, and many others newcomers will be candidates. Of course it is the local government that should select the candidates who wanted to settle on the project area, because it goes of the security and the life of the citizens of the region. Some of farmers don't have interesting in farming and it is also possible that those that lived on the project area before the beginning of its exploitation claim a priority. Farmers who make a living as a farmer, and are willing to farm should be selected so that it is activated agriculture in the project area. Moreover, each organization should support it in an impartial position, and support to prepare a proper resettlement plan.

(c) After Completion of the Rehabilitation

—Management of irrigation farming—

It is estimated that farmers of resettle after rehabilitation who were apart from agriculture and return to farm again or come from outside of project area and start agriculture are the majority. Those who are not used to agriculture and backward agricultural techniques would be included in the training, it is necessary to provide technical assistance.

Unlike what it was, it is desirable that farmers' participatory management of irrigation and drain facilities. It is an important point to operate and manage of shared facilities by self action of farmers and agricultural organization. Moreover, it has much to learn from revitalization and sustainability such as collecting water charge and management, procurement of fund for farm management and marketing agricultural products by collaboration with farm management in new organization. These actions will be followed instruction of SONADER, MDR or external assistance. The contents which would be conducted in this support are as below.

- Exploitation in collaboration among SONADER, the union and the farmers
- Financing and repayment for farming
- Continuing of a system for the use of the water royalties and payment
- Repairing and maintenance of the secondary canals and underneath
- The management of farming equipment for general use
- The training on the techniques of management and the storage of agriculture product
- The management of livestock

- Common training in agriculture technique

5.3.4 Input Support

(1) Background and Necessity of the Project

After the rehabilitation of the project, when the farmers once again start the cultivation in the rehabilitated area, they would need the support of inputs including seeds and fertilizers especially for the first cropping season. Presently, the farmers do not have enough financial resources to arrange the inputs by themselves. Besides, at the present situation, the farmers are not eligible to borrow money from UNCACEM to buy the inputs. Therefore, an input support project is planned to be executed in corresponding to the starting of cultivation. The details of the input support project are mentioned below.

(2) Outline of the Project

According to the implementation schedule, it is planned that the rehabilitation shall be completed until 2013. Hence the cultivation in the project area can be started from 2014. Since the resettlement in the Foum Gleita area and starting of cultivation will take some time, it is planned such that the full area can be cultivated in 3 years period from 2014 to 2016. Correspondingly the inputs support needs to be provided from 2014 to 2016, and the requirement of the inputs is shown in the following Table 5.3.4.

Table 5.3.5 Requirement of the Inputs

Year	Area (ha)	Requirement of Inputs			Requirement per ha
		Seeds (ton)	Urea (tons)	TSP (tons)	
2014	1,000	50	300	100	Rice Seeds = 50 kg
2015	400	20	120	40	Urea = 300 kg
2016	400	20	120	40	TSP = 100 kg

The total cost of the project is approximately estimated as 270 Million UM

(3) Implementation Organization

SONADER which is the implementation organization of the project, shall also be responsible for the implementation of the input support project. SONADER shall also find the suitable funding source for the project so that the project can be implemented as per the schedule.

(4) Possibility of Financial Support for the Project

At the beginning of the rehabilitation project, the Mauritanian government should take necessary efforts to arrange the finance for the project. If possible, the finance can be arranged in the national budget. Otherwise, the possibility of international support shall be tried.

5.3.5 Agricultural Machinery Support Project

(1) Background and Necessity of the Project

In Foum Gleita, all the farming operations including plowing, transplanting, harvesting, threshing etc., are done manually. These operations require a heavy labor, and sometimes some of the farm operations such as transplanting are done by young children, and when the transplanting works are not done properly with optimum spacing and depth, the yields will be also relatively low. In some cases, the farming operations are not carried out in time, which also result in low production. During the field survey, the farmers showed their deep interest in using farm machinery. Presently, some cooperatives are hiring the private tractors from Lexeiba for ploughing, but the farmers pointed out that the private tractors are generally not willing to travel 50 km in the rainy season. Apart from the machinery for the farming operations, there is no machinery available for transport or for measurement of agricultural production. Hence, it is proposed that an agricultural machinery support project shall be implemented so that all the farming operations according to strict farming schedule.

(2) Outline of the Project

a) Requirement of Machinery

The requirement of agricultural machinery for the project area is as bellow:

Table 5.3.6 Requirement of Agricultural Machinery

No.	Agricultural Machinery	Number of Units
1.	Tractors with Accessories	6
2.	Combine harvester (Small design)	15
3.	Power tiller with accessories	15
4.	Thresher	15
5.	Winnower	15
6.	Trucks	4
7.	Instruments of measurement of rice quality	2
8.	Weighing scale for agriculture products	15

It is estimated that the cost of the above agricultural machinery is approx. 275 million UM, including a 15% cost for spare parts.

b) Priorities of Machinery

While the agricultural machinery support project shall be implemented stage by stage, the initial requirement of the machinery shall be as follows. Specially, to improve the labor force of ploughing and harvesting, which is the heaviest work, tractor and combine harvester should be installed preferentially.

Table 5.3.7 Priorities of Agricultural Machinery

No.	Agricultural Machinery	Number of Units
1.	Tractors with Accessories	2
2.	Combine harvester (Small design)	5
3.	Power tiller with accessories	5
4.	Thresher	5
5.	Winnower	5
6.	Trucks	2
7.	Instruments of measurement of rice quality	1
8.	Weighing scale for agriculture products	5

c) Implementation Schedule

According to the implementation schedule, it is planned that the rehabilitation shall be completed until 2013, and the cultivation can be started from 2014. Therefore, the farm machinery should be available since the beginning of 2014.

(3) Implementation Organization

Basically it is desirable to utilize farm machinery in local private company, farm machinery in Kaedi is deteriorated and the number is limited, hence it is difficult to procurement. On the other hand, SNAAT under MDR is equipped with sort of farm machinery and rents farm machinery to local area. It is effective means to establish a permanent antenna office in Foum Gleita with farm machinery and technical staffs. At least it is expected an intermediary function with SONADER.

(4) Possibility of Financial Support for the Project

Even though, it is possible to utilize farm machinery in Foum Gleita, and to put in farm machinery to lease traders in Kaedi and SONADER, concern on the management ability is remaining both of them. Some of the farm machinery is already available in SNAAT, it is planned to get new machinery and equipment. It is efficient that SONADER establishes necessary contacts with SNAAT to set up an antenna office in Foum Gleita to be able to use farm machinery through a year.

5.3.6 Extension Activities Support Project

(1) Background and Necessity of the Project

Presently, the farmers in Foum Gleita are attaining a low rice yield of about 2 t/ha, where as the average yield of rice in the PPGI & II, and Lexeiba is usually 4 t/ha or more. In PPG I & II, the farmers have been trained by the SONADER, Kaedi since 1975. Similarly, the Lexeiba farmers are also well trained in farming since the previous generation. On the other hand, the farmers in Foum Gleita project who had very little experience in rice farming before starting the Foum Gleita project,

have received very little extension training until now.

Through the verification trials in the project area, it was found out that the major reasons for the reduction in the yield are mainly due to a series of sub-optimal farm management practices including poor quality of seed, minimal land preparation, non-application of phosphate fertilizer, poor fertilizer management, poor transplanting, no drainage after maturity and delayed harvest. Since the farmers have not received any training, proper technologies are not adapted in rice cultivation from transplanting to harvesting. The same problem exists in the case of vegetables production also, resulting in poor yields in Foum Gleita project area.

Presently, the extension support provided by SONADER is limited due to limited number of staff, and facilities to carry out the extension services such as transport of extension personnel to the farmers exists in therefore, after the rehabilitation of the project area, the extension services shall also be improved.

(2) Outline of the Project

a) Number of Extension Staff

During the hearing survey of the extension staff, it was informed that about 200 ha can be covered by one extension agent in consideration of the terrain, and the time required to meet the farmers. Therefore, the extension staff required for the project area is planned as follows:

- P1 area - 811 ha - 4 extension agents
- P2 area - 1,134 ha - 6 extension agents

One Manager for the whole project area

c) Transport Facilities Required

Since the transport facilities are critical to carry out the extension works, 11 motor cycles are proposed for the 11 staff of the extension section.

d) Implementation Schedule

According to the implementation schedule, it is planned that the rehabilitation shall be completed until 2013, and the cultivation can be started from 2014. Therefore, the extension support should be available since the beginning of 2014.

(3) Implementation Organization

SONADER will be the implementation organization of the extension support project. During the rehabilitation stage, SONADER shall acquire necessary budget for the implementation of the

project.

5.3.7 Maintenance of Irrigation Facilities

(1) Background and Necessity of the Project

For the middle and long term management of irrigation farming, these should be necessarily an autonomous maintenance system for the irrigation facilities. In this study, following points were found as main reasons why irrigation facilities couldn't supply sufficient amount of water: 1) there are many points with little free board in primary canals, 2) livestock damages dikes of canals, 3) the canals are clogged by sediment, 4) the overgrowth of typha hinders water flow. As the background of the problem, there is the lack of maintenance budget, because the fixed fees are not collected and facility maintenance is not taken in effect because of the serious financial situation of SONADER. Recently, even in irrigable areas, irrigation water is often cut during farming because of the floods from weakened points of dikes and the collapse of the primary canals, such a situation discourage farmers' willingness to cultivate. The mismanagement of fixed fees by SONADER is also pointed out.

Since the government carries out transfer of management of irrigation facilities to farmers' organization due to financial constraints, and farmers' ownership, a realistic methodology to improve would be to give the main responsibility to farmers' organization after the rehabilitation projects and advisory rate to SONADER for the technical assistance. Currently fixed fees are not collected, but it will be necessary to institute a clear fund management system to start collection again.

(2) Review of the Fixed Fee

As for the maintenance cost in the future, it is accounted for removal of sediment deposit of irrigation canals, weeding of slopes, operation and maintenance for facilities, repairing of farm roads, repairing of drainage canal, development of terminal facilities / plots, and maintenance cost. It is estimated 29,000UM/ha about two times at present fixed fee will be needed. This is profit in 2% (613,000UM), comes from irrigated farming after rehabilitation works. It is fully possible to pay. However, after completion of the rehabilitation works, until farm activities will be well practiced, concerning experience which they have managed without autonomy, it may be difficult for farmers to pay fixed fee newly. If the union and SONADER function properly, farmers are willing to pay fixed fee as usual. For this reason, it is desirable to be escalated fixed fee with increasing of farmers' income, as if fixed fee will be set 16,500UM/ha in first year just after completion of rehabilitation works, 20,000UM/ha in second year, 25,000UM/ha in third year, then 29,000UM/ha in fourth year.

In the long term, even though fixed fee is raised possibly, it is assumed that extensive repair works will be necessary, if fixed fee is not enough. Presently, flooding water discharged from Wadi reduced drainage ability is flooded from principal canal, and then canal embankment was broken

sometimes. If principal canal embankment is collapsed, this works is delegated to contractors not to arrange without heavy machinery. There are not saved fixed fee and maintenance fee of SONADER, so that MDR haired contractors directly and let them do repair works, if farmers claimed. However, it took long time to respond it, harvest time had been affected. It is important to establish the systems in order to communicate and respond to each other quickly, from farmers to SONADER, and then to MDR.

(3) Outline of the Project

The maintenance works of the irrigation facilities are divided into three categories: regular works, particular works and contracted works as shown in a table below. Immediately after the rehabilitation, only regular works will be needed, but after some years, necessity of particular and contracted works will be increased gradually.

Table 5.3.8 Category of Maintenance and Details

Category	Principal responsible	Details of works
Regular	The union is in charge of preparing the program of works with the collaboration of SONADER and instructs works to each cooperative.	Weeding twice a year (before and after rainy season). The tertiary canals are maintained by the cooperatives; the secondary and primary canals by union. The fixed fees are collected by cooperatives and managed by the Union.
Particular	The union is in charge of preparing the program of works with the collaboration of SONADER and conducts works	The Union manages all works to be done by manual such as reinforcement of canals and roads, repair of structures, desiltation of canals smaller than secondary.
Contracted	The union is in charge of preparing the program of works with the collaboration of SONADER and order works to contractors. Contractors implement works.	Excavation works requiring heavy equipments, concrete works requiring specialists, etc.
Water master	Water masters to maintain in facilities are assigned by cooperatives for 3 canals and by the Union for primary canals.	They are in charge of water distribution in normal period, patrolling the area, chasing animals and repair and irrigation of facilities.

(4) Implementing Organization

Until now, farmers did not practice maintenance of main facility and regular works, although these works should be conducted mainly by farmers. Therefore they must be assisted by SONADER for setting up maintenance programs and implementation of works. Therefore maintenance capacity of SONADER and farmers' organizations is improved in the rehabilitation project and the support will be continued in the following technical assistance, to realize autonomous maintenance by farmers' organization.

(5) Possibilities of Financial Support for the Project

Completion of the rehabilitation right now, it is possibly needed to be supported funds and

machinery by government, Farmers will be responsible for fee payment, fund management and decision making by themselves in the middle and long term. However, for the management and use of the funds, farmers will be assisted by SONADER to avoid corruption. Therefore, a transparent financial management system should be established. In this case, it is worth considering to adopt the audit system by the official third-party organization in Senegal.

5.4 Evaluation of A/P

Cost-benefit analysis was conducted based on the collected data in order to evaluate the impact of the implementation of the A/P on the farm economy of Foum Gleita and also on the whole economy of Mauritania.

5.4.1 Financial Analysis of A/P

(1) Assumptions Made in the Analysis

As reported in Chapter 3, a large disparity in wealth was found among the households interviewed in the farm economic survey in Foum Gleita, and the importance of each economic activity in the family budget varied. Consequently, it is expected that influence of A/P would also be different across households. Taking this fact into consideration, the conditions of average farmers in Foum Gleita and the influence of A/P upon their production activitie are assumed as follows.

Table 5.4.1 Assumptions on Production Activities of Average Farmers in Foum Gleita before and after the Implementation of A/P

Crop	Present Conditions	After implementation of A/P
Rice	It is assumed that they have a cultivation right of 0.5ha in the project area, and cultivate 0.5ha in rainy season and 0.25ha in hot dry season. The yield, selling price, and production cost per unit area are assumed to be equal to the median values among the respondents of farm economic survey (details are shown in ANNEX6).	It is assumed that the cultivation period and area do not change; the yield and selling price both increase due to the improvement in farming and marketing techniques; on the other hand, the production cost per unit area also increases due to the increase in the fertilizer use and mechanization of some farming procedures (Details are shown in ANNEX6).
Vegetables	It is assumed that the vegetables are cultivated in 0.25ha area in cold dry season in the perimeter. Analysis includes only main crops, which are onion, cabbage, and carrot. The cultivated area, yield, selling price, production cost per unit area of each vegetable is assumed to be equal to the median values among the respondents of farm economic survey (details are shown in ANNEX6).	It is assumed that the cultivation period and area do not change; out of the 0.25ha area, onion is cultivated in 0.125ha (50%), cabbage in 0.05ha (20%), and carrot in 0.025ha (10%); the yield and selling price increase due to the improvement in farming and marketing techniques; on the other hand, the production cost per unit area also increases because of the increase in fertilizer use, application of agricultural chemicals, and other reasons. (Details are shown in ANNEX6）.
Other crops	It is assumed that maize, cowpea and sweet potato are cultivated in the cold dry season in floodplains (outside of the perimeter); sorghum is cultivated in rainy season in rainfed field; and cultivated area, yield, selling price, production	No change

Crop	Present Conditions	After implementation of A/P
	cost per unit area of each crop are equal to the median values among the respondents of farm economic survey (Table 3.3.16).	
Livestock	It is assumed that the production value and production cost per year are equal to the median values among the respondents of farm economic survey (Table 3.3.16).	No change (Although a reduction in the feed cost is expected as a positive side-effect of increase in rice production, it is not included in the analysis here).
Others : Income by migrant work is excluded from the analysis. It is assumed that the number of family members in one household is 7.0 adult persons, and the family labor is enough to conduct all the productive activities of the household both before and after implementation of A/P.		

