CHAPTER 5

BASIC DEVELOPMENT CONCEPT OF THE MASTER PLAN

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5.1 Constraints and Potentials on Development of the Oases

5.1.1 Constraints on Development of the Oases

The field survey has disclosed the constraints that prevail at the oases as explained hereinafter.

1) Declining but important spiritual and cultural role of oasis.

The oases in the study area play an important spiritual role in preserving the nation's traditional culture through activities such as date cultivation, and production of sheep, goats, and camels. However, this role continues to diminish on a yearly basis due to economic development and the rise of an urban population that has no knowledge of the oases.

2) Effect of Droughts on traditional oases social system and the economy

As an outcome of decreased precipitation in recent years many nomadic people were forced to settle in the oases. In addition, date cultivation was affected by the droughts and production dropped drastically. Consequently, the nomadic people who were unable to sustain economic independence departed causing major changes in the traditional social system of the oasis.

The economy of the oases also underwent a fundamental change and agricultural and livestock production rapidly declined in contrast to the pre-drought era. This created poverty and the spread of malnutrition due to food shortages. The oasis economy has become largely dependent on income generated and sent from urban areas and the self-sustainability of its economy is being undermined.

3) Poor oases health and hygiene conditions

The common diseases of the oases are diarrhea, malaria, eye diseases, bronchial diseases, and diseases stemming from malnutrition. The mortality rate of children is markedly high due to delivery failures, disease, and malnutrition related diseases. The major causes of the diseases at the oases are presumed to be

stemmed from inadequate food intake volume and poor hygienic conditions.

4) Low irrigation efficiency

The majority of oasis residents are economically dependent on date and vegetable cultivation using groundwater resources. The production volume is limited by the volume of water resources that is available. Much of the irrigation water is distributed through earth canals and a large volume of water is lost when it is absorbed underground or through evaporation. Water is not effectively utilized Consequently, low groundwater levels due to excessive pumping for irrigation purposes have been observed at many of the wells.

5) Low agricultural productivity

Vegetable cultivation has spread rapidly at many of the oases, but productivity remains low. The underlying causes are due to root rotting of crops stemming from excessive irrigation, inappropriate cultivation techniques, and damage due to continuous cropping.

Vegetable cultivation is limited to the months of October to March and harvest activities from February to March. These limitations have produced price breakdowns and lowered profits. Disparity in the productivity of date is observed for each oasis due to the damage caused by diseases and pests as well as by difference of varieties.

6) Lack of access to health care facilities

Many of the oases do not have the means or infrastructure to forward their products to the markets and they do not have access to health care facilities. These conditions have greatly affected the oases and contributed to low income and poor health and hygienic conditions.

7) Poverty-level households headed by women

The drop in agricultural and livestock production in recent years has created a high ratio of unemployment at the oases, forcing many men to leave the oases to seek jobs in the urban areas. Consequently, there has been a rise in the number of poor households headed by women and it has become a major social issue.

In addition, the literacy rate for women remains low. Despite the increased ratio of enrollment for women in secondary schools, the disparity between genders remains.

8) Importance of shifting sand countermeasures

The agricultural land of the oases has been seriously damaged by drifting sand, which is also the cause of eye and bronchial diseases. Although afforestation projects were implemented after 1975 to mitigate these hazards, shifting sand countermeasures are still needed in conjunction with expanded protected areas (such as cultivation and residential land) and to address health management concerns.

9) Lack of basic data for water resources development

The development potential of deep and shallow wells in the study area has not been assessed. There is a need to collect and analyze basic data on groundwater levels, volume of irrigation water, and other information. These findings will enable future water resource development projects to propose an appropriate water usage plan based on a feasible volume of pumped water.

The constraints explained above are compiled in **Table 5.1.1** shown below.

Table 5.1.1 Constraints on Development of the Study Area

Field	Present Situation
Socio-economy	・A large population in poverty, especially women-headed households. ・Major industry is agriculture and livestock raising. Many households engage in agriculture. ・Money sent form outside the Oases play an important role in economy. ・Population on the decline. ・Less adult male population than female. ・Many jobless households. ・Guetna is an important event and many people come together for it. ・Oasis associations have been formed and been active. ・Primary education prevailed.
Health and Sanitation	・Symptom of malnutrition is widely recognized. ・Diarrhea is prevalent. ・High rate of child mortality.
Agriculture and Livestock raising	・Large gaps of productivity among oases. ・Relatively low productivity. ・Limited cropping period brings down vegetable price. ・Reduced production of agricultural and livestock product.
Infrastructure	・Undeveloped road network. ・Shortage in means of transportation. ・Difficulties of shipping of product to the market. ・Bad access to medical facilities.
Natural Environment	・Lowering of groundwater levels. ・Insufficient data on groundwater. ・Inefficient use of water resources. ・Damage caused by shifting sand is prevalent.

Source : The Study Team

5.1.2 Development Potentials

The development potentials that can be exploited to resolve the existing issues and problems are explained below.

1) Local identity of oasis residents

The majority of oasis residents want to live in the oasis and those who have left for the cities strongly desire to return if employment opportunities are available. The strong local identity and nostalgia for the oasis is a major factor that supports oasis development.

Moreover, the Guetna remains a strong traditional event in Mauritania and many people gather at the opportunity of the event at the oases and enables the oases to function as a marketplace where its products can be sold.

2) Organizing associations

Many oasis associations that are involved in a diverse range of activities have been formed in the oases. These associations are a potential source of loans and technical extension activities and they can be utilized to implement development projects efficiently.

3) Significant water resource potential

Presently, much of the pumped water volume is lost in the course of conveyance together with excessive irrigation. The volume of water that can be utilized effectively for production activities can be greatly increased if such loss can be prevented. Furthermore, managing the effective use of resources will contribute to sustainable production activities at the oases.

4) Improving dissemination of education

Primary education is widespread throughout the oases. Additionally, women associations are conducting activities to improve the literacy rate among women. Activities to further educate women and children will facilitate educational and technical extension activities in future.

Presently, many of the cases of diarrhea and malnutrition related diseases can be prevented through educational extension activities in health and sanitation for women. Therefore, easier access to health and hygiene related extension activities for women should be made available.

5.2 Needs of Residents

A development plan should be based on the needs of the residents to achieve sustainability and to be implemented effectively. As explained in Chapter 4, the surveyed needs of the residents are mainly centered on well excavations to alleviate water shortages and the construction of a road network for improved access to the cities.

Individual needs are concerned with improved vegetable cultivation and processing technology to raise cash incomes, as well as improvements in livestock farming, medical

and health care, education, market distribution, drifting sand prevention measures, handicrafts, and a wide variety of other areas (see **Tables 4.7.4** to **4.7.6**). Despite some variation in the needs of residents stemming from topographical conditions (the construction of dams and levees is strong among the residents of oases located along the wadis), major disparities between the residents of the Adrar and Tagant regions were not observed. This reflects the fact that the problems that confront the oases are similar.

In contrast, the needs of women focused on improving conditions related to their associations, in addition to improvements in their daily lives.

5.3 National Development Plan

Major policies targeting poverty alleviation centered on economic development, improved productivity, development of human resources, and improved access to basic infrastructure have been incorporated in the national development plan of the Mauritanian government.

The specific numerical targets for these goals in 2015, based on these development policies, are shown in **Table 2.5.1**. Major quantified goals are to eliminate the poverty-level of population by 50%, a trunk goal, and cover such field as education and an improved health care and living environment.

The current administration has continued to pursue major policies to improve access to public health services, to promote women's education, to increase food production, and to prevent population inflow into the cities.

These policies prioritize the development of the oases and rural regions that are targeted in the survey study and which play a central role in the traditional culture of Mauritania.

5.4 Regional Development Plan

5.4.1 Basic Development Concept and Development Goals

Taking account of the constraints and potentials on development as cited before as well as the needs of the residents and the national development plan, the basic structure of development activities is forged in the following manner:

(1) Basic development concept

1) Poverty alleviation

As in other rural regions, there is a large poor population in the survey study region. The poverty of households headed by women is particularly notable. The alleviation of poverty is a major national policy of the government. Hence, poverty alleviation constitutes an important issues to be tackled under this development project.

2) Improve social infrastructure

The majority of residents are satisfied with their current lives in the oasis and also express their desire to stay in the natural environment and society of the oasis. Therefore, measures to decrease child mortality rate and to improve health and sanitation conditions will be implemented to secure sustainability of the current mentally comfortable lifestyle of the oasis.

3) Sustainable use of resources

Water is an important resource that supports production of crops and livestock, the life and production activities of the oasis including animal and plant life. Therefore, it is essential that the sustainable use of all resources both in and outside the oases (beginning with water resources) is achieved in order for the oasis community to survive. Presently, the volume of water loss is great, so it is proposed to encourage the residents to make sustainable use of the resources through management and appropriate technology.

(2) Development goals

Specific long-term goals for 2015 that are based on the national poverty alleviation policy of the Government of Mauritania are explained below.

1) The poverty-level population will be reduced by half in the rural regions by increasing productivity. Female-headed households will be particularly targeted.

2) Social infrastructure related to educational activities and facilities will be improved. Overall public health and hygiene will be improved to reduce disease,

child mortality rate and illiteracy rate.
Malnutrition among children will be decreased from 23% in 1999 to 10% in 2015.

3) A water resource management system to be maintained by residents will be created and the conservation, sustainability, and efficient use of both internal and external resources of the oasis will be targeted.

As shown in **Fig. 5.4.1**, the achievement of these three goals is mutually interdependent and will enable the oasis community to become sustainable.

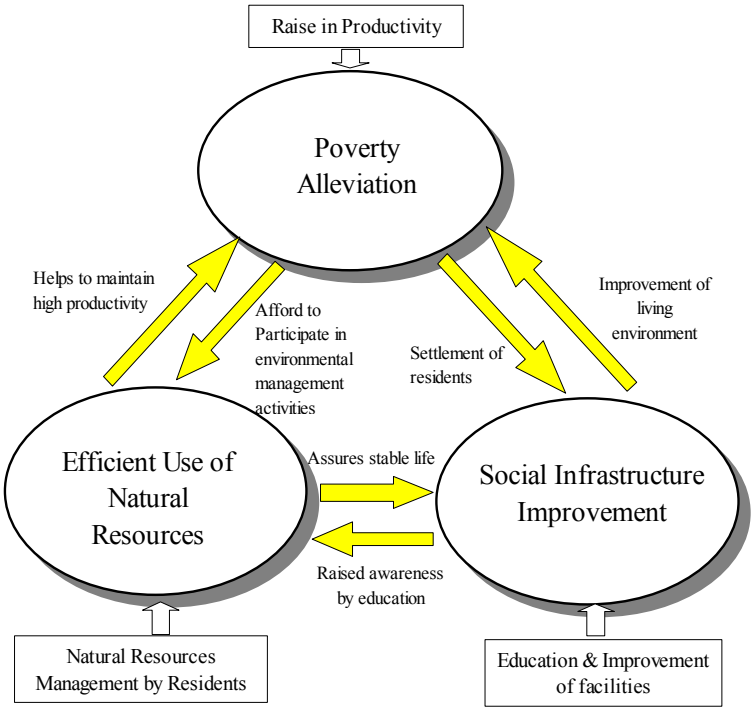


Fig. 5.4.1 Development Concept

5.4.2 Development Strategies

To achieve the development goals explained in the basic structure, the following three development strategies will be implemented based on the development potential of the oasis.

(1) Regional Development Strategy 1: Priority development issues

The following elements will be strengthened at each oasis:

1) Effective use of both internal and external resources in the Study area

In addition to pursing the efficient use of existing water, plant, and animal resources in the study area, resources that have not been hitherto exploited in the area will also be targeted to raise productivity by efficient use.

2) Improve nutritional intake and increase income from improved agricultural and livestock production

Improved nutritional intake of residents and increased income from the sale of agricultural and livestock products will be targeted through measures to disseminate suitable farming and livestock technology, to raise productivity, and to diversify the cropping period.

3) Improve social environment through educational extension and implementation of resource management

Many of the existing problems in the oases can be resolved through educational measures in areas such as farming and livestock production related technical extension activities, improved health and hygiene awareness, and better awareness about environmental and resource conservation. Therefore, improvements in the social environment will be pursued through educational measures, which will be given priority focus in each sector.

(2) Regional Development Strategy 2: Foster selected oases as bases

Presently, the majority of the agricultural markets are located in the regional cities of Nouakchott, Atar, and Tidjikja. Many oases are unable to transport their products to the market or are unable to foot the high transport costs, and consequently, they have given up production activities. Thus, the oases face the problem of low retail pricing and lack of market access. In addition, productivity is low due to inadequate technical extension activities. Hospitals and other medical facilities are inaccessible to many oasis residents because they are located in the regional cities.

To resolve these marketing related issues and to improve access to hospitals and other public facilities, selected oases will be fostered as development bases, the characteristics of which are described below. Hence, these oases will provide a focal

network of economic and social infrastructure and the development of the neighboring oases will be pursued by ripple effect.

1) Vegetable production center

Foster the oasis to serve as a demonstration farm for technical extension activities and vegetable production base for neighboring oases.