(2) Result of Analysis

The results of the financial analysis per household per year based on the above assumptions are shown in the following Table.

Table 5.4.2 Estimation of Annual Financial Condition of an Average Farm Household in Foum Gleita Before and After Implementation of A/P (UM)

	Conditions	After A/P	Balance	Notes
Rice				
Production value	56,400	311,250	254,850	Rainy season 0.5ha + Hot dry season
Production cost	41,211	125,156	83,945	0.25ha
Return	15,189	186,094	170,905	
Vegetables				Target of analysis: onion, cabbage, carrot in cold dry season (0.25ha). After implementation of A/P: Onion (0.125ha), cabbage (0.05ha), and carrot (0.025ha)..
Production value	97,203	483,875	386,672	
Production cost	10,951	56,477	45,527	
Return	86,252	427,398	341,145	
Other crops				Target of analysis: maize, sorghum, cowpea, and sweet potato All of them are cultivated outside the perimeter.
Production value	246,374	246,374	0	
Production cost	21,777	21,777	0	
Return	224,597	224,597	0	
Livestock				
Production value	50,302	50,302	0	Target of analysis: cattle, sheep, goat
Production cost	10,369	10,369	0	
Return	39,934	39,934	0	
Total Return	365,972	878,022	512,050	

Note: income by migrant work is excluded from the analysis.

The table shows that the returns from rice and vegetables will increase significantly after the implementation of A/P (As mentioned above, it is assumed that there is no change in the agriculture outside the perimeter and livestock raising after implementation of A/P). Especially, although the annual cultivated area is smaller than rice, vegetables are expected to contribute much to the family budget.

(3) Sensitivity Analysis

The sensitivity analysis was conducted to estimate how the value of total return changes if the yield and selling price of crops after A/P implementation are different from their values set in the

above analysis. With regard to the yield after A/P implementation, the upper and lower limit was set based on the information such as its current value, the results of verification trials, and documents obtained from CNRADA. With regard to the selling prices, the upper and lower limits were set in a way that they fall into the range of their usual price fluctuations, based on the data obtained from farmers and retailers and also the data on marketing price of each crop obtained from another project.

Table 5.4.3 Sensitivity Analysis 1: Yield and Selling Price of Rice and Annual Total Return per Household (1,000UM)

			Yield after A/P (paddy) (ton/ha)		
Current situation: Yield: 1.6ton/ha Selling price (paddy): 47UM/kg Total return: 366,000UM/household/year			Minimum	Standard	Maximum
			3.0 *+88%*	5.0 *+213%*	8.0 *+400%*
Selling price after A/P (paddy) (UM/kg)	Minimum	60 *+28%*	710 *+94%*	792 *+116%*	915 *+150%*
	Standard	83 *+77%*	761 *+108%*	878 *+140%*	1,053 *+188%*
	Maximum	100 *+113%*	800 *+118%*	942 *+157%*	1,155 *+216%*

The "standard" is the value used in the analysis of Table 5.4.2. The italicized figures are the increase compared to the current values. As shown in Table 5.4.2, the contribution of vegetables is 427,000UM (+93%), that of other crops is 225,000UM (+0%), and that of livestock is 40,000UM (+0%). Therefore, subtracting the sum of these values (692,000UM, +93%) from the values in the table above represents the contribution of rice .

Table 5.4.4 Sensitivity Analysis 2: Yield and Selling Price of Vegetables and Annual Total Return per Household (1,000UM)

					Yield after A/P (ton/ha)								
Current situation: Yield: (onion) 8.5 t/ha, (cabbage) 10.1 t/ha, (carrot) 13.4 t/ha Total return: 366,000UM/household/year					Minimum			Standard			Maximum		
					Onion	Cabbage	Carrot	Onion	Cabbage	Carrot	Onion	Cabbage	Carrot
					10.0	15.0	20.0	15.0	20.0	30.0	30.0	30.0	35.0
		Onion	Cabbage	Carrot	*+11%*	*+50%*	*+54%*	*+67%*	*+100%*	*+131%*	*+233%*	*+200%*	*+169%*
Selling price after A/P (UM/kg)	Min. = Current	80 *+0%*	76 *+0%*	148 *+0%*	631 *+72%*			731 *+100%*			925 *+153%*		
	Standard	109 *+36%*	125 *+64%*	206 *+39%*	733 *+100%*			878 *+140%*			1,158 *+216%*		
	Max.	150 *+88%*	200 *+163%*	300 *+103%*	887 *+142%*			1,100 *+201%*			1,506 *+312%*		

The "standard" is the value used in the analysis of Table 5.4.2. The italicized figures are the increase compared to the current values. As shown in Table 5.4.2, the contribution of rice is 186,000UM (+47%), that of other crops is 225,000UM (+0%), and that of livestock is 40,000UM (+0%). Therefore, subtracting the sum of these values (451,000UM, +47%) from the values in the table above represents the contribution of vegetables.

Combining the results in the above two tables, it is expected that under the good conditions (high yield and high selling price) for both rice and vegetables, the total return can reach nearly 5 times the current situation (+123% by rice, +265% by vegetables, total of +388%) after implementation of A/P. On the other hand, under the bad conditions (low yield and low selling price), the total return is expected to remain less than 1.3 times the current situation (+1% by rice, +25% by

vegetables, total +26%).

(4) Conclusions

If the A/P is implemented, farmers in Foum Gleita must give up cultivation in perimeter for 2 years. In addition they must provide labor to rehabilitate end canals that carry water to their plots. Whether the A/P is attractive to farmers despite these negative impacts depends on how much returns the A/P implementation will bring to them. According to the above analysis, it is expected that under the standard conditions, A/P implementation will increase farmers' annual total return to more than double of its current value (+47% by paddy, +93% by vegetables, total +140%), while about 1.3 times at the lowest estimate. Therefore, it could be judged that the A/P will be attractive to many farmers.

It was also found that farmers could not expect too much on the return they will obtain from rice farming after A/P implementation. As was estimated in Chapter 3 Section 3.4, if their annual living expenses per household are roughly 608,000UM, this amount is well above the expected return that farmers will obtain by selling all the harvest of rice after A/P implementation (186,094UM, Table5.4.2). Therefore, it cannot be expected that Foum Gleita farmers will be able to cover all the living expenses only by rice farming. Even if the yield of 8,000kg/ha and the selling price of 100UM/kg, the upper bound in the above sensitivity analysis, are realized, the value of products will be 600,000UM (8,000kg/ha×0.75ha×100UM/kg). To sum up, while the profitability of rice farming will certainly increase by A/P implementation, there is little possibility that farmers be able to sustain their lives only by rice farming, as far as the farm land area is limited to 0.5ha per household. Production of vegetables is essential for the development of farm economy.

5.4.2 Economic Analysis of A/P

Next, cost-benefit analysis was conducted to analyze the influence the A/P upon all economy of Mauritania.

(1) Assumption Made in the Analysis

Economic analysis of the A/P was conducted based on the following assumptions.

Table 5.4.5 Assumption on Economic Analysis of A/P

Item	Contents of assumption
Project years	Project years of A/P are set to be 50 years
Cost of rehabilitation	Results of estimation in the previous section are used.
Technical support cost	It is assumed that 10% of the total cost of rehabilitation（unallocated case）is needed. The amount is divided into three and included as a cost from first to third year.
Labor cost	The opportunity cost of farm work is set to be 425UM/man-day (by multiplying 500UM/man-day by 0.85 as the conversion factor for unskilled labor).
Target crop of analysis and	As in the previous section, rice and vegetables (onion, cabbage, and carrot) are included in the analysis. Expansion of cultivated area after A/P implementation follows the

Item	Contents of assumption
cultivated area	scenario estimated in Figure 5.3.1 (that is, cultivated area is step wisely expanded from third year, and reaches in eighth year 1,800ha of rice farming in rainy season, 900ha of vegetable farming in cold dry season, and 900ha of rice farming in hot dry season). On the other hand, it is assumed that the current situation does not change during the project years if the A/P is not implemented.
Yield	It is considered that whether or not the A/P is implemented, there will occasionally be years in which production decreases much because of flood. To include this negative effect in the analysis, the yield of rice and vegetables are multiplied by 0.95, that is the damage of flood is averaged into each year's decrease in yield.
Exchange rate	US$1.00 = UM265.4 = ¥91.53. These exchange rates are the average of monthly inter-bank rates of OANDA Currency Converter between January and May 2010.
Economic price	Import parity prices are calculated only for rice, urea, and TSP (see ANNEX6 for details). For most of the other prices, the value derived as market price times the standard conversion factor of 0.85 is used.

(2) Result of Analysis

Results of analysis based on the above assumptions are shown in the following table.

Table 5.4.6 Economic Analysis of A/P (Unallocated) (million UM)

	Without implementation	With A/P Implementation, project years										
		1	2	3	4	5	6	7	8-27	28	29-49	50
Inflow												
Production Value												
Rice	41	0	0	260	473	641	821	1,013	1,218	1,218	1,218	1,218
Vegetable	112	0	0	320	477	663	881	1,128	1,407	1,407	1,407	1,407
Residual value										0		420
Total inflow	153	0	0	580	950	1,304	1,702	2,142	2,625	2,625	2,625	3,044
Outflow												
Investment												
Rehabilitation work using heavy machine	0	3,344	989							695		
Small scale rehabilitation by farmers	0	15	4							0		
Incremental O&M	0	0	38	71	71	71	71	71	49	49	49	49
Incre. working capital	0	0	230	66	30	30	31	32	0	0	0	
Technical support	0	180	180	180	0	0	0	0	0	0	0	0
Operating expenditure												
Rice	56	0	0	419	542	574	606	638	672	672	672	672
Vegetables	37	0	0	157	199	242	286	331	378	378	378	378
Total oper. expenditure	93	0	0	575	741	815	892	969	1,049	1,049	1,049	1,049
Total outflow	93	3,504	1,406	857	841	916	993	1,072	1,098	1,793	1,098	1,098
Net Benefit												
Net benefit	59	-3,504	-1,406	-277	109	388	708	1,070	1,526	832	1,526	1,946
Incremental net benefit		-3,563	-1,466	-336	49	329	649	1,010	1,467	772	1,467	1,887

Net present value (NPV) at discount rate of 12% = 1,875 million UM
Internal Rate of Return (IRR) = 0.15
Benefit Cost ratio (B/C) = 1.18

表5.4.7 Economic Analysis of A/P (Allocated) (million UM)

	Without implementation	With A/P Implementation, project years										
		1	2	3	4	5	6	7	8-27	28	29-49	50
Inflow												
Total inflow	153	0	0	580	950	1,304	1,702	2,142	2,625	2,625	2,625	3,044
Outflow												
Rehabilitation work using heavy machine	0	2,203	668							695		
Total outflow	93	2,363	1,085	857	841	916	993	1,072	1,098	1,793	1,098	1,098
Net Benefit												
Net benefit	59	-2,363	-1,085	-277	109	388	708	1,070	1,526	832	1,526	1,946
Incremental net benefit		-2,422	-1,145	-336	49	329	649	1,010	1,467	772	1,467	1,887

Net present value (NPV) at discount rate of 12% = 3,150 million UM
Internal Rate of Return (IRR) =0.19
Benefit Cost ratio (B/C) = 1.35

Note：The values that are different compared to the unallocated case are highlighted.

a) Benefit

Without A/P implementation, it was estimated that the benefit from rice and vegetables farming amounts to 153 million UM/year in whole Foum Gleita. On the other hand, with A/P implementation, the benefit in the first and second year is zero as farmers cannot cultivate because of the rehabilitation work. However, from the third year, it was estimated that the benefit would increase every year, and it would reach 2,625 million UM/year in the eighth year.

b) Cost

Without A/P implementation, it was estimated that the cost of rice and vegetables farming amounts to 93 million UM/year in whole Foum Gleita. On the other hand, with A/P implementation, it was estimated that the total outflow as the sum of (1) cost of rehabilitation work using heavy machine, (2) cost of small scale rehabilitation work done by farmers, (3) incremental cost of operation and management (including the cost for monitoring and evaluation under implementation of A/P), (4) incremental working capital, (5) Cost of technical support, and (6) operating expenditure for farming would first decline from 3,504million UM (Unallocated) or 2,363 million UM (Allocated)in the first year to 841 million UM in the fourth year, and later increase step wisely to reach 1,098 million UM in the eighth year.

c) Evaluation

Without A/P implementation, it was calculated, as the balance of the above benefit and cost, that the net benefit of 59 million UM/year would be generated by rice and vegetable farming in Foum Gleita. On the other hand, with A/P implementation, it was calculated that the net benefit would increase every year starting from -3,504 million UM (Unallocated) or -2,363 million UM (Allocated) in

the first year, turning to positive in the fourth year, and reaching 1,526 million UM in the eighth year. Therefore, incremental net benefit (balance of net benefit between with and without A/P implementation) starts from -3,563 million UM (Unallocated) or -2,422 million UM (Allocated) in the first year, turns to positive in the fourth year, and reaches 1,467 million UM in the eighth year.

In the unallocated case, at a discount rate of 12%, net present value (NPV) was calculated to be 1,875 million UM, while Internal Rate of Return (IRR) to be 0.15, and Benefit-Cost ratio (B/C) to be 1.18. In the allocated case, at a discount rate of 12%, net present value (NPV) was calculated similarly to be 3,150 million UM, while Internal Rate of Return (IRR) to be 0.19, and Benefit-Cost ratio (B/C) to be 1.35. Based on this result, it can be concluded that the implementation of A/P is justified, as long as mutually exclusive projects with higher profitability do not exist.

With regard to rice farming, as reported earlier, considerable time is spent for watching bird and animals in Foum Gleita. As a result, labor cost is high, and the current net benefit was calculated to be negative (for all Foum Gleita area, benefit of 41million UM－the cost of 56 million UM = -15million UM/year). With A/P implementation, it was estimated that net benefit turns to positive after the fifth year due to the increase in yield through improvement of farming techniques and also due to the increase in selling price through improvement of the marketing ability.