2) Product transport base

Foster the oasis to serve as a product transport center for remote oases that are unable to send their products directly to city markets.

3) Consumption center

An oasis that will function as a vegetable consumption center should be created. This oasis will target tourists and visitors during the Guetna, who regularly visit the oasis, and will enable the residents to save on product transport costs. Fostering the oasis as a base will enable regional infrastructure outside of the major cities to develop and provide easier access to storage facilities by the inhabitants.

4) Center of public facilities

Public facilities that are currently accessible only in the regional cities (hospitals, secondary schools, etc.) will be constructed to enable residents of remote oases easier access to medical and educational facilities.

To implement the above measures efficiently, technical extension activities will be intensively carried out at the regional development base when these measures are implemented. The aim will be to establish the technology, the role of the demonstration farms, and to disseminate the technology to neighboring oases.

(3) Regional Development Strategy 3: Effective use of existing organizations

Participation-based organizations of the oases are engaged in many activities that are financed by internal and external sources and residents are aware of the importance of participating. A project implementation system is in the process of being

established. Regional development will fully utilize these oasis associations to implement development activities efficiently.

5.4.3 Regional Development Plans

Individual countermeasures are proposed as shown in **Table 5.4.1** according to an overall analysis of resident needs, basic development concept, and national development plan. The details of the major countermeasures are given below.

(1) Improvement of income

1) Vegetable cultivation

The agricultural productivity of the oasis is low due to damage sustained from decayed roots caused by excess application of irrigation water, pests and diseases, inadequate cultivation techniques, a concentrated harvest season which produces lower prices, high transport costs, and other factors.

Vegetable cultivation in the summer season has been avoided due to high soil temperatures. However, vegetable cultivation during the summer season is an effective means contributing to raising farmer incomes through the sale of farm products for the people gathering at the event of Guetna without incurring transport costs. Therefore, the pilot project will cultivate vegetables during the summer season on a trial basis using shade to lower the soil temperature and other environmental improvements to lower the volume of moisture evaporation. If the results prove that vegetables can be successfully cultivated during the summer season, a plan to include future countermeasures to lower soil temperatures, to plant windbreak forests, and to carry out date cultivation will be included. Specific measures to raise profitability are as follows:

- Improve cultivation technology with seedlings, crop rotation, the spread of fertilizer cultivation techniques, and ridging to prevent root rot
- Expand the cultivation of high cash crops such as carrots, onions, etc.
- Select cultivation varieties that are suited to the natural environment of the region
- Prevent and eliminate disease and pests using natural pesticides
- Establish and disseminate summer season vegetable cultivation after trial cultivation using shade and watering to lower soil temperatures

2) Date cultivation

In order to improve the productivity of dates, the following countermeasures are proposed.

- Implement appropriate planting density since diseases are caused by the high planting density currently employed.
- Disseminate the cultivation of suitable date varieties.
- Develop and disseminate appropriate disease and pest prevention and elimination technology. The development and spread of agricultural pesticides using existing natural resources are particularly important.

3) Livestock farming

Due to limited feed resources, the following measures are needed to raise productivity without increasing the number of livestock animals.

- Improve the species of sheep and mountain goat since current low productivity levels are due to inbreeding. New male species with good temperament, representing a breed that is known for their high milk producing capabilities, should be introduced to improve productivity.
- Improve the camel species by breeding activities with a high milk producing species.
- Implement afforestation using available tree varieties. Wood which can be used as feed for livestock animals will also be used in fences against shifting sand and sand drifts.
- Reduce livestock diseases by disseminating the use of vaccines, etc.
- Increase feed production by effective use of aquifers in the lowlands and introduction of pasturage in the rotation of vegetable crops.
- Promote suitable management of male and female livestock animals (Due to the inability to increase the weight of the adult male species, raising of livestock shall be focused on growing female species and adult male species shall be sold, aiming at effective use of feed resources)
- Promote poultry farming or hen egg production since it is difficult to increase the number of small to medium sized livestock animals due to the negative impact on resource volume. Raising poultry for hen egg production will also be carried out as an alternative source of protein.

4) Efficient use of unexploited resources

To improve crop productivity of the study site, nitrogen and phosphoric acid are required and protein is needed to produce poultry eggs. If artificial or imported fertilizers are used, as in the case of a few oases, there will be no commercial profit. Therefore, unexploited and inexpensive resources near the study site will be used.

- Fish waste discarded at the fish market in Nouakchott and blood, bones and other waste discarded by the slaughterhouse will be used as fertilizer and poultry feed.
- Select effective tree species for afforestation activities (trees that are suitable as livestock feed and fuel) in future.
- Make effective utilization of existing trees by adequate management of windbreak forests.

(2) Improvements of the Social Infrastructure

1) Health and hygiene education

As countermeasure against undernourishment, production of eggs and vegetables throughout the year is indispensable.

Livestock animals are found near drinking water wells and their droppings around the well have polluted its waters. The consumption of such polluted water has caused numerous outbreaks of diarrhea. Countermeasures to improve these conditions are explained below.

- Education to improve the nutritional intake, including information on hen egg consumption.
- Raise hygiene awareness (to boil water for drinking, to alienate livestock animals from drinking water wells, etc.)
- Promote year-round cultivation and processing of vegetables.

2) Improve health and educational facilities

Hospitals and secondary education are not easily accessible for oasis residents.

The following countermeasures are needed to resolve this issue.

- Construct hospitals and schools to foster demonstration development base oases and construct infrastructure on par with facilities in the regional cities.
- Improve existing facilities to improve the quality of existing medical and health facilities.
- Develop human resources to foster teachers, physicians, nurses.

In view of the EU project on road construction, the trends observed in this road project will be observed during the pilot project period and transport and road plans will be forged for the regional development plan.

3) Technical agricultural extension activities

An agricultural vocational school or trial farm do not existent in the study region or in the country. In addition, a technical cultivation manual for sandy soil cultivation does not exist. In view of these circumstances, the following measures are proposed.

- Compile a technical extension manual on vegetable, date cultivation and livestock farming based on the pilot project findings and the regional conditions.
- Strengthen extension organizations and foster human resources. Hence, agricultural technology transfer activities for extension personnel will be conducted during the pilot project period.
- Establish a trial farm or a vocational school since these facilities will be established using the pilot project facilities.

(3) Sustainable Use of Resources

The resources in the study area are the soil for agriculture, plant life for livestock feed, and water for agricultural production and drinking water. Of these resources, the most important resource is water, since it determines the volume of other resources and impacts the lives of the residents and the economy of the study region. Therefore, this Study will be mainly concerned with water resource management.

1) Water-saving irrigation technology

Excessive pumping of groundwater for irrigation purposes and the loss of irrigation water during distribution are major problems. Water-saving cultivation methods must be introduced to ensure the sustainable use of water resources.

- Determining the appropriate volume of irrigation water depends on clarifying the volume of irrigation water used for crops in the study area.
- Improved irrigation water distribution facility
- Improve irrigation methods

2) Groundwater management

To achieve sustainable use of limited water resources for agriculture, livestock farming, and household consumption, it is important to know the correlation between the pumping volume of water and groundwater levels. Hence the safe volume of pumped water will be determined in conjunction with activities to raise the water-saving awareness of oasis residents.

- Monitor the volume of irrigation water and groundwater levels. Pumped water volume, groundwater level, the pump operation time, and other data will be measured and analyzed.
- Based on the findings of monitoring activities of water management methods of the residents and proposal by resident associations, water management standards will be compiled and the residents will propose water management methods based on these standards.

5.4.4 Relevance of Development Plans

The individual countermeasures proposed in **Table 5.4.1** have been assessed comprehensively with regards to their consistency with the needs of the residents, the national development plans, etc. In a more concrete manner, the said countermeasures have been evaluated based on their relevance with the needs of the residents revealed through interview survey to them as well as with poverty alleviation, improvement of social infrastructure and sustainable use of resources proposed within context of the basic development concept. The assessment result is as per **Table 5.4.2**.

According to the evaluation findings, none of the individual countermeasures was given a total low evaluation rating of under 60% (i.e., under 9 points). Therefore, it was concluded that they were appropriate as components for the master plan.

5.5 Framework of the Master Plan

The specific targets of income expansion needed to achieve the objectives of the regional development plan, which is to reduce the poverty-level population by half, have been estimated and is shown below.

The population for the year of 1988 and 2000 is given in **Table 5.5.1**. It is presumed that the population for the year of 2015 would be hardly increased referring to the significant decrease in population during 1988 – 2000. In the light of this, the economic framework shall be projected provided that the population of the regions in question should remain as it is as of 2000.

Table 5.5.1 Population in 1988 and 2000

Region	1988*	2000**	A.A.G.R.
Adrar	61,043	49,381	-1.9
Tagant	64,908	28,326	-7.3

Source: * Annuaire Statistique 1988
**:National Office of Statistics, National Population Census in 2000

The GRDP for 2015 is shown in **Table 5.5.2;** this GRDP was projected subject to an annual growth rate of GDP being 7% and, at the same time, provided that the past trend of economic growth for each region should be maintained until 2015.

Table 5.5.2 Estimated GRDP in 2015 (at 1998 price)

(Unit: Million UM)

Sector	Adrar			Tagant		
	1998	2015	A.A.G.R.*	1998	2015	A.A.G.R.*
Agriculture	1,090.6	1,404.7	1.5	137.3	176.8	1.5
Livestock	821.7	1,058.4	1.5	410.9	529.2	1.5
Handicraft	54.8	90.6	3.0	42.3	69.9	3.0
Service	389.0	643.0	3.0	243.8	403.0	3.0
Total	2,356.1	3,196.6	1.8	834.3	1,179.0	2.0

*: Average Annual Growth Rate (% per annum)
Source : The Study Team

The income distribution structure obtained through the household survey is shown below in **Table 5.5.3**.

Table 5.5.3 Income Distribution Structure in 2001

(Unit : %)

	Adrar	Tagant
Poverty	88.1	89.8
Non-poverty	11.9	10.2

Source : Household Survey by the Study Team

The per capita income of the poverty class in 1996 was below 53,841 UM/person. This value was used to calculate the per capita income for 1998 which was 59,813 UM/person. Based on this figure, aiming at achieving the reduction of the proportion of poverty population from about 90% to about 45% by 2015, the agricultural income in 2015 should be expanded: 1.71 times in Adrar Region and 4.38 times in Tagant Region, as high as that in 1996, provided that the said reduction of poverty population should be attaine depending exclusively on agricultural sector.

In this regional development plan, an increase in agricultural income shall be targeted aiming at reduction of poverty by half as mentioned before.

Table 5.4.1 Details of the Proposed Countermeasures (1/2)

Measures	Detail	Present Conditions
Improvement of Income		
Vegetable Cultivation	Improvement of cultivation skills, Spreading of varieties with higher market values, Selection of proper varieties to be planted, Protection against pests and diseases, Establishment and propagation of vegetable cultivation in summer.	Relevant projects have been done in small scale at several places by the Oasis Project, but little sign of improvement.
Dates Cultivation	Appropriate plant density, Selection and spreading of suitable varieties, Establishment and propagation of measures against pests and diseases.	Relevant projects have been done in small scale at several places by the Oasis Project, but little sign of improvement. Requires long-term measures.
Processing of Agriculture and Livestock Products	Introduction of drying and preservation techniques and facilities	Relevant projects have been done by the Oasis Project but only in some places. No sign of spreading of the projects.
Provision of Credit Loan	Propagation of credit system	One of the principal activities of the Oasis Project and spread widely.
Enforcement of Market	Setting up of kiosks to sell agricultural and livestock product、Improvement of shipping system	Many kiosks have been set up as part of the activities of associations.
Production and Sale of Craftworks	Improvement of handicraft production skills, Introduction of appealing design, Improvement of sales route for products	One of the principal activities of the Oasis Project.
Utilizing Undeveloped Resources	Utilization of junk fish for fertilizer and animal feed, Use of date seeds for animal feed, Use of indigenous plant species for pest repellent.	Consider introduction of undeveloped materials for producing fertilizer and agrochemicals
Improvement of Livestock Raising	Upbreeding, Plantation of useful trees, Disease prevention, Production of animal feed, Introduction of appropriate male-female ratio, Chicken breeding for egg production, Installing fences for animal protection.	Consider introduction of undeveloped materials for animal feed and new productive specie. Requires long-term trial and error for upbreeding.
Tourism Development	Advertisement to lure tourists, Improvement and establishment of restaurants and souvenir shops	
Improvement of Social Infrastructure		
Improvement of Means of Transportation	Introduction of regular bus service	
Literacy Education	Offering literacy education classes	Oasis Project organize classes.
Protection of Water Source from Contamination	Installing feces around a well to protect it from contamination, Construction of frame at a well, Promotion of habit to boil water.	
Administrative Support for Association activities	Continuation of Oasis Project, Technical support for Oasis Project	Oasis Project put priorities on women's associations.
Extension of Agricultural Techniques	Publish of cultivation manuals, Fostering of extension organization and human empowerment.	The Oasis Project is dealing with it but no sign of improvement.
Improvement of Medical Facilities	Construction and improvement of medical facilities, Education of medical staff	
Health and Hygiene Education	Seminars for nutritional improvement, Education to raise awareness of public hygiene	The Oasis Project conducts an educational class to foster would-be midwives or nurses.
Development of Water Resources (Deep Wells)	Deep well drilling, Topographical map making	EU has a plan to drill about a dozen of deep wells in 2002 and later.
Chicken Breeding, Production and Taking of Eggs	Introduction and propagation of chicken breeding and egg production, Production of animal feed, Champaign to promote vegetable and egg consumption,	
Improvement of Water Pumping System	Utilization of solar and wind energy, Introduction of hand pump	PARP has a projects to spread the use of pumps powered by solar panels.
Energy Saving Cooking	Use of gas and solar cooker	The Oasis Project introduces gas cookers in some oasis.