(3) Sensitivity Analysis

The values of benefit and cost can divert from the above estimated values for various reasons. Recalculated IRRs corresponding to such changes are shown in the table below.

Table 5.4.8 Sensitivity analysis 3: Change in Benefit and Cost and IRR

		Cost					
		Unallocated			Allocated		
		-10%	No change	+10%	-10%	No change	+10%
Benefit	+10%	0.20	0.17	0.15	0.24	0.21	0.19
	No change	0.17	0.15	0.13	0.21	0.19	0.16
	-10%	0.15	0.13	0.11	0.19	0.16	0.14

It is estimated that if benefit increases by 10% and at the same time cost reduces by 10%, the IRR will be 0.20（Unallocated）or 0.24（Allocated）. On the other hand, if benefit declines by 10% and at the same time cost increases by10%, the IRR will be 0.11（Unallocated）or 0.14（Allocated）.

Next, similarly to what was done in the household financial analysis, it was analyzed for the unallocated case how IRR would change, if the values of yield and selling prices of rice and vegetables are different from the ones estimated above. As for the yield, the same upper and lower bound as used in the financial analysis were used here, too. As for the selling prices, the upper and lower bounds were set equal to ±20% the prices used in the analysis of table 5.4.6. Each result is as follows.

Table 5.4.9 Sensitivity Analysis 4: Yield and Selling Price of Rice and IRR（Unallocated）

			Yield after A/P (paddy) (ton/ha)		
			Minimum	Standard	Maximum
Current situation: Yield: 1.6ton/ha			3.0 *+88%*	5.0 *+213%*	8.0 *+400%*
Selling price after A/P (paddy) (UM/kg)	Minimum	76 *-20%*	0.10	0.13	0.17
	Standard = Current	95 *+0%*	0.11	0.15	0.20
	Maximum	114 *+20%*	0.13	0.17	0.22

The "standard" is the value used in the analysis of Table 5.4.2. The italicized figures are the increase compared to the current values.

Table 5.4.10 Sensitivity Analysis 5: Yield, Selling Price of Vegetables and IRR（Unallocated）

					Yield after A/P (ton/ha)								
Current situation :Yield : (onion) 8.5ton/ha, (cabbage) 10.1ton/ha, (carrot) 13.4ton/ha					Minimum			Standard			Maximum		
					Onion	Cab'ge	Carrot	Onion	Cab'ge	Carrot	Onion	Cab'ge	Carrot
					10.0	15.0	20.0	15.0	20.0	30.0	30.0	30.0	35.0
			Onion	Cab'ge	Carrot	*+11%*	*+50%*	*+54%*	*+67%*	*+100%*	*+131%*	*+233%*	*+200%*	*+169%*
Selling price after A/P (UM/kg)	Minimum		74 *-20%*	85 *-20%*	140 *-20%*	0.10			0.13			0.18	
	Standard = Current		93 *+0%*	106 *+0%*	175 *+0%*	0.12			0.15			0.20	
	Maximum		112 *+20%*	127 *+20%*	210 *+20%*	0.13			0.17			0.23	

The "Standard" is the values used in analysis of Table 5.4.2. The italicized figures are the increase compared to the current values.

The table shows that the changes in the economic prices of paddy and vegetables within ± 20% of the standard (current) values would not affect much the value of IRR. On the other hand, if the yield of either rice or vegetables takes its minimum value (keeping other conditions unchanged), IRR declines to 0.11（in case that yield of paddy is the lower limit）or 0.12（in case that yield of vegetable is the lower limit）. This implies that the change in yield within the estimated range has a major influence on the profitability of A/P. Furthermore, if the yields of both rice and vegetables fall into their minimum values at the same time (without any change in selling prices), the IRR was calculated to be 0.07. Therefore, the yield would be a key to determine the profitability of A/P.

(4) Conclusions

From the results of financial analysis reported earlier, it is clear that it is necessary to promote not only rice but vegetable farming to improve the households' income of farmers who are basically allowed to cultivate only 0.5 ha in the perimeter. Also, the results of economic analysis indicate that it is essential to improve the yield of rice and vegetables, through means such as technical

support during the implementation of the A/P, for it to be justified as a project.

5.5 Formulation of Model for Gorgol Region

5.5.1 Study Area of the Model for Revitalization of Irrigated Agriculture

The Study area of the model for revitalization of irrigated agriculture (hereinafter called the Model) are PPGI, PPGII, and Lexeiba pump irrigation systems located in Gorgol Region, and Foum Gelita with a gravity irrigation network. The common aspects of these project areas are the large scale of the projects, rice production, and the management by the cooperatives and union, although they have different features, such as irrigation types, geographical conditions, sizes and farmers' characters. Their problems are also similar in relation to government support, farming system, mechanization, farmer's organization, etc. It is expected that the productivity and farmer's livelihood conditions will be improved by the formulation of the Model of revitalization of irrigated agriculture.

5.5.2 Problems and Countermeasures of Irrigated Agriculture in the Region

Problems of irrigated agriculture in the area are reviewed here. In order to do that, some problems and countermeasures observed in Foum Gleita, whose conditions are the worst in the region, are extracted to apply to all the other irrigation areas.

As shown in Figure 5.1.3, the main problem in Foum Gleita, the malfunctioning of organization has been identified behind the three axes (low selling price, low productivity, reduction of cultivated area). Regarding to those problems, commonality between Foum Gleita and other areas is studied and the results are shown in the table below.

Table 5.5.1 Common Problems between Foum Gleita and Other Areas

Primary problem	Secondary problem	Commonality
Malfunction of organization	The commonality with other areas is identified as relatively high. Compared to Foum Gleita, whose union has not been functioning, other areas have operational unions in the autonomous way. However, personnel and organization have been renewed in Foum Gleita union and minimum conditions are prepared. There are still some rooms for improvement even in other areas.	
	SONADER	The commonality is identified as medium. Lexeiba with small irrigation areas are completely different from Foum Gleita and PPG, in respect of no support from SONADER. SONADER has been distrusted by Foum Gleita farmers due to past background, on the other hand, SONADER and farmers trust each other in PPG. However, SONADER should play bigger roles on farmers' organization support, and such improvement benefits the whole region.
	Union	The commonality is identified as medium. As mentioned, the Union was reconstructed and established a base for improvement in Foum Gleita. But there are still big differences of management ability with other areas. However, there are still some rooms for improvements even in other areas.
	UNCACEM	The commonality is identified as high. Input loan for rice has high demand in all areas. It is important for UNCACEM to play a proper role to provide the fund. Delay of input procurement brings about poor productivity.
Reduction of cultivated area	The commonality is identified as low. Deterioration of irrigation facilities is observed most seriously in Foum Gleita. Other areas maintain minimal functions and avoid the reduction of cultivated area. Additionally, rehabilitation projects are ongoing or planed in PPG and Lexseiba supported by donors. Therefore, situation of each areas are quite different. Therefore this problem is put as "unstable irrigation water supply", which is one of the causes of "low productivity". It is not listed as a major problem.	
Low productivity	The commonality is identified as high. Yield of rice is lowest in Foum Gleita, even though this problem is observed in other areas and should be improved. It is thoroughly worth discussing in the Model.	
	Delay of cropping season	The commonality is identified as high. Loan for rice in rainy season from UNCACEM is utilized in PPG and Lexeiba. However, Foum Gleita holds past debt and they are in a difficult situation. Except for such a point, delay of cropping season is a critical problem in the all areas.
	Low cultivation techniques	The commonality is identified as relatively high. Farm management in Foum Gleita is improper in terms of random planting, insufficient weeding, unappropriate timing of fertilizer. Technical level of other areas is better than Foum Gleita, although there are still rooms for improvement.
Low productivity	Difficulty of agri-machine procurement	The commonality is identified as high. In Gorgol River region, agricultural machines of private company in Kaedi are used, but it is extremely aging and low work efficiency. Originally the number of machineries is quite limited and most farmers can not use them. It is difficult to utilize SNAAT under the present condition.
	Damage from pest and disease	The commonality is identified as medium. The fence is already installed in most of the areas in PPG and Lexeiba, and the minimum measures against livestock invasion are undertaken. However, there are no fences in Foum Gleita, and animal control is a heavy burden. Although damages caused by pests, diseases and birds are common problems in the entire region, there are no effective countermeasures.
	Less input of fertilizer	The commonality is identified as low. Input of fertilizer is less than recommendation in Foum Gleita and it lowers productivity, while other areas secure high yield with recommended rate of fertilizer. Foum Gleita is under severe condition to obtain inputs due to its remoteness.
	Poor quality seed	The commonality is identified as low. In Foum Gleita it is difficult to buy seeds, so self-seed multiplication is common, but seeds are generally purchased in other areas. Since the quality of purchased seeds is certified, this problem is limited in Foum Gleita.
	Unstable irrigation water supply	The commonality is identified as low. As mentioned above, "Reduction of cultivated area", functionality of irrigation facility and countermeasure of rehabilitation are quite different in each area. Current situations on operation and maintenance are also different. In Foum Gleita, effective maintenance is not provided, but necessary functions are maintained relatively stable in other areas.
Low selling price	The commonality is identified as medium. Selling price is the lowest level at Foum Gleita. Actual situation is quite different with geographical conditions and capability of farmer's organizations. But still there are some rooms for improvement even in other areas.	
	Sales during low price season	The commonality is identified as low. In Foum Gleita, farmers suffer from a lot of problems, such as no warehouses, high interest on future trading, no opportunity to earn cash income. Therefore, they have to sell their product just after harvest, during low price season. In other areas, the market is near in Kaedi, and storage is utilized for rice. Besides, UNCASEM loan is available, so they can shift selling timing.
	Poor price bargaining power	The commonality is identified as relatively high. In Foum Gleita, farmers face no systematic marketing except for some vegetable selling, lack of market information, and high transportation cost. In other areas, farmers have systematic rice marketing for UNCACEM loan repayment, but as a whole the situation is almost same in all the areas.

From the results above, Table 5.5.1 shows common problems for irrigated agriculture in Gorgol River region, after exclusion of area specific problems. As a basic structure, malfunction of organization has been identified behind the two axes (low selling price, low productivity). On the other hand, expected situations after solving these problems are drawn in Figure 5.5.2. Its basic structure is same as figure 5.5.1.

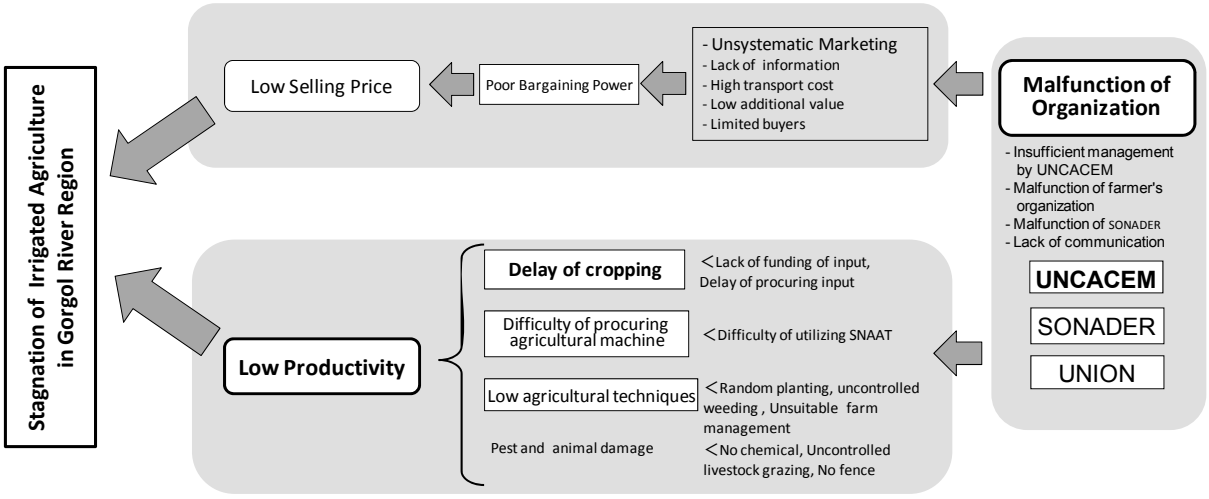


Figure 5.5.1 Problems Hindering Revitalization of Irrigated Agriculture

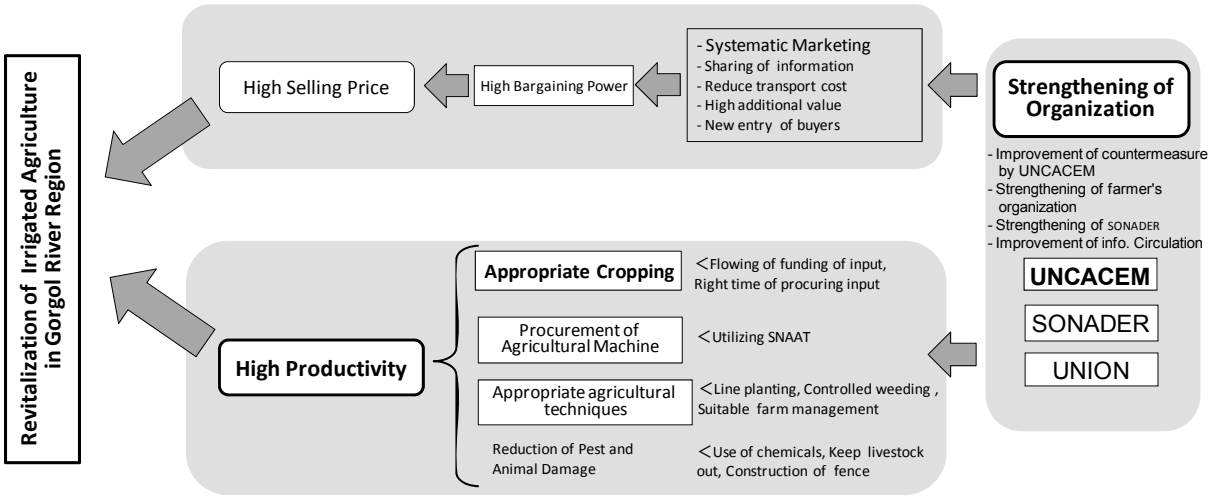


Figure 5.5.2 Countermeasure of Revitalization of Irrigated Agriculture

5.5.3 Important Issues for Revitalization of Irrigated Agriculture

Countermeasures for revitalization of irrigated agriculture in Gorgol River region are indicated in the previous chapter and some important issues among them are focused here. The results are shown in the table below.