Source : The Study Team

Table 5.4.1 Details of the Proposed Countermeasures (2/2)

Improvement of Social Infrastructure (continuation)		
Measures against Sand Shifting and Sand Stabilization	Expansion of afforestation projects, Effective arrangement of fences	One of the main activities of the Oasis Project.
Truck Improvement	Improvement of main roads and trucks	EU has an improvement plan starting form 2002.
Construction of Secondary and Higher Education Facilities	Construction of educational facilities in major oases	
Expansion of Association Organization to other Oases	Strengthening of administration of associations, Improvement of internal information transmission system	One of the main activities of the Oasis Project.
Establishment of Nursery	Construction of facilities and education/fostering of child nurses.	
Environment Protection and Effective Use of Resources		
Project for Sand Stabilization and Afforestation	Diversifying the varieties for planting, production of seedlings, planting varieties with multipurpose, Introduction of forest management techniques.	One of the main activities of the Oasis Project.
Installation of Dikes	Construction of banks and dykes against flood, topographical map making,	EU has a plan to construct some from 2002
Utilizing Surface Water and Rain Water	Installation of dams and wires to promote rainwater recharge to the groundwater.	There have been some projects by the Oasis Project and others.
Management of Groundwater	Collection of basic data by monitoring, Introduction of groundwater management by the residents and resident groups, drilling of deep wells for exploration.	
Water Saving Irrigation Techniques	Extension of water saving irrigation techniques, Introduction of hand pump	
Utilizing Alternative Energies	Utilization of solar and wind energy for pumping and electricity generation.	PARP has been introducing solar pumping system.
Environmental Improvement in Tourist Zones	Construction of toilet with septic tanks, solid waster management plan	

Source : The Study Team

Table 5.4.2 Evaluation of the Proposed Countermeasure

Proposed Measures	Needs		Effect as Regional Development			Total
	RRA and Study on-site	Female Residents' Needs	Poverty Alleviation	Improvement of Social Infrastructur	Sustainable Use of Resources	
Improvement of Income						
Vegetable Cultivation	3	3	3	3	2	14
Dates Cultivation	3	2	3	3	3	14
Processing of Agriculture and Livestock Products	3	2	3	3	2	13
Provision of Credit Loan	3	3	3	2	1	12
Enforcement of Market	3	3	3	2	1	12
Production and Sale of Craftworks	1	3	3	2	1	10
Utilizing Undeveloped Resources	1	1	2	3	3	10
Improvement of Livestock Raising	2	1	3	2	1	9
Tourism Development	1	2	3	2	1	9
Improvement of Social Infrastructure						
Improvement of Means of Transportation	3	3	3	3	2	14
Literacy Education	3	3	3	3	1	13
Protection of Water Source from Contamination	3	2	2	3	3	13
Administrative Support for Association activities	2	2	3	3	3	13
Extension of Agricultural Techniques	3	3	3	2	2	13
Improvement of Medical Facilities	3	3	2	3	1	12
Health and Hygiene Education	3	2	3	3	1	12
Development of Water Resources (Deep Wells)	3	3	2	3	1	12
Chicken Breeding, Production and Taking of Eggs	2	1	2	3	3	11
Improvement of Water Pumping System	2	2	2	2	3	11
Energy Saving Cooking	3	1	2	2	3	11
Measures against Sand Shifting and Sand Stabilization	2	1	2	3	3	11
Truck Improvement	2	3	2	3	1	11
Construction of Secondary and Higher Education Facilities	2	2	3	3	1	11
Expansion of Association Organization to other Oases	3	2	2	2	2	11
Establishment of Nursery	1	2	2	3	1	9
Environment Protection and Effective Use of Resources						
Project for Sand Stabilization and Afforestation	3	2	2	3	3	13
Installation of Dikes	2	2	2	3	3	12
Utilizing Surface Water and Rain Water	3	2	2	2	3	12
Management of Groundwater	3	1	2	2	3	11
Water Saving Irrigation Technics	2	1	2	2	3	10
Utilizing Alternative Energies	2	1	2	2	3	10
Environmental Improvement in Touristic Zones	2	1	2	3	2	10

Source : The Study Team scale: 1: small 2: middle 3: large

CHAPTER 6

PILOT STUDY PLAN

CHAPTER 6 PILOT STUDY PLAN

6.1 Objective of the Pilot Study and Pilot Projects

A pilot study shall be put into implementation in an attempt to examine the feasibility of various countermeasures which have been forged so as to materialize basic development concepts (poverty alleviation, improvement of social infrastructure and sustainable use of resources) under the regional development plan (M/P).

The countermeasures given in **Table 5.4.2** are inter-linked each other in various aspects, it is thereby advisable not to carry out each countermeasure independently in the course of the pilot study but to implement inter-linked components of each countermeasure simultaneously, so that effective completion of various countermeasures may be realized producing more benefits. In this pilot study, countermeasures have been categorized into the proposed pilot projects as given below. And, categorization of proposed countermeasures are summarized in **Table 6.1.1**.

1) Water-saving and raising agricultural productivity :

   Cropping technology, water-saving irrigation system, etc.

2) Improvement of health and hygiene conditions :

   Education on adequate dieting and hygiene concept, improvement of health and hygiene conditions of the oases, cooking, etc.

3) Resource management:

   Basic data such as pumping volume for irrigation, groundwater level, crop water requirement, etc., water-saving education and crops cultivation method.

4) Access to market, health and educational facilities:

   Public health and educational facilities, roads, transport means, marketing destination of agricultural products, etc.

In order to select the components of the pilot study to be implemented, each categorized

pilot project was evaluated based on its ripple effect on the surrounding oases and the degree of urgency involved (see **Table 6.1.2**) and the following two pilot projects have been selected as eligible ones for implementation under the present pilot study.

1. Water-saving and raising agricultural productivity

2. Improvement of health and hygiene conditions.

Table 6.1.2 Selection of Pilot Project

	Ripple effect	Urgency	Total
Water saving and productivity raise	3	3	6
Improvement of health and hygiene	3	3	6
Management of resources	2	2	4
Access	2	1	3

Evaluation ; 3：Large、2：moderate、1：small

The measures requiring large facilities that need enormous investment costs in **Table 6.1.1** and the priority measures of the Oasis Project currently under implementation and of other EU projects were excluded from the projects under the pilot study. These excluded measures shall be reviewed within the regional development plan once their implementation status together with their anticipated effects shall have been examined.

The name of each pilot project has been determined as follows taking into consideration of contents of the project. Objectives of the projects are also explained as follows.

1) Vegetable cultivation by farmers

Realization of water-saving and increasing productivity with introduction of appropriate technology, increasing income with diversification of cropping season, improving nutritional conditions by increasing intake of vegetables.

2) Water-saving cultivation of dates

Extension of water-saving irrigation method, collection of basic data through monitoring of water level of wells and amount of water drawn to be used for preparation of an appropriate water resource management plan.

3) Increasing livestock production

Examination on possibility of egg and chicken meat production to compensate for decreasing livestock production.

4) Improving public health conditions

Enhancing effectiveness of pilot projects 1) and 3) by educating residents on the improvement of sanitary environment and on food consumption.

6.2 Pilot Study Implementation Policy

The following factors will be considered in implementing pilot study with special attention paid to efficiency of the pilot study and extension and sustainability of the techniques to be applied in pilot projects.

(1) Eligible beneficiaries

Female group shall plan an important role in attaining such goals under present pilot study as poverty alleviation and improvement of health and hygiene conditions, so the beneficiaries of the pilot projects (vegetables cultivation by farmers, increasing livestock production and improving public health conditions) shall be targeted mainly to female group. On the other hand, water-saving cultivation of dates shall be targeted to the owners of dates farms.

(2) Consideration on the cost of equipment to be introduced

In view of promoting sustainable development in an area dominated by poverty-households, special consideration shall be made on cost and maintenance expense of the equipment to be introduced.

(3) Introduction of techniques acceptable to residents

In consideration of dominancy of illiterate people within the area under influence of the pilot projects, it is desirable that a simple system of monitoring that is easily acceptable to the residents be introduced for the collection of data even though being

something questionable in accuracy of collected data.

(4) Use of the association of participatory management of oasis (AGPO) and monitoring of resident activities

According to the findings of the study conducted in 2001, oasis heads or notable persons (usually the head of the associations) have great influence over the efficient operations of the associations. Hence, communication will be actively pursued with these leaders to promote understanding in implementing the pilot projects and their cooperation will be solicited.

Emphasis will be placed on communication with the oasis residents to ensure that resident participation remains a focal component of the project.

(5) Extension of technologies

If possible, participation of field agents in charge of technical extension from PGRNP project, as well as NGOs from URDO will be solicited to extend the target of technical transfer. In addition, a technical extension manual will be compiled based on the experience and knowledge gained from the pilot project to assure the continuity of technical extension after the project.

6.3 Technical Components of the Pilot Study

In line with the basic concepts, the components of the pilot projects, the technologies to be applied to these projects and prevailing constraints to be eased are compiled in **Table 6.3.1.**

Table 6.3.1 Contents of Pilot Project

Pilot Projects	Major Components	Technologies to be applied	Prevailing Constraints
Vegetable cultivation by farmers	1) Improvement of cropping technologies 2) Improvement of physical texture of soils 3) Diversification of crops and cultivation season 4) Water-saving cultivation 5) Utilization of unused resources 6) Collection of basic data	1) Ridging cultivation 2) Soil application 3) Shading, etc. 4) Irrigation with watering can, drip irrigation and pumping with manually operated pump 5) Preparation of compost with utilization of fish garbage 6) Measurement of pumping and irrigation volumes, available moisture of soils	1) Low productivity caused by root rotting 2) Ditto 3) Consumption of vegetables is less, because it is limited to their harvest season 4) Root Rotting due to excessive application of irrigation water and water-saving 5) Low productivity 6) Assessment on irrigation water volume and field water requirement
Water-saving cultivation of dates	1) Collection of basic data for management of groundwater 2) Improvement of irrigation method 3) Dissemination of water-saving concept to local people	1) Measurement of groundwater level and pumping volume 2) Hose irrigation 3) Education on water-saving technology	1) Correlation between actual irrigation volume and groundwater level 2) Water conveyance loss 3) Excessive irrigation, water conveyance loss
Increasing livestock production	1) Poultry farming method 2) Utilization of unused resources	1) Farming within hen house 2) Elaboration of feed with use of waste fish, vegetables garbage and bones	1) Protection of poultry from attack of raptores 2) Deficient provision of feed
Improving public health conditions	1) Education on health and hygiene 2) Processing of agricultural and livestock products 3) Sanitary improvement of potable water	1) Basic knowledge in public health and nutrition 2) Cooking and elaboration of vegetables, etc. 3) Quality control of wells supplying potable water	1) Disease and malnutrition 2) Malnutrition 3) Disease (diarrhea, etc.)

6.4 Eligible Oases for Pilot Project

6.4.1 Eligible Oases for Pilot Project

The following criteria were used to evaluate the oases where an AGPO has been already formed and the oases for pilot projects have been selected based on the results. These criteria, which are the components of the regional development strategy 2, were used to

assess the production potential, capabilities to be a product transportation hub, and the potential to become a consumption base of an oasis.

1) Access to the regional capital

The time required to travel from each oasis to the regional capital was evaluated.

2) Groundwater quality

The quality of the groundwater is an important factor in vegetable cultivation. The quality of irrigation was evaluated using Electric Conductivity and Sodium Adsorption Ratio (SAR). The selection was made in such a way that oases with different water quality would be chosen.

3) Experience in vegetable cultivation

Past experience in vegetable cultivation was evaluated.

4) Potential to become a regional center

The oasis was assessed for its location as a regional center or for its potential to become a focal regional center in the future.

5) Possibility to become a production base

The possibility of an oasis to serve as a future focal vegetable production base was assessed.

The results of the evaluation have been given in **Table 6.4.1** and **6.4.2.**

Based on the evaluation table, the oases of Tawaz and Tidjikja, which gained the highest ratings were selected. In addition, two oases from each region with different geographic and demographic conditions (Tenllaba, Toungad, Nimlane, Lehoueitatt) have been selected as project sites for the reason that these oases have actively functioning associations and cooperatives that are likely to cooperate with the pilot projects.

Existing conditions of the oases for the pilot projects are summarized in **Table 6.4.3**. These target oases for the pilot projects comprise different features in terms of

geographic condition (distance from the regional capital: 0 – 186 km), natural condition (available water resources: surface water at wadis, groundwater in sand dune and fissure water) and socio-economic conditions (population: 656 – 6,061; annual income per capita: 10,672 – 134,325 UM).