Table 5.5.2 Important Issues for Revitalization of Irrigated Agriculture

Major Issues	Important Issues	Importance
Capacity building of organization	High priority. It is essential to enhance the management ability of organization for conducting activities. It contributes to increase productivity and improve marketing.	
	SONADER	It is important to enhance the ability of SONADER. SONDER's support for operation and maintenance is essential for farmers in Foum Gleita, whrere the union was restructured, and PPG.
	Union	It is important to enhance the ability of the union. Operational abilities are different in each area, but comparing with advanced farmer's organization in Senegal, there are stills some rooms for improvement even in Lexeiba.
	UNCACEM	It is very important to enhance the ability of UNCASEM. Demands for input loan for rice is high in all area and the role of UNCACEM to provide the fund is also important.
High productivity	High priority. Rice yield is lowest in Foum Gleita, but this problem is observed in other areas and should be solved. It is thoroughly worth discussing in the Model.	
	Appropriate cropping seasons	Highest priority. Delay of cropping has a negative effect and causes low productivity, difficulty of double cropping in a year in all areas. Farmers in Lexceiba prioritize the observance of the timing of cropping most, so its strengthening and applying to other areas are expected.
	Procurement of agricultural machinery	High priority. When high quality agricultural machineries are procured in appropriate timing, it comes out reduction of labor force, harvesting losses, and appropriate timing of operation, so that it is expected to increase rice production. Utilization of SNAAT is expected.
	High cultivation techniques	Relatively high priority. Farming techniques in Foum Gleita is the poorest compared to other areas, therefore, improvement is important. Other areas are better than Foum Gleita, but there are still some rooms for improvements.
	Reduction of pest and disease damage	It is important to minimize the damage, but not prioritized much in the Model. Only Foum Gleita doesn't have fences for animal prevention, so the condition is a quite different. Damages caused by pests, diseases and birds are common problem in the region but concrete effective measures are not established. Therefore the issue is not included in the Model.
High selling price	The issue is not included in the Model. Rice selling in Lexceiba and PPG is relatively easy and the bottom price is secured with a system for UNCACEM buying rice through GIE. In Foum Gleita, the situation is quite different and it is necessary to support. This issue is not included in the Model but included in A/P.	
	High bargaining power	This is an important issue but not so within the Model. Situations on rice marketing are quite different between Foum Gleita and other areas in geographical conditions and capability of farmer's organizations. Therefore it is not included in the Model.

Important issues discussed above are listed in Table 5.5.3. As the major issues, capacity building of organization and high productivity are raised, and it is necessary to undertake both. In the former, 3 important issues are addressed; 1. Improvement of UNCACEM, 2. Strengthening of farmer's organization and 3. Strengthening of SONADER. In the latter, 2 important issues are included; 1. Suitable cropping season and 2. Procurement of farm machinery. The contents of each important issue are explained as below, according to the order of priority.

Table 5.5.3 Important Issues on Model

Capacity building of organizations
1. Improvement of UNCACEM
2. Strengthening of farmers' organization
3. Strengthening of SONADER
High productivity
1. Suitable cropping season
2. Procurement of farm machinery

(1) Capacity Building of Organizations

a) Improvement of UNCASEM

On the project area of Foum Gleita agriculture can not last because it is impossible to obtain

financing for the purchase of the inputs. It is notorious that some farmers try not to repay the borrowed money. Unless UNCACEM, borrower's side is not repaid their loans during harvest time, even if farmers need loans for next cropping season, they can't get new loans in advance. That is the problems on the financing system. Because of this, input isn't provided to next season's loans in proper time, cause of low yield, delaying their payment. Finally, it is difficult for them to procure input loans. If farmers want to loan the system is very complicated for them, and it is difficult condition for them to continue smooth financing for double cropping etc. It is expected that improving of the loan system, easing loan condition, making procedure easy, and also being fulfilling loan found for UNCACEM.

b) Strengthening of Farmer's Organization

This is an essential element to improve productivity and marketing with appropriate and vitalization of the farmer's organization. Lexeiba, pump irrigation area, has expanded their field by themselves and has been practicing farming steadily. It is like a good model around project area. One of the particularities in the area comes from the leader of the union who is reliable as well as knowledgeable. Even without the technical support of SONADER, they maintain the activities of production and arrange the necessary inputs. Since the government can not support farmers fully, farmers should target independent and sustainable farming by themselves. Therefore capable and reliable leaders of farmers' organizations are essential and fostering leaders is also necessary.

c) Strengthening of SONADER

This is a necessary measure for preserving the functions of the irrigation network in order to re-establish, maintain and increase the irrigated areas. At the same time, this is for increasing the production with the improvement of the farming techniques. SONADER is in charge on behalf of the government, of the maintenance of the main facilities, but it is not functioning properly, since its budget, technical staff and technical training were reduced. It is observed that irrigation water is not provided on time and not in suitable quantity. The pumping stations are old and need to be fixed continuously. In Lexeiba, the maintenance of the pumps is not supported by SONADER but made by cooperatives or Union. Thus in the long run, such a sustainable and independent farming and maintenance should be established by farmers, but it is difficult to materialize in a short term. So SONADER should supervise them with enough time to ensure technological transfer. SONADER should be strengthened in capacities for planning, techniques and supervision, and in personnel.

(2) High Productivity

a) Suitable Cropping Season

This is a countermeasure to follow the suitable cropping season and to improve the productivity through improvement of timing of input supply and farm techniques. Considering one cropping season, cultivation in a suitable period for each crop is important element to increase the

productivity due to the limitation of the climate condition. Hence, it is necessary to follow the cropping season. Considering a year, there are three cropping seasons; rainy, cold-dry and hot-dry season. However, including the preparation time, double cropping is the maximum in reality. According to the climatic conditions and the availability of irrigation water, productivity imporovement is expected with double cropping in a year. These are already practiced in some areas, but have not been continued. Even without development of new agricultural field or irrigation system, cropping area increase is expected with double cropping. It is necessary to improve timing of cropping season and farmers' farming techniques such as proper timing of inputs supply, suitable varieties, suitable cropping schedule, and farming practices. Additionally, as mentioned in the capacity building of organization above, improvement of UNCACEM, who does not fully support farmers for input supply in appropriate timing, is also very important.

b) Procurement of the Farm Machinery

This is a counter measure to undertake the high productivity through the use of farm machinery. But the project area being far and poor, the machines tend to arrive too late or not provided most of the time. Because of it, the cultivation schedule and the harvests are delayed, as a result, the harvest decreases. When the machines don't arrive, it is necessary to call on the family and relatives to make the works. It represents a heavy load and at the same time the efficiency is very weak. So to improve the situation, it would be desirable to have an antenna of supplying of the farm equipment adapted to the size of the project area. But considering the difficulties of financing, the situation of the maintenance organisation and their present capacity would not permit to take care of it. On the other hand, lately (in 2008), the SNAAT has been established and it was possible to procure the farm machinery in rural area. The SNAAT of Rosso being distant, an antenna would be necessary to distribute the material in the vicinity of the project area with the wanted technicians. For the cases where the project area can provide itself the material, it would be necessary for the SNAAT to displace or to transfer its technicians there. Such a system would incite the foreign countries to help for materials.

5.5.4 Related Organizations

To implement solution of each issue, the related organization is organized at the following table.

Table 5.5.4 Related Organization of the Project

Major Issues	Important Issues	Farmer's organization			Administrative organization							
		Farmer	Cooperative	Union	SONADER	CNRADA	SNAAT	UCASEM	MDR	DconMIN	Int MIN	Local gvt
Capacity Building of Organization												
	Improvement of UNCACEM	○	○	○	○			◎	◎	◎		
	Strengthening of farmer's organization	○	◎	◎	◎				◎			
	Strengthening of SONADER	○	○	○	◎	○		○	◎	○		
High Productivity												
	Suitable Cropping Season	○	○	○	◎	○	○	○	◎			
	Procurement of Farm Machinery	○	○	○	○		◎		◎			

Note ; Symbol ◎ shows related organization or C/P organization at the supported by outside, symbol ○ is related organization

5.5.5 Implementation schedule

Considered to the priority of each important issue, formulation of the project for the solution and temporary implementation schedule are described as follow. It is assumed that the preparation which is included the procurement of fund and negotiation to domestic and foreign aid organization and formulation of the project takes 1 to 2 years, and implementation takes 2 to 3 years. (Specially, there are obstacles such as the adjustment each ministry, the development of laws, the evaluation of the price of the farm land, the establishment of land registration system and interests in local area. Therefore, it is possible to take more years to carry out the promotion of the system of the agricultural land property than planned schedule as follow.

The A/P in Foum Gleita is the first priority project for SONADER related to all project. It is assumed that SONADER doesn't have enough time to carry out the other project. However, at the beginning of the project, it is desirable to address the project early as possible to target the existing irrigated area.

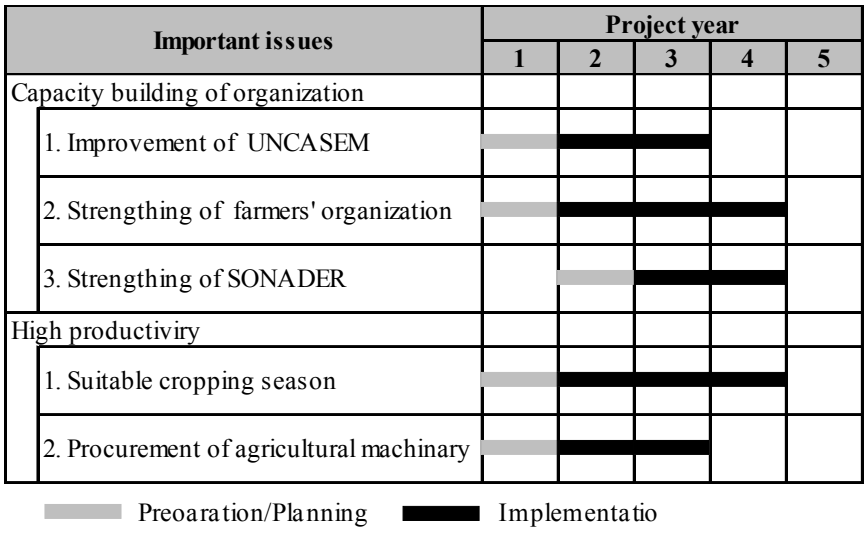


Figure 5.5.3 Implementation Schedule for Revitalization Model of the Irrigated Agriculture

CHAPTER 6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

(1) The Senegal river basin is the only granary in Mauritania, and a portion of the farmland area is concentrated in the Gorgol river basin, which is a tributary of the Senegal river. The Foum Gleita project area is developed 1,950 ha of arable irrigated faming on the 4,400 ha of the whole area. It is essential to revitalize the area, where now only 500 ha area is exploited. With the potential expansion of 3,600 ha, the area has the potential to exceed Kaedi as agricultural production center of Gorgol region, and therefore the rehabilitation works are undoubtedly of paramount importance for the region.

(2) The plan to revitalize agriculture in this project area was prepared based on the estimation of the repairing of the irrigation and drainage facilities, development of protection fence, fields, and formulation of operation and maintenance plan. And, the economic evaluation of the plan was made based on the benefits and costs of the work. The plan provides for the reactivation of the 1,950 ha area in 10 years to restore agricultural production, and economic evaluation shows that the economic rate of return exceeds 15%. The commonly practiced rehabilitation works are planned, and no particular technical or sophisticated efforts are needed. The project will have a positive environmental and social impact, and its rapid implementation is justified because it helps to fight against poverty among the farmers and to ensure stability for country's food security.

(3) To promote the works of the rehabilitation as national project without delay is essential to reform the appropriate the union of cooperatives and farmers who use these facilities. Implementing the rehabilitation as agricultural infrastructures reform, it is important to carry out totally the strengthening of SONADER, the union and the cooperatives, the improvement of the farming techniques in order to manage the sustainable and effective farming.

(4) For the reinforcement of the farmer’s organization and improvement of farming, the active training and management of SONADER is essential to obtain the appropriate involvement of the Union of cooperatives and farmers. The strengthening of the Foum Gleita antenna office is particularly necessary. To avoid the decline of agriculture activities that has occurred in the past, the present Cooperative Union will be essential for the maintenance of the irrigation system facilities and therefore transparent administrative reforms of this organization that reflects the intentions of the farmers must be completed as quickly as possible. As long as it is carried out, if the facilities will be rehabilitated, these experiences make them repeat their past mistake. The continuous support is desired when the study team has been carrying out the organization supporting.

(5) To promote the resettlement of the farmers, it is necessary to distribute drinking water in the villages. According to information from Ministry of Water Resource and Planning, the regional water supply covering the entire population of Foum Gleita is under process. Hence it is not necessary to include this activity in the works of the revitalization of agriculture. SONADER shall hold discussion and exchange information with the concerned department to establish emergency facilities in the Foum Gleita area.

(6) One of the factor that decline of the function of the irrigation facility is addressed the damage of the canals by accessing of animals. To prevent animals entering the irrigated area is necessary to preserve the function of facilities for a middle and long term. The rehabilitation work includes the priority components, the installation of protective fence of the main canals and provision of drinking water for the farm animals. At the same time, SONADER and the union shall intensify the discussion with the livestock producers and strong instruction from local government will be needed..

6.2 Recommendations

For the revitalization of agriculture in the Foum Gleita Project, the rehabilitation works including excavation, backfilling and concrete lining of canals using heavy machinery, and construction of fence with wire net are quantitatively important, but they should not be a problem because there is no particular problem from the technical viewpoint. The benefit of irrigation from the dam is that water supplies are available all throughout the year. Therefore, agriculture activities can be restarted once the rehabilitation will be completed as they will lead to increased food production and revitalization of the area, and therefore it is recommended to start the rehabilitation as soon as possible. During the implementation of the project, the following recommendations shall be considered.

(1) The farmers must return back to resume the farming activities. To select the return of the interested farmers, the motivated professionals who would work there must show clear and transparent methodologies. It is recommended that SONADER, which will be primarily responsible, shall prepare a resettlement plan for the quick return of the farmers. While selecting the farmers for resettlement, the applicants who wish to return only to receive the right to use as well as those who do not farm but claim a right of residence should be carefully excluded, and the farmers who will do farming permanently should be selected. It is necessary to the evaluation included the environmental Society consideration, discussing the process of the resettlement program.

(2) In order to avoid the declining of agriculture not to happen again, it is necessary to strengthen SONADER, the main management body, is essential. It is recommended to determine quickly the reform of SONADER and increasing of number of technical staffs including the necessary budget for the reorganization in Foume Gleita antenna office.

(3) For sustainable agriculture of the large irrigation project, it is essential to form a transparent union, and it is recommended to reform the current cooperative union. The support and cooperation of SONADER are necessary in order to carry out the reform of the union, and to make it sustainable without failure. It is recommended to provide continuous investment and equipment for this purpose.

(4) In order to maintain sustainable agriculture, the farmers need to fulfill the part of their obligations which include payment of water charges, repayment of loans and maintaining the irrigation network. It is recommended that SONADER shall conduct awareness ownership among the farmers through the meeting with cooperatives and the union so that they understand that the irrigation facility is their property and they should carry out their duties and responsibilities.

(5) The implementation of the project shall be carried out by SONADER and also be supported with the legal and financial assistance from the Ministry of Economic Development, which is related organization, and Ministry of Agriculture. Implementation of next study to carry out the project, if the stakeholder meeting is held, it is desirable to include the environmental Society Consideration and easing measures in the agenda.

(6) After the rehabilitation of the project, monitoring and evaluation shall be carried out, and based on its result, the system for improvement of methods of cultivation and maintenance of the facilities should be established. It is recommended that a system shall be established allowing the autonomy of farmer organizations, cooperatives and Union in a long-term.

(7) Foum Gleita reservoir has an effective capacity of 400 million m^3 of usable volume. If the storage height of the water in the reservoir is increased by one meter, then the reservoir volume can be increased by 100 million m^3. Besides, it can protect the project areas at the downstream from the dam to the Senegal river, which are normally damaged extensively by the frequent floods that occur every year by the overflow of the Gorgol river. In this case, it is necessary to make some improvements in the structure of the dam including the spillway crest of the dam. It is proposed that discussion shall be made with the Ministry of Water Resources and Planning to verify the technical and administrative feasibility of such improvements.

APPENDIX

APPENDIX 1 Assignment Schedule

	Assignment	Name	Society	Grade	2008				2009												2010						
					Fiscal Year of 2008 (1st year)				Fiscal Year of 2009 (2nd year)												Fiscal Year of 2010 (3rd year)						
					Phase 1				Phase 2																		
					9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10
Field work	**Leader/ irrigated agriculture**	Menjo Michimasa	NTCI	2					3.27					2.73				0.90				1.63			1.03				0.33	
	Irrigation plan/ evaluation of environmental impact	Suzuki Takafumi	NTCI	3					3.30					1.93					1.17			1.03			1.00				0.33	
	Agricultural exploitation 1 / distribution 1	Murugaboopathi Chellasamy	NTCI	4					2.60				0.53					1.30				1.53			1.00					
	Participatory water management 1	Kuwahara Tsuneo	NTCI	3					2.30					1.70								1.53			1.00					
	Participatory water management 2	Takigawa Eiichi	NTCI	5					1.37						2.10					2.53										
	Agricultural exploitation 2	Nakamura Maiko	NTCI	4											3.60					2.53										
	Program of water supply for villages	Tsuchiya Toshihiro	NTCI	3												1.47														
	Coordinator / distribution 2	Nagai Tomokazu	NTCI	5					3.27						3.60				2.47			1.63			1.00					
	Coordinator	Sorimachi Saki	NTCI	5																									0.33	
Home work	**Leader/ irrigated agriculture**	Menjo Michimasa	NTCI	2			0.30				0.50															0.50			0.50	
	Irrigation plan/ evaluation of environmental impact		NTCI	3			0.30				0.50															0.50			0.50	
	Agricultural exploitation 1 / distribution 1		NTCI	4							0.50																			
	Participatory water management 1		NTCI	3							0.50																			
	Reports						IC/R			P/R(1)	IT/R					P/R(2)						PR(3)				DF/R			FR	
	Stages of the study						1st fieldwork																	3rd fieldwork			4th fieldwork			
							Preparation work in Japan			1st home work												2nd fieldwork				2nd home work			3rd home work	

Legend: Period of assignment

IC/R: Inception report P/R: Progress report IT/R: Interim report DF/R: Draft final report F/R: Final report

NTCI : NTC International Co., Ltd.

APPENDIX 2

MINUTES OF MEETING ON THE INCEPTION REPORT
FOR
THE DEVELOPMENT STUDY FOR THE PROJECT ON REVITALIZATION OF IRRIGATED AGRICULTURE IN THE IRRIGATED ZONE OF FOUM GLEITA IN THE ISLAMIC REPUBLIC OF MAURITANIA

NOUAKCHOTT, NOVEMBER 19, 2008

Ahmed Ould Bah Ould Cheikh Sidiya
General Director of National Agency for
Rural Development (SONADER)

Mr. Michimasa MENJO
Team Leader, JICA Study Team

The Study Team for the Development Study for the Project on Revitalization of Irrigated Agriculture in the Irrigated Zone of Foum Gleita in the Islamic Republic of Mauritania (hereinafter referred to as the Study Team) organized by Japan International Cooperation Agency (JICA), headed by Mr. Michimasa MENJO as Team Leader, and the Steering Committee headed by Mr. Ahmed Ould Bah Ould Cheikh Sidiya, General Director of the National Agency for Rural Development (SONADER), held a meeting and discussed on the Inception Report explained by the Study Team.

The list of participants is attached in Annex.

1. Submission of the Inception Report

The National Agency for Rural Development received 20 copies in French of the Inception Report submitted by the Study Team on November 19, 2008.

2. Meeting

A meeting was held between the Study Team and the Steering Committee at the Conference room of the SONADER in Nouakchott on November 19, 2008 to discuss on the Inception Report.

3. Presentation

The Study Team explained to the steering committee the Inception Report that contains the objectives, approaches and methodologies of the Development Study for the Project on Revitalization of Irrigated Agriculture in the Irrigated Zone of Foum Gleita.

4. Discussion

Based on the discussion, the Steering Committee and the Study Team confirmed their agreement on the contents of the Inception Report. Meanwhile, the following matters were discussed between both the parties.

(a) Mauritania side asked that the measures for drinking water should be given high priority in the study. The Study Team answered that drinking water would be consider as a priority matter even though the revitalization of irrigated agriculture would be main component in the study.

(b) Mauritania side asked that the supports by Japanese assistances (included pilot project) should be concentrated in the zone of Foum Gleita. The Study Team answered that main works of the study would be done for Foum Gleita but the study about surrounding area is also necessary to make the sustainable plan for Foum Gleita. Additionally to say, we must emphasise that Japanese assistance could not solve all the problems without participant's involvement in the project and the full beneficiary participatory would be most important for sustainable development.

(c) Mauritania side explained that they wish to include the diagnosis of Foum Gleita Dam in the works of the team. The Study Team answered that the diagnosis of Dam was beyond the scope of the study, so they could only offer comments based on field observation.

(d) At the end of the Steering Committee, both parties agreed that the study would be conducted on basis with closely cooperation.

LISTE DES PARTICIPANTS

Partie mauritanienne

SOCIETE NATIONALE DE DEVELOPPEMENT RURAL (SONADER)

M. Ahmed Ould Bah Ould Cheikh Sidiya	Directeur Général
M. Guisset Alassane Cherif	Directeur des Etudes et Aménagements
M. Kane Mamadou Ismaila	Directeur Administratif et Financier
M. Ismail Ould Ahmed	Directeur Programmation et suivi évaluation
M. Cheikh Mohamed Lagdaf Ould Mohamed	Responsable informatique
M. Abdellahi Ould Baba	Directeur Régional du Gorgol
M. Abdellahi Ould Guèye	Chef d'antenne de Foum Gleita

MINISTERE DES AFFAIRES ECONOMIQUES ET DU DEVELOPPEMENT

M. Bah Ould Bedda	Chef du service de la coopération bilatérale, Direction de la coopération économique et financière

MINISTERE DU DEVELOPPEMENT RURAL

Mme. Lalla Aîche Mint Rabouh	Direction des politiques, coopération, et suivi évaluation

CENTRE NATIONAL DE RECHERCHE AGRONOMIQUE ET DE DEVELOPPEMENT AGRICOLE

M. Ngam Abou Oumar	Directeur Général par intérim
M. Abdoul Omar Sarr	Chercheur

ELUS LOCAUX ET RESPONSABLES PAYSANS

El Hacen Ould Elhoucein dit Abdella	Maire de Foum Gleita et gérant de l'UCAF
Cherif Ould El Yamani	Président de l'UCAF (Union des coopératives agricoles de Foum Gleita)
Chef Bâ	Vice Président et Directeur de l'UCAF
Khalidou Dembely	Président de la coopérative de Foum Gleita

Partie japonaise

JICA SENEGAL

M. Shinji UMEMOTO	Chef du bureau JICA du Sénégal
M. Motonobu ICHIJO	Conseiller en Agriculture, Bureau JICA du Sénégal
M. Mamadou Aliou Barry	Deputy Programme Director

MISSION D'ETUDE

M. Michimasa MENJO	Chef de mission/agriculture irriguée
M. Takafumi SUZUKI	Irrigation/Gestion environnementale
M. Tomokaze NAGAI	Coordination/Marketing
M. Shigeru TAKAGI	Conseiller

THE DEVELOPMENT STUDY FOR THE PROJECT ON REVITALIZATION OF IRRIGATED AGRICULTURE IN THE IRRIGATED ZONE OF FOUM GLEITA IN THE ISLAMIC REPUBLIC OF MAURITANIA

MINUTES OF MEETING ON THE PROGRESS REPORT 1

NOUAKCHOTT, FEBRUARY 12, 2009

Ahmed Ould Bah Ould Cheikh Sidiya
Directeur Général
Société Nationale de Développement Rural

Michimasa Menjo
Chef de la mission d'étude JICA

The Study Team for the Development Study for the Project on Revitalization of Irrigated Agriculture in the Irrigated Zone of Foum Gleita in the Islamic Republic of Mauritania (hereinafter referred to as the Study Team) organized by Japan International Cooperation Agency (JICA), headed by Mr. Michimasa MENJO as Team Leader, and the Steering Committee headed by Mr. Ahmed Ould Bah Ould Cheikh Sidiya, Director General of the National Agency for Rural Development (SONADER), held a meeting and discussed on the Progress Report 1 explained by the Study Team.

The list of participants is attached in Annex.

1. Submission of the Progress Report 1

The Study Team has submitted 20 copies of Progress Report 1 for Phase 1 on February 12, 2009.

2. Meeting

A meeting was held between the Study Team and the Steering Committee at the Conference Room of the SONADER in Nouakchott on February 12, 2009 to explain and to discuss on the Progress Report 1.

3. Discussion

Through the explanation of the Progress Report by the Study Team, the Steering Committee recognized the contents as successful results, and therefore congratulated and encouraged the Study Team. Meanwhile the following matters were discussed between both the parties and each side expressed their opinions.

(a) SONADER requested that the top priority of the Study be Foum Gleita irrigation area. The Study Team answered that the top priority is given to Foum Gleita area, while the Study is also conducted in parallel in the Gorgol Basin area.

(b) Members of the Steering Committee insisted that a project for drinking water system for Foum Gleita has a high priority in this Study. Since the drinking water is supplied by the irrigation canal, the Study Team recognizes its necessity not only for the purpose of future maintenance activities of canals, which enable water stoppage during cleaning works, but also for farmers' basic sanitation.

(c) SONADER emphasized that rehabilitation of the Project would have mostly positive impacts concerning environment impact evaluation.

(d) Farmers Cooperatives leaders from Foum Gleita gave their opinions about details of rehabilitation work. The Study Team answered that their concern would be taken into consideration during the actual works.

4. Comments

SONADER expressed that further comments would be made and will be submitted within a week to the Study Team after scrutinizing the Progress Report. The Study Team took notice of the information and informed that necessary amendments of the report shall be made after receiving the comments from SONADER.

LISTE OF ATTENDANTS TO THE STEERING COMMITTEE (February 12, 2009)

Mauritanienne side

National Agency for Rural Development (SONADER)

Mr. Ahmed Ould Bah Ould Sidiya	Directeur Général
Mr. Guisset Alassane Cherif	Directeur des Etudes et Aménagements
Mr. Ismael Ould Ahmed	Directeur Programmation et Suivi et Evaluation
Mr. Diop Alioun Demme	Directeur de la Mise en valeur
Mr. Abdallahi Ould Baba	Directeur Regional Gorgol
Mr. Abdellahi Ould Gueye	Chef Service Antenne Foum Gleita office
Mr. Touda Boulkhair	Chef Service des Etudes

Ministry of Economic Affaires and Development

Mr Houssein Ould Meydoub	Chef Service Coopération Bilatérale/Direction de la Coopération Economique et Financière

Ministry of Rural Development

Mr. Demba Ould Sabar	Chef Service Evaluation et Suivi/ Direction des Politiques, Coopération, Suivi et Evaluation

National Agronomic Research and Agricultural Development Center (CNRADA)

Mr. Abou Sarr	Chercheur

Local leaders

ElHacen Ould Elhoucein dit Abdella	Maire de Foum Gleita/ Gérant de l'Union des Coopératives de Foum Gleita (UCDF)
Mr. Chef Ba	Vice président de l'Union des Coopératives Agricoles de Foum Gleita
Mr.Cherif Ould Yamami	Président de l'Union des Coopératives Agricoles de Foum Gleita
Mr. Kalidou Dembelle	Président de Coopérative
Mr. Al Housseyn Samba Sow	President de la Coopérative Foiré
Mr. Sidi Ahmed Ould Emasse	President de la Coopérative Nejah

Japanese side

Mr. Michimasa MENJO	Chef de l'équipe/Agriculture Irriguée
Mr. Takafumi SUZUKI	Irrigation/Gestion de l'Environnement
Mr. Chellasamy MURUGABOOPATHI	Agriculture et Commercialisation (1)
Mr. Tsuneo KUWAHARA	Gestion participative de l'eau (1)
Mr. Eiichi TAKIGAWA	Gestion participative de l'eau (2)
Mr. Tomakazu NAGAI	Coordinateur/ Commercialisation (2)

MINUTES OF MEETING ON THE INTERIM REPORT

FOR

THE DEVELOPMENT STUDY FOR THE PROJECT ON REVITALIZATION OF IRRIGATED AGRICULTURE IN THE IRRIGATED ZONE OF FOUM GLEITA IN THE ISLAMIC REPUBLIC OF MAURITANIA

NOUAKCHOTT, MAY 20, 2009

Ahmed Ould Bah Ould Cheikh Sidiya	Mr. Michimasa MENJO
General Director of National Agency for	Team Leader, JICA Study Team
Rural Development (SONADER)	

The Study Team for the Development Study for the Project on Revitalization of Irrigated Agriculture in the Irrigated Zone of Foum Gleita in the Islamic Republic of Mauritania (hereinafter referred to as the Study Team) organized by Japan International Cooperation Agency (JICA), headed by Mr. Michimasa MENJO as Team Leader, and the Steering Committee headed by Mr. Ahmed Ould Bah Ould Cheikh Sidiya, General Director of the National Agency for Rural Development (SONADER), held a meeting and discussed on the Interim Report explained by the Study Team. The list of participants is attached in Annex.

1. Submission of the Interim Report

The National Agency for Rural Development received 30 copies in French of the Inception Report submitted by the Study Team on May 19, 2009.

2. Meeting

A meeting was held between the Study Team and the Steering Committee at the Conference room of the SONADER in Nouakchott on May 20, 2009 to discuss on the Interim Report.

3. Presentation

The Study Team explained to the steering committee the Interim Report that contains the modifications of the Progress Report (1), the draft of Action Plan, and Verification Study Plan for the Foum Gleita Project.

4. Discussion

Based on the discussion, the Steering Committee and the Study Team confirmed their agreement on the contents of the Interim Report. Meanwhile, the following matters were discussed between both the parties.

(a) Mauritanian side reaffirmed that the Study should be focused on the Foum Gleita Project Area, and the Model Plan for the Gorgol basin should be formulated based on the results of the Action Plan of the Foum Gleita Project Area.