6.4.2 Components of the Pilot Project by Oasis

The components of each pilot project were selected on the basis of the following criteria for the selection.

1) Vegetable cultivation by farmers

   Possibility of vegetable production was evaluated by conditions for vegetable production (such as natural conditions and access to market) and by the experience in vegetable cultivation.

2) Water-saving cultivation of dates

   The same oases for the vegetable cultivation by farmers were selected for water-saving cultivation of dates because both projects involve groundwater monitoring.

3) Increasing livestock production

   Oases which are poorer and have difficult access to major villages were chosen for increasing livestock production because the project aims to improve nutritional conditions.

4) Improving public health conditions

   Oases with bad access to a hospital were selected for improving public health conditions.

As a consequence of selection, components of pilot projects for each target oasis were determined as shown in **Table 6.4.4**.

Table 6.4.4 Characteristics of Oasis and Pilot Project

(Adrar Region)

Oasis	Tawaz	Toungad	Tenllaba
Pilot project	1) Vegetable cultivation by farmers 2) Water-saving cultivation of dates	1) Vegetable cultivation by farmers 2) Water-saving cultivation of dates	1) Increasing livestock production 2) Improving public health conditions
Character-istics	1) Large-scale vegetable cultivation. 2) Low groundwater level. 3) Better access to the market.	1) Major oasis of dates production. 2) Many visitors during Guetna. 3) Bad accesses to the market.	1) Bad access to the market. 2) Low average income.

(Tagant Region)

Oasis	Tidjikja	Nimlane	Lehoueitatt
Pilot project	1) Vegetable cultivation by farmers 2) Water-saving cultivation of dates	1) Vegetable cultivation by farmers 2) Water-saving cultivation of dates	1) Increasing livestock production 2) Improving public health conditions
Character-istics	1) Vegetable consuming area. 2) Prevalent vegetable cultivation by women's association.	1) Better access to the market. 2) Fertile soil.	1) Bad access to the market. 2) Extreme poverty.

6.5 Pilot Project Implementation Plan

The pilot study shall be conducted dividing the period into three stages as given below (Initially, it was scheduled to be conducted from January 2002 to June 2003, but the period was prolonged to March 2004).

- Stage 1: Preparation (January – March, 2002)
- Stage 2: Implementation of preparatory pilot project on vegetable cultivation, and full implementation of the other three pilot projects with monitoring (May – September, 2002)
- Stage 3: Implementation of all the pilot projects and monitoring (October 2002 – March 2004)

The major activities by stage of the pilot projects are shown in **Table 6.5.1**. Except for the pilot project: vegetable cultivation by farmers, all pilot projects shall envisage the same activities in both the stage 2 and the stage 3; as for the vegetable cultivation by farmers, preparatory pilot project on cultivation of summer-season vegetables shall be carried out in the stage 2 normal pilot project shall be conducted in the stage 3.

The implementation plan of the pilot study is shown in **Fig. 6.5.1**, and **Tables 6.5.2** to **6.5.5** describe the detailed plans and PDMs for each pilot project.

Table 6.5.1 Major Activities of the Pilot Projects

Pilot project	Stage 1 - Preparation	Stage 2 -Vegetable cultivation trial -Implementation of the other projects.	Stage 3 - Full Implementation of all the projects.
Vegetable cultivation by farmers	- Preparation of materials. - Selection of trial field, association and leader.	- Excavation of well. - Trial of vegetable cultivation during summer. - Technical training. - Monitoring. - Midterm evaluation.	- Implementation of the project. - Technical training. - Monitoring. - Final evaluation.
Water-saving cultivation of dates	- Preparation of materials. - Selection of association and dates farms. - Implementation of trial.	- Analyzing results of the trial. - Implementation of the project. - Technical training. - Monitoring. - Midterm evaluation.	- Reviewing the project based on the midterm evaluation. - Continuing the project. - Monitoring. - Final evaluation.
Increasing livestock production	- Collecting and processing material for feed. - Selection of association. - Implementation of trial.	- Collecting and processing material for feed. - Analyzing results of the trial. - Implementation of the project. - Technical training. - Monitoring. - Midterm evaluation.	- Reviewing the project based on the midterm evaluation. - Collecting and processing material for feed. - Continuing the project. - Monitoring. - Final evaluation.
Improving public health conditions	- Selection of association. - Collection of residents needs for the education.	- Implementation of the project. - Technical training. - Monitoring. - Midterm evaluation.	- Reviewing the project based on the midterm evaluation. - Continuing the project. - Monitoring. - Final evaluation.

Special considerations on activities of each stage are as explained below:

1) Prior to the official start of the pilot project, the objectives and major component of the pilot study shall be explained to the leaders of associations or to village administrative bodies such as Jemma of the oases to be benefited and also to other relevant organizations, in an attempt to gain understanding and cooperation for the pilot study.

2) At the opportunity of the first PCM workshop, a covenant shall be signed by the responsible persons for the properties and for the associations, target of the pilot projects. At the same PCM workshop, an explanation on the equipment to be introduced and the rationale for implementation of the pilot study shall be made. In so far as education on public health is concerned, the components of the project shall be forged after an exchange of opinions shall have been made on the request by residents.

3) An abroad study tour shall be held in Morocco that is an advanced area in an arid agriculture area and has an experience of providing technical cooperation to the Study Area. The purpose of the tour was technology transfer to the counterpart personnel through the collection of technical materials on applicable agricultural techniques and visiting relevant facilities.

4) With regard to vegetable cultivation during the summer season, commonly cultivated vegetables such as tomatoes and carrots shall be sowed to coordinate their harvest season with summer season.

5) As for water-saving cultivation of dates, the Study Team in collaboration with counterpart personnel and responsible persons of each oases shall make a visit to farms to make a technology transfer on monitoring and to discuss on groundwater management method to be undertaken by initiative of beneficiaries, so that an adequate implementation plan for water-saving proposal should be elaborated.

6) Cropping plan for vegetable cultivation shall be prepared taking account of the possibility for double harvests a year or triple harvests a year.

6.6 Monitoring Plan

Technical monitoring will be conducted for each project and a survey of people's awareness of the pilot study also will be conducted. The monitoring plan is summarized in **Table 6.6.1** and the details described in the paragraphs which follow.

Table 6.6.1 Monitoring Plans

Project	Monitoring item
Vegetable cultivation by farmers	1. Yield and profitability 2. Growth of crops 3. Cultivation management 4. Sales and consumption
Water-saving cultivation of dates	1. Pumping volume of water 2. Water level at wells 3. Irrigation volume of water 4. Change of moisture content of soils
Increasing livestock production	1. Survival rate 2. Productivity of eggs 3. Profitability
Improving public health conditions	1. Possibility to reform living conditions and practices 2. Possibility to improve living conditions 3. Possibility to improve health and nutritional conditions
People's awareness	1. Effect of the project 2. Development of human resources 3. Degree of people's interest

The pilot projects shall be implemented paying attention to the aspects as explained hereinafter.

(1) Vegetable Cultivation by farmers

For better understanding of the technologies to be applied among the beneficiaries, the Study Team in collaboration with counterpart personnel and beneficiaries shall conduct monitoring on growth of crops, measurement of yield, etc. This monitoring shall be realized at harvest period as well as taking opportunities of holding PCM workshop and rendering technical transfer services.

(2) Water-saving Cultivation of dates

The monitoring task under the present pilot project entails continuous observation work which is troublesome to local people. Nevertheless, in the light of importance of this observation work results in providing basic data for water use and management in the future, efforts shall be made in the course of technology transfer and PCM workshop to obtain consensus from local people.

The eligible farms in which pilot project is to be developed shall be: 1) Owner of farm is enthusiastic about implementation of monitoring relevant to water-saving cultivation, 2) Target farms are dispersed widely each other throughout the oasis region, and 3) Movement of groundwater level is typified at oasis level.

(3) Increasing Livestock Production

The monitoring task shall be conducted at the opportunity of each PCM workshop and rendering of technology transfer. In addition, in case of outbreak of incidents like pest, monitoring task shall be undertaken on all such occasions.

(4) Improving Public Health Conditions

An important issue under the present pilot project is to be acquainted with the components of the pilot project by the local people and to adopt them into their routine life. Thorough explanation to local people shall be made and materials which may be procured or made without difficulty by local people shall be provided.

(5) Monitoring on People's Awareness

The purpose of the monitoring on the people's awareness is to grasp the degree of people's involvement in implementing and managing the pilot projects and also to the degree of achieving the objectives of M/P and its sustainability.

All evaluations will be made by three groups: the Study Team, the participants of the pilot projects, and persons who do not participate in the pilot projects. The Study Team mainly conducts the evaluation based on PCM Method, and the participants of the pilot projects will evaluate their own activities through workshops (Participatory Evaluation). Residents of the same oasis who do not participate in the pilot projects will be evaluated using RRA (Rapid Rural Appraisal) method.

The monitoring of participants and non-participants include people's interest in the pilot projects, ripple effect of the projects, etc. and these factors shall be employed as indicators.

Fig. 6.5.1 Implementation Plan of Pilot Project

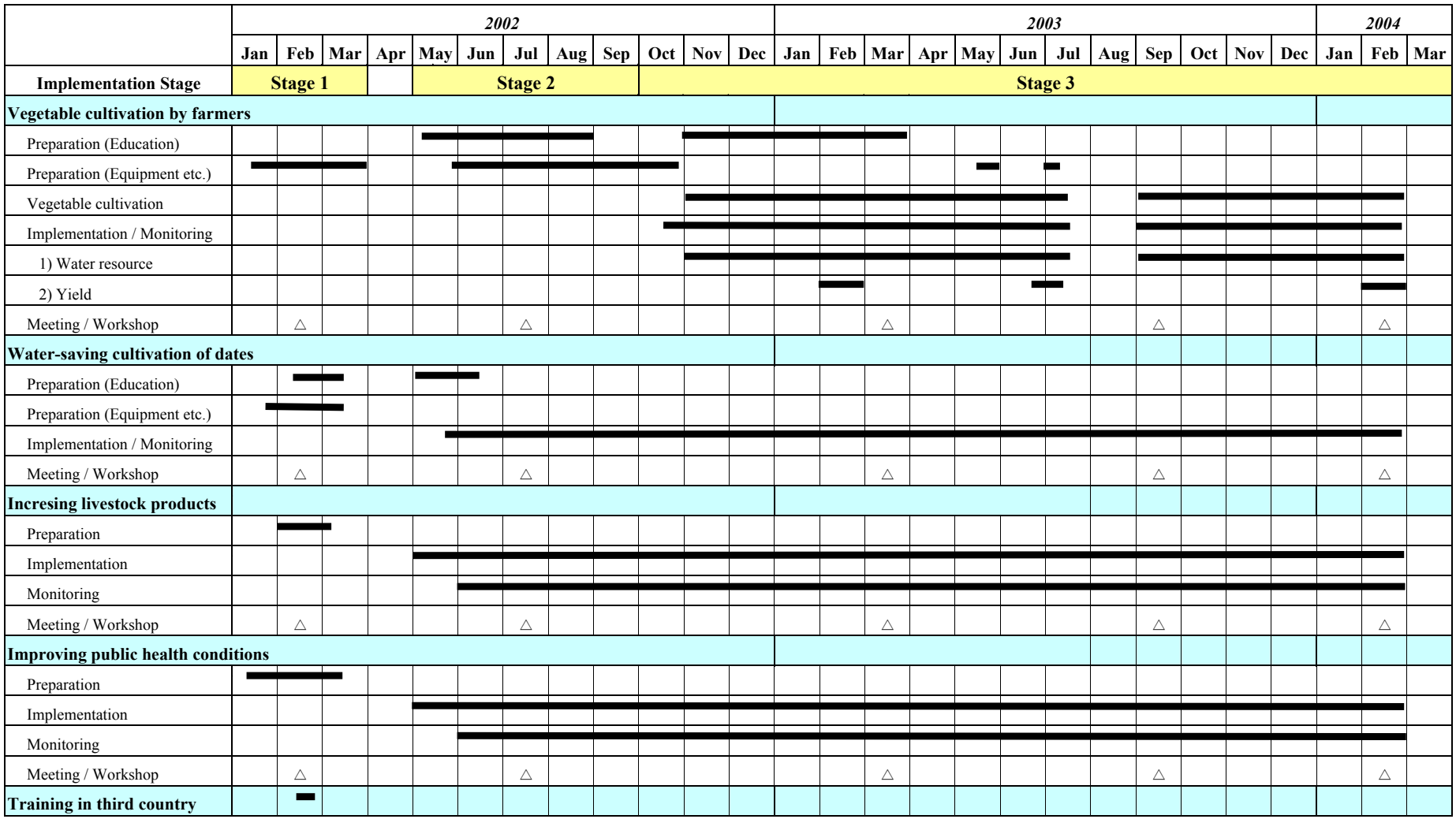


Table 6.1.1 Classification of Project for Selection of Pilot Project

Proposed Measures	Classification of Project				Construction of Large Facilities	Existence of Projects by Other Donor
	Water Saving and Productivity Raise	Improvement of Health and Hygiene	Management of Resources	Access		
Improvement of Income						
Vegetable Cultivation	O	O				*
Dates Cultivation	O					*
Processing of Agriculture and Livestock Products		O				*
Provision of Credit Loan	O	O	O	O		**
Enforcement of Market				O		**
Production and Sale of Craftworks				O		**
Utilizing Undeveloped Resources	O	O				
Improvement of Livestock Raising	O	O	O			*
Tourism Development			O	O		
Improvement of Social Infrastructure						
Improvement of Means of Transportation		O		O	√	
Literacy Education	O	O	O	O		**
Protection of Water Source from Contamination		O	O			
Administrative Support for Association activities	O	O	O			**
Extension of Agricultural Techniques	O		O			*
Improvement of Medical Facilities		O			√	
Health and Hygiene Education		O				*
Development of Water Resources (Deep Wells)					√	**
Chicken Breeding, Production and Taking of Eggs		O				
Improvement of Water Pumping System	O					*
Energy Saving Cooking		O				*
Measures against Sand Shifting and Sand Stabilization			O			**
Truck Improvement		O		O	√	*
Construction of Secondary and Higher Education Facilities					√	
Expansion of Association Organization to other Oases				O		**
Establishment of Nursery					√	
Environment Protection and Effective Use of Resources						
Project for Sand Stabilization and Afforestation	O	O	O			**
Installation of Dikes	O		O		√	**
Utilizing Surface Water and Rain Water	O		O			**
Management of Groundwater	O		O			
Water Saving Irrigation Technics	O		O			
Utilizing Alternative Energies			O		√	*
Environmental Improvement in Touristic Zones			O			

Note : shaded measures correspond to ones with tick mark or ** mark

Table 6.4.1 Selection Matrix for Pilot Project Site (Adrar)

Name of Oasis	Moughataa	1) Accessibility	2) Effect of technical extension	3) Water Quality	4) Vegetable	5) Possibility	6) Possibility	Total
Ain Ehl Tayaa	Atar	5	4	1	2	5	3	20
Azweiga et El Hassiane	Aoujeft	2	1	4	2	2	2	13
Chinguetti	Chinguetti	3	4	4	3	3	2	19
El Maaden	Atar	2	2	1	4	3	2	14
Meddah	Aoujeft	1	3	3	5	3	2	17
Gleitat	Aoujeft	1	2	3	5	2	2	15
J'reif	Atar	3	1	3	5	1	2	15
Ksar Torchane	Atar	2	3	2	3	3	2	15
Loudey	Aoujeft	3	2	2	3	2	2	14
M'haireth	Aoujeft	3	3	1	4	2	2	15
N'teirguente	Aoujeft	1	2	1	3	2	2	11
Ouadane	Ouadane	3	3	3	3	3	4	19
Tenllaba	Ouadane	3	3	3	3	3	4	19
Tawaz	Atar	4	4	3	5	4	5	25
Tayaret	Atar	3	2	2	4	3	2	16
Tenwement	Chinguetti	1	2	3	5	2	2	15
Tirebane	Aoujeft	2	2	5	3	3	2	17
Terwen	Atar	4	2	1	2	2	2	13
Timinite	Aoujeft	1	1	4	3	1	2	12
Toungad	Aoujeft	2	4	3	5	3	4	21
Wekchada	Aoujeft	1	3	2	3	4	2	15

1) Access to Regional Capital
2) Role of experimental farm
3) Effect on water saving
4) Experience of vegetable cultivation
5) Possibility of collecting and shipping center of agricultural products in the region
6) Possibility of production center of vegetables

Table 6.4.2 Selection Matrix for Pilot Project Site (Tagant)

Name of Oasis	Moughataa	1) Accessibility	2) Effect of technical extension	3) Water Quality	4) Vegetable	5) Possibility	6) Possibility	Total
Acherim	Tidjikja	4	3	5	2	2	2	18
Aghlembit	Tidjikja	3	2	4	3	1	2	15
Aouenat Erji	Tidjikja	3	1	2	4	1	2	13
Ederroum	Tidjikja	4	2	4	2	2	2	16
Lehoueitatt	Tidjikja	4	3	3	4	3	3	20
El Gheddiya	Tichitt	1	3	2	4	1	2	13
El Housseiniya	Moudjeria	2	1	2	2	2	2	11
El Meinan	Tidjikja	2	2	1	1	2	2	10
Ksar El Barka	Moudjeria	1	1	3	2	1	2	10
Lekhdeima	Moudjeria	1	2	4	4	1	2	14
N'batt	Tidjikja	1	2	4	2	1	2	12
N'beika	Moudjeria	5	4	3	5	4	4	25
Nimlane	Tidjikja	5	4	2	5	5	5	26
Rachid	Tidjikja	2	3	4	4	1	3	17
Tichitt	Tichitt	1	3	2	4	1	3	14
Tidjikja ville	Tidjikja	5	5	4	5	5	5	29
Zouera	Tidjikja	1	1	5	2	1	2	12

Source : Study Team

1) Access to Regional Capital
2) Role of experimental farm
3) Effect on water saving
4) Experience of vegetable cultivation
5) Possibility of collecting and shipping center of agricultural products in the region
6) Possibility of production center of vegetables

Table 6.4.3 Summary of Existing Conditions of Oasis for the Pilot Projects

	Adrar			Tagant		
	Tawaz	Toungad	Tenllaba	Tidjikja	Nimlane	Lehoueitatt
Locatoin (Distance from the regional capital Km, Time needed to go to the capital in minutes)	30Km, 75min.	65Km, 110min.	186Km, 180min.	0Km, 0min.	35Km, 30min.	22Km, 60min.
Natural condition (Wadi : Sand ratio)	(10:75)	(85:15)	(15:80)	(80:15)	(30:60)	(90:5)
Population	2,371	835	992	6,061	745	656
Population compositon (%) (Male:Female:Child)	(31:29:40)	(25:28:47)	(32:29:39)	(23:39:38)	(23:37:40)	(23:40:38)
***Women-headed household (%)	16	-	7	35	33	16
** Average income (UM/Capita)	134,325	120,186	30,817	67,642	36,226	10,672
** Income from agriculture and livestock (%)	83	98	95	98	90	95
**Income composition (%) (Live.:Dates:Veg.)	(1:63:18)	(34:30:14)	(88:1:7)	(2:78:18)	(62:7:17)	(45:30:16)
Ratio of household engaged in agriculture and livestock (%)	93	100	85	60	69	76
Jobless household (%)	0	0	1	17	9	19
Groundwater level (m) Low / High	15.2 / 11.6	6.3 / 5.4	6.6 / 3.8	10.2 / 7.0	7.3 / 6.1	6.8 / 5.5
Irrigated area (Ha)	280	60	15	8	-	2
Dates trees (Number)	37,500	49,000	13,500	28,000	9,100 ('95)	8,000
Visitors during Guetna	500	2,500	500	3,000	150	225
Dates price	High	High	High	High	Middle	Low
**Number of births (per woman)	6.9	6.0	5.9	6.9	4.7	7.2
** Average death rate of child (%)	23	13	24	23	17	15
School *	K (3)			K (2)		
	P (5)	P (1)	P(1)	P (8)	P (1)	P (1)
	J (1)			J (2)	J (1)	
				H (1)		
Pupil and student *	K (90)			K (149)		
	P (360)	P (142)	P (97)	P (1,760)	P (177)	P (122)
	J (100)			J (1,036)	J (70)	
				H (190)		
Number of association members	370	154	185	521	184	214
Number of cooperatives	9	6	7	29	6	2

* K: Kindergarten, P: Primary School, J: Junior High School, H: High school

Source : ** : Household survey by the Study Team *** : Project Oasis

Table 6.5.2 Outline of Pilot Project (1/2) (Breakdown)

Name : Vegetable Cultivation by Farmers

Targeted Oasis : Tawaz、Toungad、Tidjikja、Nimlane

Item	Content	Remarks
1. Objective	Raise income by increasing crop yield. Disseminate cultivation utilizing water-saving irrigation techniques and monitor irrigation water volume, pumped water volume, groundwater levels to collect basic water management data.	
2. Beneficiaries	Associations of Tawaz, Toungad, Tidjikja, Nimlane	
3. Project Implementing Body	UCP office, National Water Resource Center, JICA study team	
4. Project Content		
1. Summary	Vegetable cultivation is a major activity of the associations in the targeted areas. Presently, the yield is low and much of the irrigation water is wasted. This project aims to raise the productivity of vegetable cultivation by associations through technical extension activities and to monitor water resources in order to collect basic water management data. Activities to use unexploited resources as fertilizer and pesticides will also be carried out.	
2. Major Facilities and Activities	Facilities/Activities: 1. Vegetable cultivation using water-saving irrigation methods Construction and Implementation: 1. Associations	
3. Maintenance and Operations	Supervision : Oasis Project Execution : Associations, NGO or Local Consultants	
4. Period of Construction Works and Activities	1. Preparation of material and equipment (4 months) 2. Winter and summer season vegetable cultivation (4 months each) 3. Technical extension for associations (7 times x 4 locations = 28 times) 4. Monitoring and analysis of groundwater levels and volume of irrigation water (8 months) (except Tawaz)	
5. Project Costs	1. Fence construction: support each 1.5 m 2. Construction of production and observation wells and manual pump installation (1 unit each), except Tawaz 3. Measuring instrument for pumped volume of irrigation water and hose (4 sets) 4. Required instruments (water gauge, soil temperature gauge, etc.) 5. Workshop cost, 6. Personnel costs, 7. Transportation costs	

6. Monitoring Activities

Item	*Data Collection Frequency*	*Data Collection*	*Participant*	*Evaluator*
1. Crop yield volume, growth conditions	Harvest period	NGO or L.C., extension personnel, study team	NGO or L.C.	Study team
2. Pumped water volume, groundwater levels	Irrigation	NGO or L.C., CNRE, study team	NGO or L.C.	Study team
3. Activities of women associations	All times	NGO or L.C., CNRE, study team	NGO or L.C.	Study team

7. Schedule

Work Items	01	2002											2003						
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7
1) Technical education						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
2) Material preparation			■			■	■													
3) Vegetable cultivation						□	□	□	□			■	■	■	■			■	■	■
4) Groundwater monitoring												■	■	■	■			■	■	■
5) Meeting / Workshop			△					△										△		

* NGO or L.C.; NGO or Local Consultants CNRE; National Water Resources Center

* □ : Trial ■ : Implementation

Table 6.5.2 Outline of Pilot Project (2/2) (PDM)

Project: Vegetable Cultivation by Farmers
Oasis：Tawaz、Toungad、Tidjikja、Nimlane
Target Group：Vegetable cultivation farmers in each oasis
Period：Jan. 2002～July 2003 Implementing Agency ：JICA

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal 1. Poverty is alleviated 2. Health and sanitary conditions are improved 3. Resources can be utilized sustainably	1. Until 2015, poverty is reduced by half 2. Until 2015, malnutrition is reduced by half 3. Water resources are utilized stably	1,2,3 Technical evaluation for each item (Monitoring), Questionnaire survey, Sample survey, etc.	Phase III of Oasis Project is implemented
Project Purpose Income increases (by improvement of the vegetable cultivation technique)	The poverty of women's head holders is reduced	Household survey	
Outputs 1. Agricultural technique is achieved by local technical instructors 2. Cultivation technique is extended to the oasis 3. Fertilizer is used in farm fields 4. Vegetables can be eaten all around the year 5. Irrigation water is reduced 6. Basic data can be obtained for the examination of appropriate water use	1. Technical instructions are given regularly 2. Vegetable production increases 3. Quantity of fertilizer use in the farm fields 4. Vegetable can be harvested in July and August 5. Groundwater level is stable/ recovered 6. Existence of the records of monitoring	1. Questionnaire survey 2. Yield survey 3. Yield survey 4. Sample survey 5. Records of monitoring 6. Records of monitoring	1. Visitors at Guetna buy vegetable 2. Rainfall is not reduced extremely
Activities 1 To instruct local technical instructors in vegetable cultivation 2 To instruct cultivation technique to Tawaz, Toungad, Tidjikja and Nimlane 3 To utilize the unused resources as fertilizers 4 To extend vegetable cultivation in summer 5 To implement water-saving irrigation 6 To monitor irrigation water and the level of groundwater after digging wells	Input ＜JICA Study Team＞ Personnel Members of the Study Team Equipment Fence Installations such as shading shelf Hand pump Seeds of vegetables Oil drums and hose Unused resources Extension manual Money Cost of digging wells Personnel expenses for local technical instructors Transportation expenses	＜Mauritania＞ Personnel Vegetable cultivation farmers Local technical instructors Equipment Pilot farms	Preconditions The residents in the oasis agree with implementing the pilot project

Table 6.5.3 Outline of Pilot Project (1/2) (Breakdown)