(b) Mauritanian side once again reconfirmed that the drinking water for the Foum Gleita Project Area should have a high priority in the study. The Study Team answered that a Water Supply Expert is newly assigned in the Study in order to analyze the drinking water situation in the project area.

(c) The Study Team requested that CNRADA should provide their full active support for the Verification Trials to be conducted in Foum Gleita. CNRADA fully agreed to provide their active support for the Verification Trials.

(d) Mauritania side mentioned that Sahel Rice varieties are more suitable for the Foum Gleita area than the NERICA upland varieties. The Study Team answered that the NERICA varieties will be experimented mainly to analyze the possibility of growing rice in low water availability areas. The suitable varieties will be selected after discussion of the Study Team with the farmers' cooperatives, SONADER and CNRADA.

(e) The Study Team explained that the emergency rehabilitation works will be carried out during this phase in the most vulnerable areas of the project which needs urgent rehabilitation works. The Mauritanian side appreciated the efforts of the Study Team in this matter.

LIST OF PARTICIPANTS (French)

Partie mauritanienne

SOCIETE NATIONALE DE DEVELOPPEMENT RURAL (SONADER)

M. Ahmed Ould Bah Ould Cheikh Sidiya	Directeur Général
M. Guisset Alassane Cherif	Directeur des Etudes et Aménagements
M. Ismail Ould Ahmed	Directeur Programmation et suivi évaluation
M. Cheikh Mohamed Lagdaf Ould Mohamed	Responsable informatique
M. Abdellahi Ould Guèye	Chef d'antenne de Foum Gleita
M. Touda Belkhair	Chef service des études (DEA)
M. Diop Aliou Demme	Direction de la mise en valeur
M. Diop Mohamedine	Conseiller technique

MINISTERE DES AFFAIRES ECONOMIQUES ET DU DEVELOPPEMENT

M. Houssein Mejdoub	Chef du service Direction du Financement et de l'Evaluation

MINISTERE DU DEVELOPPEMENT RURAL

M. Demba Ould Sabar	Chef de service Suivi et Evaluation (DPCSE)

CENTRE NATIONAL DE RECHERCHE AGRONOMIQUE ET DE DEVELOPPEMENT AGRICOLE

M. N'Gam Abou Oumar	Directeur
M. Ahmed Ould Memed	Représentant régional
M. Abdoul Oumar sarr	Chercheur

ELUS LOCAUX ET RESPONSABLES PAYSANS

M. El Hacen Ould Elhoucein dit Abdella	Maire de Foum Gleita et gérant de l'UCAF
M. Cherif Ould El Yamani	Président de l'UCAF (Union des coopératives agricoles de Foum Gleita)
M. Kalidou Alassane	Vice Président et Directeur de l'UCAF

Partie japonaise

MISSION D'ETUDE

M. Michimasa MENJO	Chef de mission/agriculture irriguée
M. Takafumi SUZUKI	Irrigation/Gestion environnementale
M. C. MURUGABOOPATHI	Exploitation agricole
M. Tsuneo KUWAHARA	Gestion participative de l'eau
Melle Maiko NAKAMURA	Exploitation agricole
M. Tomokaze NAGAI	Coordination/Marketing

MINUTES OF MEETING ON THE PROGRESS REPORT 3
FOR
THE DEVELOPMENT STUDY FOR THE PROJECT ON REVITALIZATION OF IRRIGATED AGRICULTURE IN THE IRRIGATED ZONE OF FOUM GLEITA IN THE ISLAMIC REPUBLIC OF MAURITANIA

NOUAKCHOTT, MARCH 10, 2010

Mr. Ahemed Ould Bah Ould Cheikh Sidiya
General Director of National Agency for
Rural Development (SONADER)

Mr. Michimasa MENJO
Team Leader, JICA Study Team

The Study Team for the Development Study for the Project on Revitalization of Irrigated Agriculture in the Irrigated Zone of Foum Gleita in the Islamic Republic of Mauritania (hereinafter referred to as the Study Team) organized by Japan International Cooperation Agency (JICA), headed by Mr. Michimasa MENJO as the Team Leader, and the Steering Committee headed by Mr. Ahmed Ould Bah Ould Cheikh Sidiya, General Director of the National Agency for Rural Development (SONADER), held a meeting and discussed on the Progress Report 3 explained by the Study Team.

The list of participants is attached in the Annex.

1. Submission of the Progress Report 3

SONADER received 25 copies in French of the Progress Report 3 submitted by the Study Team on March 10, 2010.

2. Meeting

A meeting was held between the Study Team and the Steering Committee at the Conference room of the SONADER in Nouakchott on March 10, 2010 to discuss on the Progress Report 3.

3. Presentation

The Study Team explained the Progress Report 3 to the steering committee that contains the details of the Phase 2 Study including participatory irrigation facilities management, verification trials, rural society survey, farm economic survey, drinking water facilities plan, rehabilitation plan of the irrigation facilities, action plan (draft), and model plan (draft) of the Development Study for the Project on Revitalization of Irrigated Agriculture in the Irrigated Zone of Foum Gleita.

4. Discussion

Based on the discussion, the Steering Committee and the Study Team confirmed their agreement on the contents of the Progress Report 3. Meanwhile, the following matters were discussed between both the parties.

(a) The Study team explained that the plan for the drinking water facilities for Foum Gleita and the surrounding areas is already under consideration by the Department of Hydrology and Barrage under the Ministry of Hydrology and Development as a high priority project. Hence, it was agreed that the drinking water facilities shall not be included in this Study.

(b) The Study team suggested the Mauritanian side that the preparation of a resettlement plan will be very useful for the smooth progress of the Foum Gleita Irrigation Project.

(c) The Mauritania side explained about the necessity of farm machinery and vehicles for the sustainability of the Foum Gleita Project.

(d) The President of the farmers' cooperative union (UCAF) requested to SONADER to provide necessary support for the reactivation of the cooperatives and formation of new Union within the next 2 months period. SONADER confirmed that they will provide the needful support to carry out such activities successfully.

(e) After discussing all the agenda, the meeting was ended at 15h30mn.

LIST OF ATTENDANTS

Mauritanian Side

Mr. Ahmed Ould Bah Ould Cheikh Sidiya	SONADER	Directeur General
Mr. Diop Mohameden	SONADER	Conseillé Technique DG
Mr. Abdellahi Ould Gueya	SONADER	Chef Antenne Foum Gleita
Mr. Mohamed Lemine Ould Cheikh	SONADER	Chef Projet PRPB
Mr. Diop Alioune	SONADER	Directeur Mise en Valeur
Mr. Ousmane Gueye	SONADER	Chef Service
Mr. Kane Djibril	SONADER	Chef Service Vulgarisations, FG
Mr. Mohamed Vall Ould Weraa	SONADER	Formateur
Mr. Cherif Ould Yemani	UCAF	President, UCAF, Foum Gleita
Mr. Bah Ould Bedda	MAED	Chef Service
Mr. Anne Mamadou	MDR/DPCSE	Chef Service Programmation

Japanese Side

JICA Senegal

Mr. Haruhiko IGAWA	JICA Senegal Office

Study Team

Mr. Michimasa MENJO	Team Leader/Irrigated Agriculture
Mr. Takafumi SUZUKI	Irrigation/Environmental Management
Mr. Chellasamy MURUGABOOPATHI	Agriculture and Marketing (1)
Mr. Tsuneo KUWAHARA	Participatory water management (1)
Mr. Tomakazu NAGAI	Coordinator/ Marketing (2)

MINUTES OF MEETING ON THE PROGRESS OF WORK
FOR
THE DEVELOPMENT STUDY FOR THE PROJECT ON REVITALIZATION OF IRRIGATED AGRICULTURE IN THE IRRIGATED ZONE OF FOUM GLEITA IN THE ISLAMIC REPUBLIC OF MAURITANIA

NOUAKCHOTT, June 7, 2010

Mr. Ahemed Ould Bah Ould Cheikh Sidiya
General Director of National Agency for
Rural Development (SONADER)

Mr. Michimasa MENJO
Team Leader, JICA Study Team

The Study Team for the Development Study for the Project on Revitalization of Irrigated Agriculture in the Irrigated Zone of Foum Gleita in the Islamic Republic of Mauritania (hereinafter referred to as the Study Team) organized by Japan International Cooperation Agency (JICA), headed by Mr. Michimasa MENJO as the Team Leader, and the Steering Committee headed by Mr. Ahmed Ould Bah Ould Cheikh Sidiya, General Director of the National Agency for Rural Development (SONADER), held a meeting under the presence of officials of the Japan Embassy and JICA DAKAR, and discussed on the Progress of Work until the beginning of June as explained below.

The list of participants is attached in the Annex.

1. Submission of the Report on the Progress of Work

The Study team submitted the Report on the Progress of Work which includes drafts of A/P, M/P, Conclusion and Recommendation.

2. Meeting

A meeting was held between the Study Team and the Steering Committee at the Conference room of the SONADER in Nouakchott on June 07, 2010 to discuss on the above mentioned report.

3. Presentation

The Study Team explained the report on the Progress of Work to the steering committee that contains the details of the Draft Action Plan (draft), Draft Model Plan (draft), Conclusion and Recommendation of the Development Study for the Project on Revitalization of Irrigated Agriculture in the Irrigated Zone of Foum Gleita. Besides, the Study Team also explained the progress of establishment for new organizational set-up of the farmers union in Foum Gleita.

4. Discussion

Based on the discussion, the Steering Committee and the Study Team basically confirmed their understanding and agreement on the contents of the report and the presentation. Meanwhile, the following matters were discussed between both the parties.

(a) The Study Team explained that the sustainability of the project can not be maintained only by the rehabilitation of the irrigation and drainage facilities, and they insisted on the importance of proper formation of the farmers union and strengthening of SONADER towards the sustainability of the project.

(b) In due consideration of the demands of the farmers, JICA Study Team indicated a proper intermediate plan for future formation of the new union.

(c) The issue to set up a union of farmers organization, was discussed for a long time by SONADER and the concerned parties in the meeting, and SONADER committed to itself to carry on consulting with all the involved parties taking into consideration of the legal aspect of the issue.

(d) The Study Team requested that SONADER should provide necessary support so that the on-going activities in Foum Gleita project towards the formation of a new union would be

successful. SONADER confirmed that they will provide the needful support to carry out such activities successfully.

(e) The Steering committee requested that recommendations shall be made in the report on the necessity of finding solutions to avoid the livestock damages of irrigation and drain canals and facilities for guaranteeing their sustainability.

(f) In consideration of the urgency of the project, the Steering Committee strongly requested for the assistance of Government of Japan for the immediate implementation of the rehabilitation of the project. Besides, they also requested for a technical assistance to take place from the end of the study until the start of the rehabilitation works, so that the on-going activities and momentum in establishing a new union and other activities of the project would progress smoothly without any discontinuation.

(g) The Study team requested that any comments on the Report on the Progress of Work shall be submitted until the end of June, 2010.

(h) After discussing all the agenda, the meeting was ended at 16h00.

LIST OF ATTENDANTS

Mauritanian Side

Société Nationale pour le Développement Rural

M. Ahmed Ould Bah Ould Cheikh Sidiya	Directeur Général
M. Touda Belkheir	Directeur des Études et Aménagements
M. Ba Mamadou Oumar	Directeur Régional du Gorgol
M. Abdellahi Ould Guèye	Chef d'Antenne de Foum Gleita
M. Diop Aliou Demme	Directeur Mise en Valeur
M. Mohamed Vall Ould Weraa	Formateur
M. Aly Ould Abeidi	Contrôleur de gestion

Ministère du Développment Rural

M. Demba Ould Sabar	Chef Service du Suivi Évaluation, Direction des Politiques, Coopérations et Suivi Évaluation

Mninistère des Affaires Économiques et du Développement

M. Wane Baila Abdoul	Chef Service de la Coopération Bilatérale, Direction des Financements et Évaluation

Centre National de Recherche Agronomique et de Développement Agricole

M. Abdoul Oumar Sarr	Chercheur

Japanese Side

Embassy of Japan in Mauritania

Ms. Michito KAWASAKI	Political Attache, Embassy of Japan

JICA Senegal

Mr. Haruhiko IGAWA	JICA Senegal Office

Study Team

Mr. Michimasa MENJO	Team Leader/Irrigated Agriculture
Mr. Takafumi SUZUKI	Irrigation/Environmental Management
Mr. Chellasamy MURUGABOOPATHI	Agriculture and Marketing (1)
Mr. Tsuneo KUWAHARA	Participatory water management (1)
Mr. Tomakazu NAGAI	Coordinator/ Marketing (2)

MINUTES OF MEETING ON THE PROGRESS OF WORK
FOR
THE DEVELOPMENT STUDY FOR THE PROJECT ON REVITALIZATION OF IRRIGATED AGRICULTURE IN THE IRRIGATED ZONE OF FOUM GLEITA IN THE ISLAMIC REPUBLIC OF MAURITANIA

NOUAKCHOTT, August 31, 2010

Mr. Mohamed Ould H'MALLA
General Director of National Agency for
Rural Development (SONADER)

Mr. Michimasa MENJO
Team Leader, JICA Study Team

The Study Team for the Development Study for the Project on Revitalization of Irrigated Agriculture in the Irrigated Zone of Foum Gleita in the Islamic Republic of Mauritania (hereinafter referred to as the Study Team) organized by Japan International Cooperation Agency (JICA), headed by Mr. Michimasa MENJO as the Team Leader, and the Steering Committee headed by Mr. Mohamed Ould H'MALLA, General Director of the National Agency for Rural Development (SONADER), held a meeting under the presence of officials of the Japan Embassy and JICA DAKAR, and discussed on the Draft Final Report of the Project as explained below.

The list of participants is attached in the Annex.

1. Submission of the Draft Final Report for the Project

The Study team submitted the Draft Final Report for the project which summarizes and analyzes the activities of the study components and proposes an Action Plan and Model Plan of the Project including Conclusions and Recommendations. SONADER received 30 copies in French and 5 copies in English of the Draft Final Reports.

2. Meeting

A meeting was held between the Study Team and the Steering Committee at the Conference room of the SONADER in Nouakchott on August 31, 2010 to discuss on the above mentioned report.

3. Presentation

The Study Team briefed the story of the Project and explained the report to the steering committee that contains the details of the Action Plan (draft final), Model Plan (draft final), Conclusion and Recommendation of the Development Study for the Project on Revitalization of Irrigated Agriculture in the Irrigated Zone of Foum Gleita. Besides, the Study Team also suggested some modifications in the final report concerning the following matters:

- Downsizing of principal and primary canals: Inside surface of these canals are proposed for concrete lining. The lining will improve and reduce roughness of water flowing hydraulic condition. This improvement could allow the downsizing of the canals cross section so as to contribute to the reduction of construction cost.
- Allocated rehabilitation cost of principal and primary canals for present irrigation area: The principal and primary canal can cover and contribute irrigation area for total 3,600ha in future including 1,950ha of present project scale. To evaluate a proper economy of the Project corresponding to the actual irrigation area for the present project scale, it will be preferable to take into consideration the allocated rehabilitation cost for 1950 ha as it can cover the entire 3600 ha.