Name : Water-saving Cultivation of Dates

Targeted Oasis : Toungad、Nimlane、Lehoueitatt

Item	Content	Remarks
1. Objective	Water-saving irrigation methods will be promoted and the pumped water volume, groundwater levels, and irrigation volume will be monitored in date cultivation, which is the most widespread crop cultivated in the oases. Basic data will be collected to promote groundwater management.	
2. Beneficiaries	Date farmers in Toungad、Nimlane、Lehoueitatt	
3. Project Implementing Body	UCP office, National Water Resource Center, JICA study team	
4. Project Content		
1. Summary	The major crop of the project area is dates. Due to the inadequate use of irrigation water, groundwater levels are dropping. The pilot project will determine the appropriate volume of water required by monitoring the pumped water volume and groundwater levels and will collect basic data in water resource management, which is currently nonexistent. In addition, water-saving irrigation methods will be introduced and monitored in the pilot project and extension activities on these methods will be conducted based on the results that are achieved.	
2. Major Facilities and Activities	Facilities/Activities: 1. Water-saving irrigation methods in date cultivation Construction and Implementation: 1. Date farmers	
3. Maintenance and Operations	Supervision: The UCP office Execution : selected farmers and NGO or Local Consultants	
4. Period of Construction Works and Activities	1. Preparation of equipment and materials (2.5 months) 2. Water-saving cultivation and monitoring activities (13 months)	
5. Project Costs	1. 30 sets of drum cans with measurement scale and cock (10 units per 3 oases) 2. 600m hose (20m x 30 oases) 3. 30 sets of water measuring device (10 units x 3 oases) 4. Meeting costs (3 times) 5. Personnel costs 6. Transportation costs	

6. Monitoring Activities

Item	*Data Collection Frequency*	*Data Collection*	*Participant*	*Evaluator*
1. Growth conditions of dates	Collect data monthly.	NGO or L.C., extension personnel, study team	NGO or L.C.	Study team
2. Pumped water volume, groundwater levels, irrigation water volume	Collect data for each irrigation.	NGO or L.C., extension personnel, study team	NGO or L.C.	Study team

7. Schedule

Work Item	01	2002											2003						
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7
1) Technical education						■	■	■	■	■	■	■	■	■	■	■	■	■		
2) Material preparation			■	■		■	■													
3) Water-saving cultivation and groundwater monitoring				▒	▒	■	■	■	■	■	■	■	■	■	■	■	■	■		
4) Meeting and workshop			△					△										△		

* NGO or L.C. ; NGO or Local Consultant,

▒ : Trial ■ : Implementation

Table 6.5.3 Outline of the Pilot Project (2/2) (PDM)

Project: Water-saving Cultivation of Dates
Oasis：Toungad、Nimlane、Lehoueitatt
Target Group：Dates cultivation farmers in each oasis
Period：Jan. 2002～July 2003　　Implementing Agency：JICA

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal 1. Poverty is alleviated 2. Health and sanitary conditions are improved 3. Resources can be utilized sustainably	1. Until 2015, poverty is reduced by half 2. Until 2015, malnutrition is reduced by half 3. Water resources are utilized stably	1,2,3 Technical evaluation for each item (Monitoring) 2 Questionnaire survey on medical agencies 2 Sample survey	Phase III of Oasis Project is implemented。
Project Purpose Water-saving cultivation of dates through effective use of water are extended	1. Irrigation water decreases 2. Existence of appropriate records of monitoring water level and quantity	1. Monitoring survey 2. Records of monitoring	
Outputs 1. Irrigation water decreases 2. Fluctuations of groundwater become clarified 3. Appropriate water use is grasped	1. Irrigation water decreases compared to the present one 2. Existence of the records of irrigation water per unit 3. Existence of the records of groundwater level	1. Sample survey, questionnaire survey 2. The records of monitoring 3. The records of monitoring	Rainfall is not reduced extremely
Activities 1. To extend water-saving cultivation technique to the dates cultivation farmers in the oasis 2. To monitor groundwater level 3. To monitor irrigation water	Input ＜JICA Study Team＞ Personnel Members of the Study Team Equipment Oil drums with cocks Hoses Water level meter Materials for workshops Money Personnel expenses for local technical instructors Transportation expenses Expenses for meetings	＜Mauritania＞ Personnel Farmers for monitoring and cultivation Local technical instructors	Preconditions The residents in the oasis agree with implementing the pilot project。

Table 6.5.4 Outline of Pilot Project (1/2) (Breakdown)

Name：Increasing Livestock Production
Targeted Oasis：Tenllaba、Lehoueitatt

Item	Content		Remarks
1. Objective	Increase the production of chicken and eggs in order to improve malnutrition problems.		
2. Beneficiaries	Women's cooperatives in Tenllaba、Lehoueitatt.		
3. Project Implementing Body	The UCP office and JICA study team		
4. Project Content			
1. Summary	There is a high malnutrition rate among the oasis residents. Countermeasures such as disseminating hen and egg production will be conducted. Unexploited resources such as junk fish will be utilized as poultry feed.		
2. Major Facilities and Activities	Activities	Construction and Implementation	
	1. Guidance in poultry farming	1. Extension personnel, Study team, NGO or Local Consultants	
3. Maintenance and Operations	Supervision : UCP office, livestock farms Execution : Women's cooperative, NGO or Local Consultants		
4. Period of Construction Works and Activities	1) Extension activities in chicken raising (13 months) 2) Implementation (13 months)		
5. Project Costs	1) Hens (80) 2) Processing feed resources 3) Construction of hen house 4) Meeting costs 5) Personnel costs 6) Transportation costs		Distribute hatchlings from incubated eggs to other farms.

6. Monitoring Activities

Item	*Data Collection Frequency*	*Data Collection*	*Participant*	*Evaluator*
1. Egg production	Every month, occasions of laying eggs	NGO or L.C., Study team	NGO or L.C.	Study team
2. Improvement of nutrition	At workshops	NGO or L.C., Study team	NGO or L.C.	Study team
3. Activities by residents	Constantly throughout the preparation period, and all times	NGO or L.C., Study team	NGO or L.C.	Study team

7. Schedule

	01	2002												2003						
Work Item	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7
1) Technical education																				
2) Poultry farming																				
3) Monitoring of Egg production																				
4) Collection of unused resources																				
5) Meeting, workshop			△					△											△	

* NGO or L.C.；NGO or Local consultant
* : Trial : Implementation

Table 6.5.4 Outline of Pilot Project (2/2) (PDM)

Project: Increasing Livestock Production
Oasis：Tenllaba, Lehoueitatt
Target Group：Women's cooperatives in the target oases
Period：Jan. 2002～July 2003　　Implementing Agency：JICA

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal 1. Poverty is alleviated 2. Health and sanitary conditions are improved 3. Resources can be utilized sustainably	1. Until 2015, poverty is reduced by half 2. Until 2015, malnutrition is reduced by half 3. Water resources are utilized stably	1,2,3 Technical evaluation for each item (Monitoring), Questionnaire survey, Sample survey	Phase III of Oasis Project is implemented。
Project Purpose Nutritional condition is improved in the oasis	1. Diseases caused by malnutrition decrease 2. Mortality rate of children decreases	1,2 Interview on the residents and at medical centers	
Outputs 1. Consumption of protein and vitamin increases 2. Unused resources are used effectively	1-1. Patients of disease decrease 1-2. Egg consumption of the residents increases 1-3. Mortality rate of children decreases 2. Change of the volume of fertilizer use	1-1. Questionnaire survey on medical agencies 1-2. Monitoring by the implementing AGPO/ Cooperatives of poultry farming, monitoring of laying eggs 1-3. Questionnaire survey on medical agencies 2. Questionnaire survey	Resources of feed does not decrease (due to extreme decrease of rainfall)
Activities 1-1. To distribute poultry 1-2. To instruct the technique of poultry farming 1-3. To start poultry farming 1-4. To consume chickens and eggs 2-1. To use fowl droppings and food residues as fertilizer	Input ＜JICA Study Team＞ Personnel Members of the Study Team Equipment Manual of poultry farming Feed Chicks Vaccines Hen houses Money Personnel expenses for local technical instructors	＜Mauritania＞ Personnel Implementing AGPO/ Cooperatives Local technical instructors on poultry farming Equipment Land for hen houses	Preconditions The residents in the oasis agree with implementing the pilot project

Table 6.5.5 Outline of Pilot Project (1/2) (Breakdown)

Name : Improving Public Health Conditions
Target Oasis : Tenllaba, Lehoueitatt

Item	Content	Remarks
1. Objective	Decrease the occurrence of diseases among residents (diarrhea, malnutrition, etc.) and improve health and hygienic conditions by providing information on health, hygiene, and nutritional intake.	
2. Beneficiaries	Women's cooperatives in Tenllaba, Lehoueitatt	
3. Project Implementing Body	UCP Office, JICA study team	
4. Project Content		
1. Summary	Diarrhea and malnutrition are widespread in the project area. Diarrhea is mainly caused by the pollution of well water by the dung of livestock animals that are allowed near the drinking water wells. Countermeasures such as constructing fences around the wells to prevent livestock animals from entering the vicinity of the wells will be implemented. Vegetable cultivation and livestock production will be effectively integrated through the pilot project. Therefore, educational activities on the effectiveness of egg consumption, cooking and dried processing of vegetables will be conducted in a form of workshop.	
2. Major Facilities and Activities	Activity: 1) Public health and hygiene education; 2) Cooking and processing of vegetable and eggs Construction and Implementation: 1) NGO or Local Consultants, study team; 2) Local Consultants or NGO	
3. Management and Operations	Supervision : UCP office Execution : Women's cooperatives, NGO or Local consultants	
4. Period of Construction Works and Activities	1. Preparing materials and survey on equipment and materials (5 months) 2. Health and hygiene educational activities (13 months, intermittently) 3. Monitoring improvements in health and hygienic conditions (5 times)	
5. Project Costs	1. Cost of processing materials and utensils 2. Meeting costs (3 times) 3. Cost of materials for vegetables cultivation such as pots 4. Costs of printing texts 5. Personnel costs 6. Transportation costs	

6. Monitoring Activities

Item	*Data Collection Frequency*	*Data Collection*	*Participant*	*Evaluator*
1. Health and hygiene conditions	At workshops	NGO or L.C., extension personnel, study team	NGO or L.C.	Study team
2. Effectiveness of cooking and processing measures	All times	NGO or L.C., extension personnel, study team	NGO or L.C.	Study team
3. Condition of residents' activities	All times	NGO or L.C., extension personnel, study team	NGO or L.C.	Study team

7. Schedule

	01	2002												2003						
Work Item	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7
1)Preparation																				
2)Technical training																				
3)Education on hygiene, cooking and processing																				
4)Monitoring																				
5)Workshop			△					△											△	

* NGO or L.C. ; NGO or Local consultant
* : Trial : Implementation

Table 6.5.5 Outline of Pilot Project (2/2) (PDM)

Project: Improving Public Health Condition
Oasis：Tenllaba, Lehoueitatt
Target Group：The residents in each oasis
Period：Jan. 2002～ July 2003 Implementing Agency：JICA

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal 1. Poverty is alleviated 2. Health and sanitary conditions are improved 3. Resources can be utilized sustainably	1. Until 2015, poverty is reduced by half 2. Until 2015, malnutrition is reduced by half 3. Water resources are utilized stably	1,2,3 Technical evaluation for each item (Monitoring), Questionnaire survey, Sample survey	Phase III of Oasis Project is implemented
Project Purpose Health condition of oasis residents is improved	1. Diseases caused by water pollution decrease 2. Diseases caused by malnutrition decrease 3. Mortality rate of children decreases	1,2,3 Interview on health and hygiene, Number of patients at medical agencies	
Outputs 1. The concept of hygiene takes root 2. (Through the improvement of drinking water quality) The residents can use drinking water of better quality 3. (Through availability of vegetable consumption all around the year) Disease of malnutrition decreases 4. The habit of consuming eggs takes root 5. Technique of processing and cooking takes root	1. Understanding on health and hygiene education is high 2. Coliform are not detected from drinking water 3. Number of the patients of malnutrition decreases 4. Frequency of eating eggs increases 5. Cooking methods are diversified	1. Questionnaire survey 2. Simple examination of water quality 3. Number of the patients at medical agencies 4. Monitoring survey 5. Monitoring survey	1. Groundwater pollution does not break out by using pesticide and fertilizer 2. Rainfall does not extremely decrease
Activities 1. To implement the seminars on health and hygiene education to the residents in Tenllaba and Lehoueitatt 2. To extend measures of protecting drinking water well, and pumping-up and conserving water 3. To extend vegetable cultivation in summer 4. To implement the seminars on promoting egg consumption 5. To practice cooking and processing	Input ＜JICA Study Team＞ Personnel Members of the Study Team Equipment Materials for education Equipment for cooking and processing Money Expenses for holding meetings Personnel expenses for local instructors of health and hygiene Transportation expenses	＜＜Mauritania＞ Personnel Participants of the seminars on health and hygiene education Instructors of health and hygiene Equipment Place for implementing the seminars	Preconditions The residents in the oasis agree with implementing the pilot project

CHAPTER 7

IMPLEMENTATION OF PILOT STUDY

CHAPTER 7 IMPLEMENTATION OF PILOT STUDY

7.1 Background of the Pilot Study and Response of Inhabitants

This chapter discusses the implementation process of the Pilot Study, response of inhabitants in each stage, technical accomplishments of each pilot project, and overall evaluation and lessons learned.