4. Discussion

Based on the discussion, the Steering Committee and the Study Team basically confirmed their understanding and agreement on the contents of the report and the presentation. Meanwhile, the following matters were discussed between both the parties.

(a) The Study Team explained that the activation and sustainability of the project can be maintained by the rehabilitation of the irrigation and drainage facilities in addition to the participatory activities of farmers and strengthening of SONADER.

(b) In consideration of the urgency of the project, the Steering Committee eagerly expressed the necessity of the support and the assistance by Government of Japan for the immediate implementation of the rehabilitation of the project.

(c) The Steering committee expressed some remarks. The Study team answered that the remarks by Steering Committee will be taken into consideration in Final Report. The Study Team also requested that any remark on the Report shall be submitted until September, 30, 2010.

(d) After discussing all the agenda, the meeting was ended at 13h00.

LIST OF ATTENDANTS

Mauritanian side

Société Nationale pour le Développement Rural	
M. Mohamed Ould H'Malla	Directeur Général
M. Zeidane Ould Sidi Boubacar	DGA
M. Moulaye Ould Mayuf	Conseiller juridique
M. Diop Mohamedine	Conseiller technique
M. Diop Aliou Demme	Directeur Mise en Valeur
M. Ismail Ould Ahmed	Directeur suivi-évaluation
M. Kane Mamadou Ismaila	DAF
M. Touda Belkheir	Directeur des Études et Aménagements
M. Aly Ould Aberdy	Contrôleur de gestion
M. Abdellahi Ould Guèye	Chef d'Antenne de Foum Gleita
M. Diallo Moussa	Laboratoire
M. Cheik Mohamed Lagfal Ould Mohamed	Responsable informatique
M. Mohamed Fall	Formateur
Ministère du Développement Rural	
M. Demba Ould Sabar	Chef de service
Ministère des Affaires Économiques et du Développement	
M. Hussein Mejdoub	DA/DMCAE/MAED
Centre National de Recherche Agronomique et de Développement Agricole	
M. Abdoul Oumar Sarr	Chercheur
Organisations agricoles	
M. Dia Saidou Samba	Vice président Coopérative Pellital
M. Jaafar Ould Lehbib	Président P1
M. Ragel Ould Yehafdou Ould Jafaar	Président UCAF
M. Emssa Ould Emessa	Président P2

Japanese side

Ambassade du Japon en Mauritanie	
Mme. Michito KAWASAKI	Attaché Politique, Ambassade du Japon
JICA Sénégal	
M. Haruhiko IGAWA	JICA Bureau JICA du Sénégal
Study Team	
M. Michimasa MENJO	Chef d'Equipe/Agriculture Irriguée
M. Takafumi SUZUKI	Irrigation/Gestion environnementale
Melle Saki Sorimachi	Coordinatrice

APPENDIX3 面会者リスト

【Organisations Gouvernementales 政府機関】

Société Nationale pour le Développement Rural (SONADER) 農村開発公社

	Nom 氏名	Titre 肩書	
	Siège à Nouakchott ヌアクショット本部		
1	Ahmed ould Bah ould Cheikh Sidiya	Directeur Général	総裁
2	Guisset Alassane Chérif	Directeur des Etudes et Aménagements	調査・整備局長
3	Kane Mamadou Ismaila	Directeur Adiministratif et Financier	総務・財務局長
4	Ismail ould Ahmed	Directeur du Suivi et Évaluation	計画・モニタリング評価局長
5	Cheikh Mohamed Lagadaf ould Mohamed	Responsable Informatique	IT マネージャー
	Direction Régionale du Gorgol ゴルゴル州支局		
1	Abdellahi ould Baba	Directeur Régional	支局長
2	Mody Samba Ndiaye	Chef Service Travaux	工事部長
3	Bekar ould Djah	Chef Service Administratif	管理部長
	Antenne de Foum Gléita フーム・グレイタ支局		
1	Abdellahi ould Guèye	Chef d'Antenne	支所長
2	Kane Djibril Ousmane	Chef Service Vulgarisation	普及部長
3	Mohameden Habiboullah	Chef Service Travaux	工事部長
4	Idoumou ould Ethmane	Agent de Vulgarisation à la Base (AVB)	農業普及員
5	Ba Abdoul Alassane	AVB	農業普及員
6	Jaavar ould El Hacen	AVB	農業普及員
7	Samba Yéné	AVB	農業普及員
8	Mohamed Fall ould Wery	Formateur	研修担当

Ministère du Développement Rural (MDR) 農村開発省

	Nom 氏名	Titre 肩書	
1	Aly Fall	Secrétaire Général	事務次官
2	Fall Mokhtar	Conseiller Technique Chargé de l'Elevage	畜産技術シニアアドバイザー
3	Lalla Aîche mint Rabouh	Directrice des Politiques, Coopération, et Suivi Evaluation	政策協力モニタリング評価局長
4	Mamoudou Samba Anne	Ingénieur Statisticien-Agro-économiste	農業経済・統計エンジニア

Ministère des Affaires Economiques et du Développement (MAED) 経済開発省

1	Mohamed El Hassen ould Boukhreiss	Directeur des Financements et Evaluations	財務評価局長
2	Bah ould Bedda	Chef Service, Chargé de la Coopération Bilatérale	国際協力局 日本課長

Ministère de l'Environnement 環境省

	Nom 氏名	Titre 肩書	
1	Hamoud ould Sid'Ahmed	Conseiller Juridique	法律アドバイザー

Ministère de l'Hydraulique et de l'Energie 水資源省

	Nom 氏名	Titre 肩書	
1	Lefdal ould Dadde	Coordinateur National du Programme Régional Solaire – Phase II	地方ソーラープログラムフェーズⅡ調整員

Centre National de Recherche Agronomique et de Développement Agricoles (CNRADA) 国立農学・農業開発研究センター

	Nom 氏名	Titre 肩書	
1	Ngam Abou Oumar	Directeur Général	総裁
2	Abdoul Omar Sarr	Chercheur	研究員

Agence Nationale d'Eau Potable et d'Assainissement (ANEPA) 国立・飲料水浄化機関

	Nom 氏名	Titre 肩書	
1	Brahim ould H'Meyada	Directeur Général	総裁

Société Nationale de l'Eau (SNDE) 水道公社

	Nom 氏名	Titre 肩書	
1	Mohamed Salem ould Bahiya	Chef Département Etudes et Travaux	調査・工事部長
2	Ahmad Salem ould Abderraouf	Chef Département Production et Maintenance	生産・維持管理部長

Société Nationale des Forages et Puits (SNFP) 井戸公社

	Nom 氏名	Titre 肩書	
1	Sidi El Mokhtar ould Abdelahi	Directeur	総裁
2	Ba Smaila	Directeur Technical	技術局長

【Organisations Internationales 国際機関】

Banque Mondiale (World Bank) 世界銀行

	Nom 氏名	Titre 肩書	
1	Amadou Oumar Ba	Spécialiste Principal des Services Agricoles (Chargé du PDIAIM)	農業分野シニア専門官（PDIAIM 担当）
2	Brahim ould Abdelwedoud	Spécialiste Urbain Principal AFTUW (Chargé du PDIAIM)	都市問題シニア専門官（PDIAIM 担当）

Programme des Nations Unies pour le Développement (PNUD, UNDP) 国連開発計画

	Nom 氏名	Titre 肩書	
1	Jean-Marc Lozier	Security Adviser	セキュリティーアドバイザー

Programme Alimentaire Mondial (PAM, WFP) 世界食糧計画

	Nom 氏名	Titre 肩書	
1	Guy Gauvreau	Représentant	代表
2	Amadou Samaké	Directeur Adjoint	次長
3	Boubacar Konte	Chargé de Programme Développement Rural	農村開発プログラム担当

Organisation des Nations Unies pour l'Alimentation et l'Agriculture (FAO) 国際連合食糧農業機関

	Nom 氏名	Titre 肩書	
1	Radisav Pavlovic	Représentant	所長
2	Ahmeda ould Mohamed Ahmed	Assistant au Représentant	所長補佐

Centre du Riz pour l'Afrique (ADRAO, WARDA) アフリカ稲作センター

	Nom 氏名	Titre 肩書	
1	Vicent Bado	Chef de Station, St.Louis	St.Louis 所長
2	Karim Traore	Rice Breeder	専門家(育種)
3	Baboucar Mannch	Molecular Biologist	専門家(分子性物学)
4	Souleymane Gaye	Research Assistant	研究助手
5	Matt Demont	Agricultural Economist	専門家(農業経済)

【Organisations dans la zone d'intervention 調査対象地域の組織】

Hôpital Régional de Kaédi カエディ地方病院

	Nom 氏名	Titre 肩書	
1	Goungui Youssef	Chef service de l'information en la suruveyllance epidemioligy	感染症調査情報サービス長

Poste de santé de Foum Gléita フーム・グレイタ診療所

	Nom 氏名	Titre 肩書	
1	Abou Spuleymane Bâ	Infirmier	看護士

Représentants des résidents de Foum Gléita フーム・グレイタ住民代表

	Nom 氏名	Titre 肩書	
1	El Hacen ould El Houcein dit Abdella	Maire de Foum Gléita	フーム･グレイタ市長
2	Chérif ould El Yamani	Président de l'Union des Coopératives Agricoles de Foum Gléita (UCAF)	フーム･グレイタ農業組合連盟（ユニオン）会長
3	Chef Bâ	Vice-Président de l'UCAF	フーム･グレイタ農業組合連盟（ユニオン）副会長
4	Khalidou Dembely	Président d'une coopérative de Foum Gleita	フーム･グレイタ協同組合会長

ONGs actives dans la domaine de l'agriculture à Foum Gléita
フーム・グレイタにおいて農業分野で活動中の NGO

	Nom 氏名	Titre 肩書	
1	Sidi Mohamed	Président de l'Association pour la Formation des Productions et de Développement (AFPD)	生産訓練開発協会代表
2	Abdoulaye Harouna Ba	Président de l'SOS Génération Future	将来世代 SOS 代表
3	Tuhirou Moussa	Association Mauritanienne pour le Développement et l'Education à la Base (AMADE)	開発と基礎教育のためのモーリタニア協会

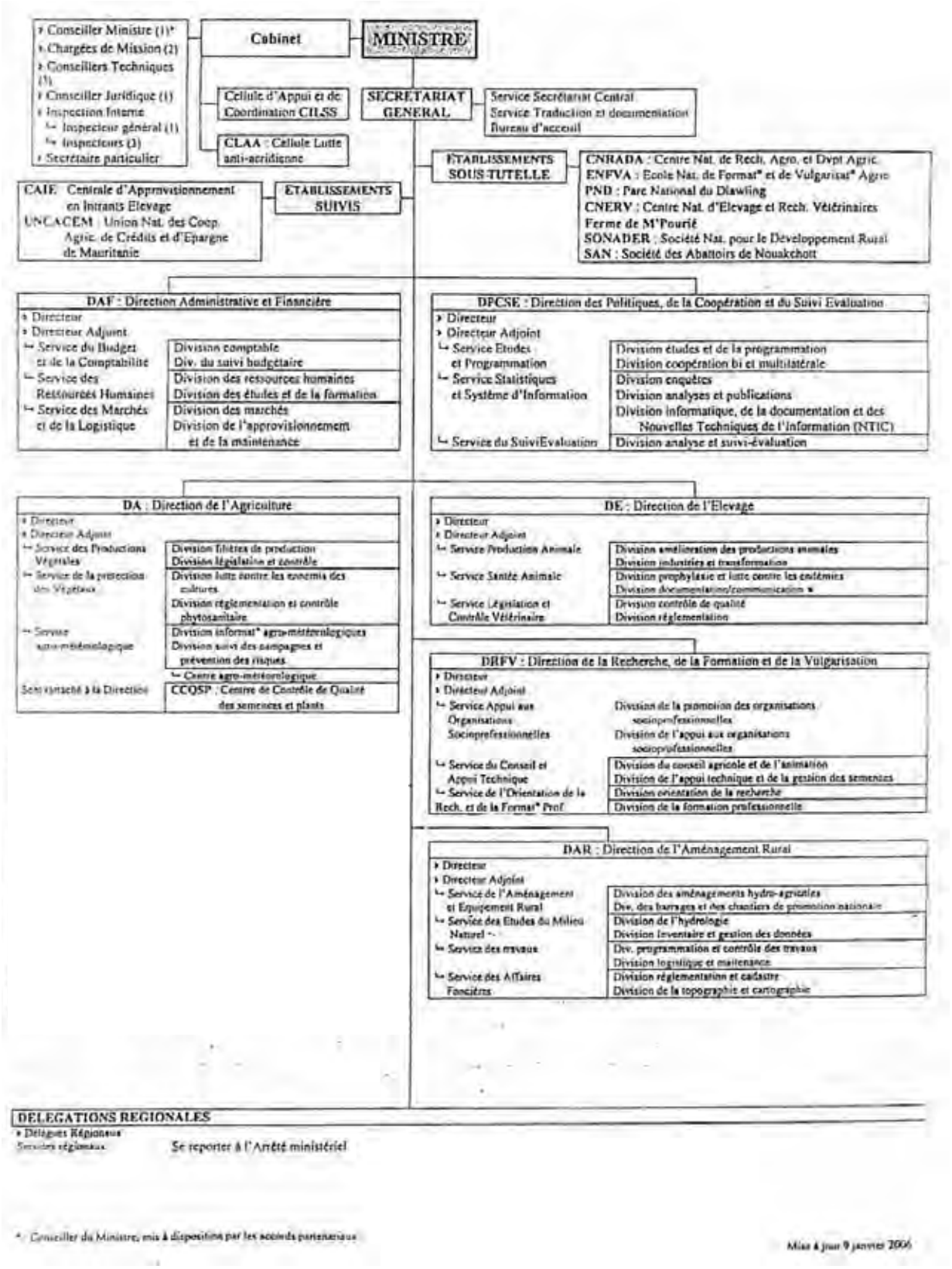
ONGs actives dans la domaine de l'agriculture dans la zone de Kaédi
カエディ周辺において農業分野で活動中の NGO

	Nom 氏名	Titre 肩書	
1	Gaye Abdourahmane	Président de l'Association de Coopération et de Recherche pour le Développement (ACORD)	開発研究協力協会代表

Autres personnalités de la Région du Gorogol その他のゴルゴル州要人

	Nom 氏名	Titre 肩書	
1	Mohamed ould El Medani	Wali du Gorgol	ゴルゴル州知事
2	Ahmed ould Sidi El Mokhtar	Hakem de M'Bout	ムブト県知事
3	Yenge ould El Moustapha	Chef Brigade Gendarmerie de M'bout	ムブト憲兵隊長