A summary of all the Pilot Studies, covering the iterative improvement process of problems, countermeasures, results and goals for next stage is presented in **Fig. 7.1.1.** The trend in number of the participants in the workshops held in respective stage of pilot projects is presented in **Fig. 7.1.2**, showing also the percentages of female and literate participants. In addition, an evaluation of the pilot studies by participants as well as non-participants is summarized in **Fig. 7.1.3**, based on the opinions gathered in the questionnaire survey.

Major subjects and outcomes of each pilot study are as explained hereinafter.

7.1.1 Vegetable Cultivation by Farmers

Because Stage 2 of the Pilot Study (Trial for vegetable cultivation by farmers during summer season) started in May, anticipated results were barely attained due to damage caused by hot winds that prevailed in advance of transplanted seedlings taking root, failure to correct excessive application of irrigation water, etc. As a consequence, the pilot study in Tawaz was suspended and the morale of participants broke down accordingly.

Hence, at the second workshop, the question was raised by the inhabitants as to why an absence of close communication between the inhabitants and the Study Team prevailed. In response to this question, the Study Team made an effort to realize joint work with the participants and to have more time in contact with them so that mutual understanding between the Study Team and the participants could be deepened. This effort bore the following fruits in the course of the subsequent Stage 3 (Phase 1) of the Pilot Study.

1) Farmers were more likely to abstain from excessive application of irrigation water and yield of crops was boosted remarkably with use of adequate irrigation water.

2) More participants affirmed that the components of this pilot study were appropriate.

The above fruits are considered as a sign of better understanding by the inhabitants on the purpose of the Pilot Study, as a result of deepened communication between the Study

Team and the participants.

In the course of the Stage 3 (Phase 2) of the Pilot Study, sowing time of vegetables was brought forward to the period February thru April, taking account of the outcome of the Stage 2, and harvest was realized during May – June, thus demonstrating the viability of vegetable cultivation during the summer season.

With the attainment of positive Pilot Study effects, many participants were willing to carry out water-saving cultivation with preparation of ridges.

The number of participants in this pilot study was apparently boosted in the course of the Stage 3 (Phases 1 & 2). This leap is attributable to an increase of female participants in Tagant from 23 to 39 and male participants in Tawaz from 11 to 21. It is considered that this increase (in Phase 2) in Tagant is a spin-off of conspicuous rise in yield of vegetables in Nimlane and Tidjikja. On the other hand, in Tawaz the pilot study was temporarily suspended as an outcome of failure in the Stage 2. Nevertheless, with introduction of simple drip irrigation system (see **Fig. 7.1.4**) in response to request of inhabitants, yield of vegetables was boosted remarkably and more farmers, having interest in this drip irrigation system, began to participate in this pilot study.

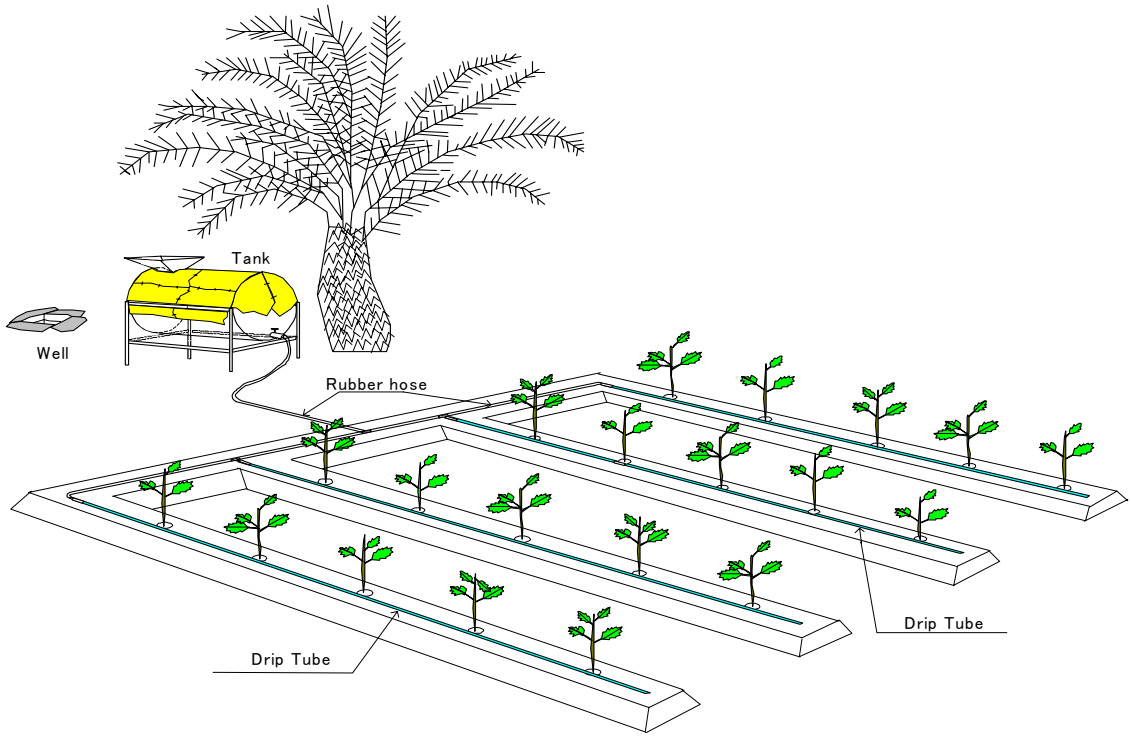


Fig.7.1.4 Simple Drip Irrigation System

The number of participants at the 4th workshop declined regrettably because many farmers in rain-fed farming and owing to higher rainfall during 2003, preferred to engage in crop cultivation at remote rain-fed farms instead of rendering labor for a task at the pilot farm.

The participants in this pilot study had lower proportion of literate persons and higher proportion of females in comparison with other studies (refer to **Fig. 7.1.2**). By oasis, more individual farm owners participated in Tawaz and more illiterate female persons took a part in the pilot study at the rest of the oases. Even though the proportion of illiterate female participants rose, the technologies applied to the present pilot study contributed to raising farm productivity at all oasis in this Study. It is thereby concluded that the said technologies are appropriate ones for the local natural and socio-economic circumstances.

7.1.2 Water-saving Cultivation of Dates

At first it was scheduled to realize water-saving cultivation of dates at the four oases located in Tawaz, Toungad, Tidjikja and Nimlane, but the target oases were changed to oases located in Toungad, Nimlane and Lehoueitatt. Reasons for site elimination or selection are listed below.

- Groundwater level in Tawaz is relatively high (20 m below ground level) and unstable structure of well wall makes it technically unfeasible to pump groundwater by means of hand pump; thus monitoring by inhabitants is a dangerous task.

- No dates cultivation farm is found in the vicinity of the pilot farm for vegetable cultivation by farmers in Tidjikja; date cultivation farms are generally located in sand dune region with disadvantageous vehicle access.

- Lehoueitatt belongs to the same river basin with Tidjikja and date cultivation farms there are located close to the community area, which enables local people to monitor and administration water tasks without difficulty.

The materials and implements employed under the present pilot study (see **Fig. 7.1.5**) were easily handled by inhabitants in Tagant region where use of hand-operated pumps is predominant and water-saving effect is apparently grasped by inhabitants. Thus, many farmers were eager to use water-saving implements, resulting in an expansion of date cultivation area owing to water- saving effect after introduction of the implements.

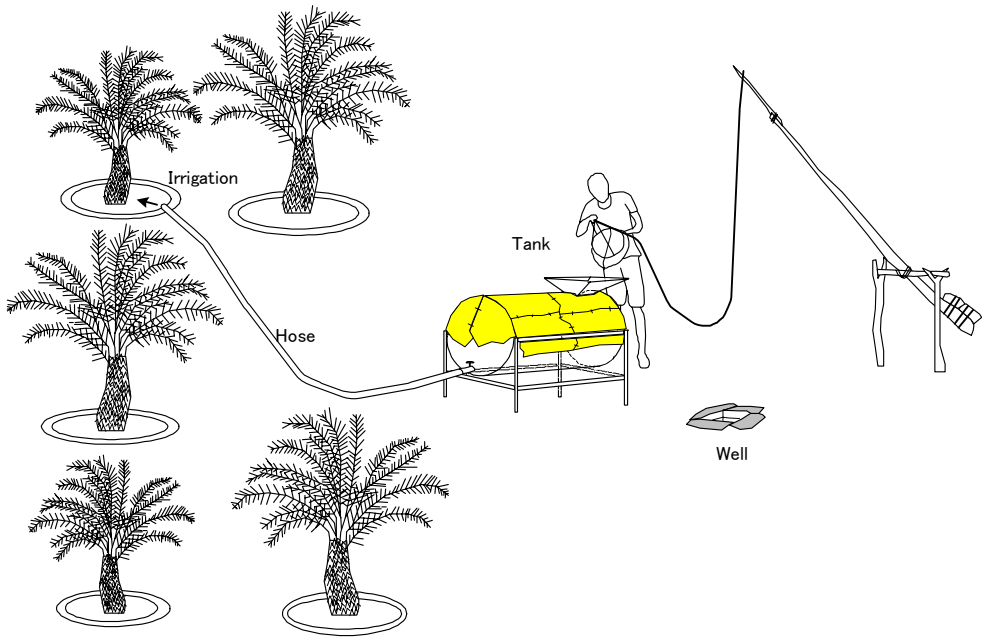


Fig. 7.1.5 Materials for Water Saving Cultivation of the Date Palm

Meanwhile, monitoring of groundwater was interrupted at pilot farms that depend on the pumping well in Toungad for the following reasons:

- The pilot farm pumping groundwater through the well has relatively extensive farm area, where as few as only one or two date trees are irrigated only from stored water in a storage tank having a capacity of 200 liters. Hence, pumps are required and operated whenever the storage tank is filled with water, imposing higher cost in manpower and energy on farmers.

- The extensive farm area also requires higher cost to install a longer conveyance pipe to connect the storage tank to the irrigable farm.

The participants in this pilot study include land owners of date farms and most of them are literate and males. Generally speaking, the number of participants had been consistent from the 2nd workshop on; nevertheless, the number of participants in Toungad decreased from 19 persons at the 2nd workshops to almost half at subsequent workshops. By contrast, the participants of the last workshop at two oases in Tagant region doubled in comparison with the 1st workshop. This may imply that there is room for improvement of the technologies applied to the oases where pumping of groundwater prevails. Meanwhile, the technologies applied to the oases depending on hand-operated pump are appropriate and are expected to be disseminated among farmers.

At farms where monitoring of groundwater was continuously conducted, farmers' awareness of the merits for water-saving cultivationled to the following activities:

- Arranging of pumping volume of water based on quantitative analysis of the relation between pumping volume and groundwater level.

- Female association engaging in vegetable cultivation in Tidjikja spontaneously undertakes the water administration task of setting pumping time.

The above-mentioned activities are the result of local people's awareness on the importance for adequate water administration in pursuit of continuous utilization of limited water resources. This situation, in turn, suggests the possibility for dissemination of water-saving activity among inhabitants by the community.

7.1.3 Increasing Livestock Production

During the Stage 2 (Trial pilot study), poultry farming was started at two oases (Tenllaba and Lehoueitatt) with construction of hen house and introduction of raising adult fowls and chicks. The starting time coincides with the summer season and the number of chickens and chicks raised decreased remarkably, as a consequence of invasion of hot winds, spreading disease epidemic, etc. As countermeasures against such adverse circumstances, responsible persons of the association in collaboration with the Study Team undertook activities such as lower the temperature within hen houses by sprinkling of water, physical inspection on raised chickens and chicks, vaccination, and so on.

Meanwhile, the following spontaneous activities were conducted by the participants of this pilot study in Tenllaba.

- Construction of wall against the wind to protect chickens from being attacked by hot winds.

- Raising of chickens began under the guidance of a male association member who had experience in poultry farming. In the course of the Stage 3 (Phase 1), female members participated in the technical seminar on poultry farming under the sponsorship of the Oasis Project, which contributed to raising awareness of female members of association to embark on poultry farming on their own initiative.

As a result of the above-mentioned activities, hatching started from the beginning of the

Stage 3, and the number of chickens raised was increased rapidly, reaching 50 chickens in total in Tenllaba. As a result, 10 chickens which had been provided at first to a female group in Tenllaba were returned to the Study Team in compliance with the agreement made at the beginning of this pilot study. These chickens were then provided to other female group in Tenllaba for their embarking on poultry farming.

Reflecting internal circumstances within oases, present pilot study in Lehoueitatt was undertaken by two female associations from the beginning. One of these associations had been keen on raising chickens with installation of open chicken house, preparation of vegetable cultivation farms for supply of vegetable wastes to feed chickens, etc and the number of chickens raised increased accordingly. It is regrettable, nevertheless, that the number of chickens raised decreased later on due to attack of predatory animals like weasels. On the other hand, the other association was reluctant to engage in poultry farming without attaining an increase in chickens raised.