APPENDIX 4 Organization Chart of Ministry of Rural Development



APPENDIX 5 List of Collected Documents

N°	Documents	Type	Taille	Nombre de pages	Original ou Copie	Nombre	Fourni / Publié par
1	Evaluation of ACOPAM	PDF	A4	87	Photocopie	1	ACOPAM
2	1/200,000 Gorgol Basin	Tiff	A4	-	Photocopie	1	Cartography Department
3	Protocole pour KAEDI	PDF	A4	48	Photocopie	1	CEREDIAR.ORG 2007
4	CNI, Mauritanie 2001	PDF	A4	163	Photocopie	1	CNI
5	Rural Development Horizon 2010, 1999	MS Word	A4	-	Photocopie	1	CNRADA
6	2008-2010 Public Investment Program (PIP Rechercher EN)	MS Excel	A4	-	Photocopie	1	Economy and Finance Ministry
7	Presentation note of the Advisory Group for Mauritania, 2008-2010	MS Word	A4	12	Photocopie	1	Economy and Finance Ministry
8	FAO/WFP Crop and Food Supply Assessment	PDF	A4	14	Photocopie	1	FAO
9	The Senegal River basin	PDF	A4	-	Photocopie	1	FAO
10	Serie Statistiques Agricole 1983-1998	MS Excel	A4	3	Photocopie	1	MDR
11	Serie Statistiques Agricole 1999-2007	MS Excel	A4	3	Photocopie	1	MDR
12	Itineraire Technique pour la production, la recolte et la livraison du paddy dans la region du Trarza	Photocopie		13	Photocopie		MDR
13	Loi N° 67.171 du 18 Juillet 1967 Portant	Photocopie		28	Photocopie		MDR
14	Recueil des lois et decret sur la cooperation, les G.I.E. et les associations	Photocopie		28	Photocopie		MDR
15	Decret 2004-094 EIA-law	PDF	A4	22	Photocopie	1	Ministere d'Emvironment
16	Decret N°2007 105 Etude d impact sur l'environnement	PDF	A4	14	Photocopie	1	Ministere d'Emvironment
17	Loi N° 2000-045	PDF	A4	17	Photocopie	1	Ministere d'Emvironment
18	Rapport sur la mise en oeuvre du cadre strategique de lutte contre la pauvrete Mauritanie	PDF	A4	44	Photocopie	1	Ministère des Affaires Economiques et du Développement
19	Gorgol Region Profile	MS Word	A4	-	Photocopie	1	Ministre d' Interior
20	Bulletin Semestriel d'Information sur la Securite Allimantaire en Mauritanie	PDF	A4	29	Photocopie	1	National Statistic Office
21	Agregats de la Comptabilite Nationale et Indicateurs Economiques 1995-2005	Livre	A4	-	Original	1	National Statistic Office
22	Annuaire Statistique 1995-2005	Livre	A4	69	Original	1	National Statistic Office
23	Bulletin Trimestriel de Conjoncture, Aout 2008	Livre	A4	-	Original	1	National Statistic Office
24	Bulletin Trimestriel de Conjoncture, Juin 2007	Livre	A4	-	Original	1	National Statistic Office
25	Note Trimestrielle de Conjoncture, Aout 2008	Livre	A4	-	Original	1	National Statistic Office
26	Carte, Peuplement et cultures de saison seche dans la vallee du senegal	Photocopie		1	Photocopie		ORSTOM
27	Program of Agricultural Development	PDF	A4	8	Photocopie	1	PDAIM
28	Aquaduct, 1983	Plan	A0	1	Photocopie	1	SCET-RIM
29	Box culvert, Typical	Plan	A1	1	Photocopie	1	SCET-RIM
30	Cross Section of AD, 2007	Plan	A0	1	Photocopie	1	SCET-RIM
31	Cross Section of AG, 2007	Plan	A0	1	Photocopie	1	SCET-RIM
32	Cross Section of Most Secondary Drainage, 2007	Plan	A0	-	Photocopie	1	SCET-RIM
33	Cross Section of Most Secondary Irrigation Canal, 2007	Plan	A0	-	Photocopie	1	SCET-RIM
34	Cross Section of P1, 2007	Plan	A0	1	Photocopie	1	SCET-RIM
35	Cross Section of P2, 2007	Plan	A0	1	Photocopie	1	SCET-RIM
36	Intake of S10, 1983	Plan	A0	1	Photocopie	1	SCET-RIM
37	Intake of S19, 1983	Plan	A0	1	Photocopie	1	SCET-RIM
38	Intake of S20, 1983	Plan	A0	1	Photocopie	1	SCET-RIM
39	Intake of S22, 1983	Plan	A0	1	Photocopie	1	SCET-RIM
40	Intake of S23, 1983	Plan	A0	1	Photocopie	1	SCET-RIM
41	Intake of S26, 1983	Plan	A0	1	Photocopie	1	SCET-RIM
42	Intake of S3, 1983	Plan	A0	1	Photocopie	1	SCET-RIM
43	Intake of S8, 1983	Plan	A0	1	Photocopie	1	SCET-RIM
44	Intake of S9, 1983	Plan	A0	1	Photocopie	1	SCET-RIM
45	Parts of Principal Drainage of DP2, 1983	Plan	A0	-	Photocopie	1	SCET-RIM
46	Parts of Principal Drainage of DP8, 1983	Plan	A0	-	Photocopie	1	SCET-RIM
47	Parts of Principal Drainage of DP9, 1983	Plan	A0	-	Photocopie	1	SCET-RIM
48	Parts of Secondary Drainage of DR2, 1983	Plan	A0	-	Photocopie	1	SCET-RIM
49	Parts of Secondary Drainage of DR25, 1983	Plan	A0	-	Photocopie	1	SCET-RIM
50	Parts of Secondary Drainage of DR8, 1983	Plan	A0	-	Photocopie	1	SCET-RIM
51	Parts of Secondary Drainage of DR9, 1983	Plan	A0	-	Photocopie	1	SCET-RIM
52	Plan and Profile of Primary Canal P1, 1982	Plan	A0	4	Photocopie	1	SCET-RIM
53	Plan and Profile of Primary Canal P2, 1982	Plan	A0	3	Photocopie	1	SCET-RIM
54	Plan and Profile of Principal Canal AD, 1982	Plan	A0	1	Photocopie	1	SCET-RIM
55	Plan and Profile of Principal Canal AG, 1982	Plan	A0	3	Photocopie	1	SCET-RIM

N°	Documents	Type	Taille	Nombre de pages	Original ou Copie	Nombre	Fourni / Publié par
56	Plan and Profile of Principal Canal OA, 1981	Plan	A0	3	Photocopie	1	SCET-RIM
57	Plan and Profile of Secondary Canal S1, 1982	Plan	A0	2	Photocopie	1	SCET-RIM
58	Plan and Profile of Secondary Canal S16, 1981	Plan	A0	1	Photocopie	1	SCET-RIM
59	Plan and Profile of Secondary Canal S17, 1982	Plan	A0	1	Photocopie	1	SCET-RIM
60	Plan and Profile of Secondary Canal S18, 1982	Plan	A0	1	Photocopie	1	SCET-RIM
61	Plan and Profile of Secondary Canal S19, 1982	Plan	A0	1	Photocopie	1	SCET-RIM
62	Plan and Profile of Secondary Canal S20, 1982	Plan	A0	1	Photocopie	1	SCET-RIM
63	Plan and Profile of Secondary Canal S21, 1982	Plan	A0	2	Photocopie	1	SCET-RIM
64	Plan and Profile of Secondary Canal S22, 1982	Plan	A0	1	Photocopie	1	SCET-RIM
65	Plan and Profile of Secondary Canal S23, 1982	Plan	A0	2	Photocopie	1	SCET-RIM
66	Plan and Profile of Secondary Canal S24, 1982	Plan	A0	2	Photocopie	1	SCET-RIM
67	Plan and Profile of Secondary Canal S25, 1982	Plan	A0	1	Photocopie	1	SCET-RIM
68	Plan and Profile of Secondary Canal S26, 1982	Plan	A0	1	Photocopie	1	SCET-RIM
69	Plan and Profile of Secondary Canal S3, 1982	Plan	A0	1	Photocopie	1	SCET-RIM
70	Plan and Profile of Secondary Canal S4, 1982	Plan	A0	2	Photocopie	1	SCET-RIM
71	Plan and Profile of Secondary Canal S5, 1982	Plan	A0	1	Photocopie	1	SCET-RIM
72	Plan and Profile of Secondary Canal S6, 1982	Plan	A0	1	Photocopie	1	SCET-RIM
73	Plan and Profile of Secondary Canal SS, 1982	Plan	A0	1	Photocopie	1	SCET-RIM
74	Siphon SF7, 1983	Plan	A0	1	Photocopie	1	SCET-RIM
75	Siphon SF8, 1983	Plan	A0	1	Photocopie	1	SCET-RIM
76	Siphon SF9, 1983	Plan	A0	1	Photocopie	1	SCET-RIM
77	Tertiary, Typical	Plan	A1	1	Photocopie	1	SCET-RIM
78	Situation Socio-sanitaire de la Wilaya du Gorgol 2008	PDF	A4	152	Photocopie	1	SONADER
79	Strategie Agroalimentaire de la Mauritanie	MS Word	A4	75	Photocopie	1	SONADER
80	Stratégie de Développement du Secteur Rural Horizon 2015	MS Word	A4	108	Photocopie	1	SONADER
81	Carte altitides culturales SEDAGRI 1/50,000	Photocopie	A4	1	Photocopie		SONADER
82	Carte morph et pedo SEDAGRI 1/50,000	Photocopie	A4	1	Photocopie		SONADER
83	Etude d'application des schemas directeurs de la vallee et du delta rive droite du fleuve senegal	Photocopie	A4	4	Photocopie		SONADER
84	Etude des schemas directeurs de la gestion de l'eau et d'amenagement de la vallee du Gorgol	Photocopie	A4	6	Photocopie		SONADER
85	Etude pour la restauration du reseau hydraulique du bassin du fleuve senegal	Photocopie	A4	11	Photocopie		SONADER
86	Hauteurs de pluie relevee par la Direction de Foum Gleita	Photocopie	A4	1	Photocopie	1	SONADER
87	Rapport Annuel 01.07.1983 au 31.12.1984	Photocopie		6	Photocopie		SONADER
88	Rapport d'Enquete Nutritionnelle, Gorgol	Photocopie		19	Photocopie		SONADER
89	Resultats campagnes agricoles des grands perimetres, Foum Gleita	Photocopie		1	Photocopie		SONADER
90	Resultats campagnes agricoles des grands perimetres, PPG I & PPG II	Photocopie		1	Photocopie		SONADER
91	USAID South Dakota 1982	Photocopie	A4	1	Photocopie		SONADER
92	Amenagement Hydro-Agricole du Gorgol Noir Lot D	Livre	A4	-	Photocopie	1	SONADER
93	Amenagement Hydro-Agricole du Gorgol Noir, Decembre 1985	Livre	A4	-	Photocopie	1	SONADER
94	Amenagement Hydro-Agricole du Gorgol Noir, Dossier d'appel d'offres piece 3, Memoire Descriptif	Livre	A4	-	Photocopie	1	SONADER
95	Amenagement Hydro-Agricole du Gorgol Noir, Dossier d'appel d'offres Volume 2, Memoire Descriptif	Livre	A4	-	Photocopie	1	SONADER
96	Amenagement Hydro-Agricole du Gorgol Noir, Dossier d'appel d'offres Volume 2, Memoire Descriptif Lot B	Livre	A4	-	Photocopie	1	SONADER
97	Amenagement Hydro-Agricole du Gorgol Noir, Dossier d'appel d'offres Volume 3, Cahier de Prescriptions Speciales	Livre	A4	-	Photocopie	1	SONADER
98	Amenagement Hydro-Agricole du Gorgol Noir, Dossier d'appel d'offres Volume 4, Cahier de Prescriptions Techniques	Livre	A4	-	Photocopie	1	SONADER
99	Amenagement Hydro-Agricole du Gorgol Noir, Dossier d'appel d'offres Volume 5, Mode d'Evaluation des Travaux	Livre	A4	-	Photocopie	1	SONADER
100	Amenagement Hydro-Agricole du Gorgol Noir, Dossier d'appel d'offres Volume 6, Avant-Metre	Livre	A4	-	Photocopie	1	SONADER
101	Assistance Technique au Project du Gorgol Noir Mission d'appui No. 2, Juillet 1992	Livre	A4	-	Photocopie	1	SONADER
102	Assistance Technique au Project du Gorgol Noir Mission d'appui No. 3, Novembre-Decembre 1992	Livre	A4	-	Photocopie	1	SONADER

N°	Documents	Type	Taille	Nombre de pages	Original ou Copie	Nombre	Fourni / Publié par
103	Assistance Technique au Project du Gorgol Noir Mission d'appui No. 4, Mai 1993	Livre	A4	-	Photocopie	1	SONADER
104	Assistance Technique au Project du Gorgol Noir Mission d'appui No. 5, Novembre 1994	Livre	A4	-	Photocopie	1	SONADER
105	Dossier d'Appel d'Offres A Piece Ecrites, Avant Metres, Decembre 1985	Livre	A4	-	Photocopie	1	SONADER
106	Dossier d'Appel d'Offres A Piece Ecrites, Bordereau des Prix, Decembre 1985	Livre	A4	-	Photocopie	1	SONADER
107	Dossier d'Appel d'Offres A Piece Ecrites, Detail Estimatif, Decembre 1985	Livre	A4	-	Photocopie	1	SONADER
108	Dossier d'Appel d'Offres Lot, Avril 1975	Livre	A4	-	Photocopie	1	SONADER
109	Etude de Consolidation et d'Extension du Perimetre de Foum Gleita, Phase II, Avant -Project Detaile Vol. 1, Juin 1989	Livre	A4	-	Photocopie	1	SONADER
110	Etude de Consolidation et d'Extension du Perimetre de Foum Gleita, Phase II, Vol. 4b, Decembre 1988	Livre	A4	-	Photocopie	1	SONADER
111	Extension du Perimetre Pilote du Gorgol, Amenagement Hydro-Agricole, Station de Pompage, Aout 1992	Livre	A4	-	Photocopie	1	SONADER
112	Perimetre de Foum Gleita Phase 1: Diagnostic et proposition de solutions Rapport	Livre	A4	51	Original	1	SONADER
113	Problematique de l'intersification Culturale sur le Perimetre Pilote du Gorgol, Novembre	Livre	A4	-	Photocopie	1	SONADER
114	1/50,000 Gorgol Basin	Carte	A4	-	Photocopie	1	SONADER Kaedi
115	A Holistic Approach to Irrigated Rice Farming Problems Uncovers More Than Jsust Soil Degradation	PDF	A4	8	Photocopie	1	WARDA
116	Nerica: the New Rice for Africa - a Compedium	Livre	A5	195	Original	1	WARDA
117	LISTE DES PROJETS 2006	MS Excel	A4	11	Photocopie	1	Web
118	CADRE STRATEGIQUE DE LUTTE CONTRE LA PAUVRETE	PDF	A4	62	Photocopie	1	Web
119	Development of Agricultural Exportation	PDF	A4	31	Photocopie	1	Web
120	RAPPORT DE SUIVI DU CSLP POUR 2003, Developpement rural, environnement et	PDF	A4	83	Photocopie	1	Web