The accomplishments in this pilot study cited before suggest that an expansion of poultry farming is foreseeable within the oasis region, although sustainable poultry farming is highly dependant on the morale of the participants. On the other hand, the participants at the final workshop had the opinion that consistent supply of feed is the main factor for undertaking sustainable poultry farming in the future. At first, fish powder was considered as protein feed, but it was proven to be inappropriate because chickens had no appetite for this kind of feed. In the wake of such failure, it is recommended to hasten the utilization of date seeds, garbage of livestock (bowels, blood, etc), bones of livestock, vegetable wastes, insects, etc. as raw materials for feed.

The majority of eggs and adult fowls were kept by farmers. Some fowls sit on eggs and the rest of them were sold or consumed by farmers; some eggs were also not sold. Many inhabitants are well aware of the effect of egg consumption to improve their nutrition. In this connection, dissemination of cooking techniques for eggs and chickens constitutes another important subject if an expansion of poultry farming is anticipated.

7.1.4 Improving Public Health Conditions

The pilot study relevant that improvement of public health condition was achieved in Tenllaba and Lehouitatt, the same as the case of the pilot study for “Increasing Livestock Production”. In this pilot study, the main components of education on public health and hygiene with use of visual materials, installation of public toilet, holding classes on cooking, questionnaire survey on public health conditions, had been carried out repeatedly.

In the course of the present pilot study, local people in Tenllaba were willing to employ some components of the pilot study by installing another public toilet by themselves after having seen installation of public toilet by the Study Team, by making and selling bread by the members of female association after having participated in the class on cooking, etc.

In Lehoueitatt, on the other hand, activities on initiative of the members of the associations was scarcely observed, although the same seminar as in Tenllaba was held there. This unfavorable situation may be due to lack of financial resources for initial investment, absence of marketing channel, etc.

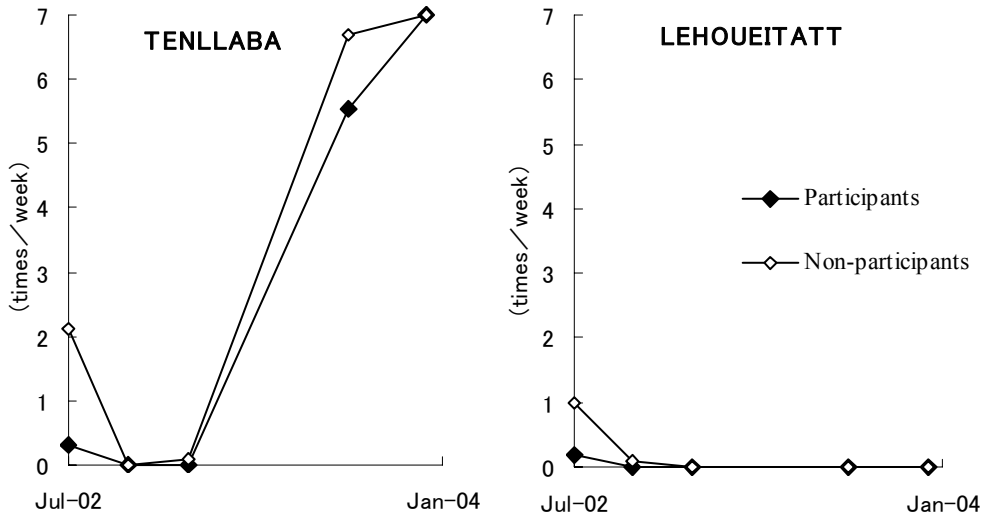
The questionnaire survey carried out at every workshop had the following results:

- Measurement of height and weight of pupils and survey on frequency of contracting a disease did not bring results in the course of the pilot study.

- During the execution of the pilot study, no salient improvement was observed in health and hygiene customs such as boiling of water for drinking, washing hands, securing of safe water at water sources, etc. in either Tenllaba or Lehoueitatt.

Starting from the Stage 3, vegetable cultivation was introduced as a nutritional improvement measures. Crops were harvested during the pilot study in Tenllaba, but this did not happen in Lehoueitatt due to delay in sowing.

Fig 7.1.4 shows the trend in vegetable consumption during this pilot study by participants by respective oasis. This chart suggests that vegetables were consumed every day in Tenllaba where harvest of vegetables was recorded as of January 2004. By contrast, vegetables were scarcely consumed in Lehoueitatt where no harvest of vegetables was recorded during that period. Thus it seems that local people tend to consume more vegetables when they are produced. In summary, extension of vegetable cultivation should bring positive effect on improvement of nutritional condition of local people.



Source : The Study Team

Fig. 7.1.6 Changes in Vegetable Consumption

7.1.5 Evaluation of the Pilot Study by Participants and by Non-participants

The results of interview survey with the participants and non-participants at workshops is summarized in **Fig. 7.1.3**.

Most of the participants in the Pilot Study had the opinion that, thanks to implementation of the Pilot Study, the activities of the association were invigorated and the relation of the participants was deepened during the latter half of the Pilot Study. This reflects the trend that the fruits of an individual pilot study started apparently during first half of the Pilot Study, but they were concentrated during the latter half. Meanwhile, an adverse result was produced between the participants and others, as a consequence of implementation of the Pilot Study.

The majority of the participants replied that they were satisfied with the technologies applied during the pilot studies, having acquainted themselves with their components. Based on a rise in yield of vegetables and an increase in number of chickens raised, as well as by eagerness of the participants for continuation of the Pilot Study, it may be concluded that the technologies introduced are appropriate.

Close to 60 – 80% of the non-participants in the Pilot Study desired to participate in the pilot studies, but only 30% of these non-participants thoroughly acquainted themselves with the contents of the pilot studies that were implemented. In summary, most of the non-participants were interested in the Pilot Study without having information on the contents.

It was revealed on the other hand that the implementation of the pilot studies was rarely related with the activities of individuals and associations of the non-participants. A small portion of these non-participants affirmed the influence of the pilot studies; for example, they followed ridging cultivation technology proposed in the pilot study at their farms, after having confirmed the effect of this technology.

The above result suggests that it is more effective to accumulate as many successful examples as possible at demonstration farms for their dissemination so that many persons would have an opportunity to observe them and be exposed to them.

7.2 Technical Accomplishments through the Pilot Study

7.2.1 Rise in Yield of Vegetables

Vegetables that are at present cultivated under basin irrigation method, suffer from depressed yield, except for market-oriented large-scale farms. This unfavorable situation may be related with the following factors.

1) Root rotting generally takes place as a consequence of lowering of oxygen proportion within soils caused by excessive application of irrigation water.

2) Dried up and hardened soils prevent plants from attaining healthy growth.

3) Severe sunshine restrains germination and root taking of seedlings.

In view of tackling the problems mentioned above, vegetable cultivation under the pilot study was conducted by employing of the following techniques; namely,

1) Ridging cultivation

   Root rotting can be prevented by holding adequate contents of moisture, air and solid phases within soils. The soils located in the pilot study were likely to repel water when they dried up; therefore, the proposal was made to prepare ridges at central part of farm lot for storing irrigation water to accelerate infiltration into soils (Refer to **Fig 7.2.1**).

2) Soil application

Fine-textured soils should be mixed with coarse sand to raise the proportion of air phase within soils.

3) Shading

Shading is proposed to restrain rising of soil temperature and drying-up of soils, and as a result, to hasten root's healthy growth into the soil and germination of seeds.

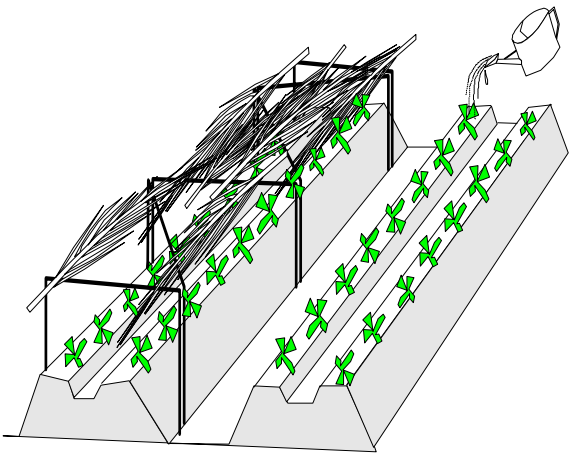


Fig. 7.2.1 Ridging and Shading

Crop yield and profitability results attained through Stage 3 (Phase 1) of the pilot study for vegetable cultivation by farmers depending on the techniques together with harvest period are given in **Table 7.2.1** and **Fig. 7.2.2**. This outcome indicates that yield and profitability of vegetables cultivated under ridging irrigation are remarkably higher than those cultivated under basin irrigation, because crops didn't suffer from root rotting during cultivation period. In addition, shading promises high productivity of vegetables (even though it was during the summer season when crop cultivation had not been realized so far), by making it possible to realize long-term harvest of vegetables. In the course of the Stage 3 (Phase 2), the same trial was carried out resulting in accomplishment of similar productivity.

In an attempt to conduct a quantitative analysis of the effect on growth of plants, trend of soil moisture and temperature was grasped as shown in **Table 7.2.2** and **7.2.3**.

Table 7.2.2 Transition of Soil Moisture

Cultivation method	Immediately after irrigation (AM 7:30)	Immediately before irrigation (PM 5:30)
Ridging irrigation	21 %	14 %
Basin irrigation	37 %	30 %

Source : The Study Team

Table 7.2.3 Transition of Temperature

Cultivation method	In the atmosphere	Soil surface	
		Without irrigation	With irrigation
Without shading	48℃	50℃	36℃
With shading	34℃	41℃	29℃

Source : The Study Team

1) Soil moisture at farms under basin irrigation is excessive because irrigation water saturates non-capillary pores, meanwhile that under ridging irrigation remains within

suitable range owing to favorable growth of plants without root rotting that was attained by maintenance of adequate proportion of three phases of soil.

2) Shading contributes to lowering temperature both in the soil and in the atmosphere, which brings about favorable circumstance for growth of plants.

7.2.2 Irrigation Water Amount

In order to compare the prevailing irrigation amount with the theoretically designed irrigation amount, survey on characteristics of soil moisture at irrigated farms was carried out. The total readily available moisture (TRAM) value was calculated on the basis of the field capacity and the water content at wilting point (A value of pF 2.7 was obtained using simple tensiometer, close to 2 – 4% in volume). The results are shown in **Table 7.2.4**. The present irrigation interval was also surveyed and the results are categorized by crop as shown in **Table 7.2.5**.

The prevailing irrigation for date palm was carried out using basin method where a ridge is constructed around root area and irrigation water is stored in the basin. The ridge height was 15-20 cm and water depth in the basin was 10 cm on average. In the irrigation method for vegetables, the basin is made by ridge along the canal with an approximate height of 10 cm to convey irrigation water from the canal. After the basin is filled up with irrigation water in the range of 50–60 mm, almost equal to the depth of the canal, irrigation water is conveyed to the basins located in the lower reach. An average irrigation amount of each application under prevailing basin irrigation method is calculated to be 55 mm.
The theoretical crop water consumption is estimated in **Table 7.2.6**, by using the Penman-Monteus method with the meteorological data collected at Atar station and at Tidjikja station (This said estimated value was employed to compare with the present irrigation amount, in view of the fact that the Study Team was not in a position to carry out a test on crop water consumption of date palm in the course of the Pilot Study).

The comparison of the prevailing net monthly irrigation amount with the irrigation water requirement calculated on the basis of crop water consumption is as shown in **Table 7.2.7**. The prevailing irrigation amount was estimated based on the irrigation interval and net irrigation amount.

Evaluating prevailing irrigation water amount from the viewpoint of the theoretical crop water requirement, it is concluded that water saving is highly viable, subject to adequacy of irrigation interval. Present water loss through canals and at the field basins is estimated at around 20 to 30% of the total irrigation amount. However, with approximation of

prevailing irrigation interval and crop water requirement to the theoretical amount estimated based on the TRAM value of soil, it is highly probable that prevailing total irrigation amount can be reduced to the range of 1/2 - 1/3 .

7.2.3 Fluctuation in Groundwater Level and Available Volume of Sustainable Water Resources

(1) Fluctuation in groundwater level

Since the 1970's, groundwater level has shown downward trend due to predominance of the years with less rainfall and other factors. Furthermore, the trend is accelerating because groundwater has been taken without any controls and because drilling deeper at dried-up well sites or construction of new wells at other sites after abandoning dried-up wells are common in this region.

Thus, in order to collect and compile basic data on administration of water resources to enable their sustainable utilization, monitoring and analysis of groundwater level and pumping volume of groundwater was conducted.

Fluctuation of groundwater level was grasped by processing monitoring data collected at 44 wells, including those at pilot farms, for the period of almost 2 years from May 2002 to April 2004. This monitoring data revealed that the groundwater level in general showed downward trend even though there was slight up-and-down fluctuation until the beginning of August 2003 and daily precipitation scarcely exceeded 10 mm. Since then, daily precipitation exceeding 20 mm and continuous rainfall during several days took place during the beginning of August 2003 (during the beginning of July in Tawaz), which caused the groundwater level to rise. The groundwater level, however, again turned down slightly since then until April 2004, except for at the wells adjacent to wadis. Analyzing this fluctuation of groundwater level, it is considered that meteorological phenomena represented by rainfall and evapotranspiration constitute the main factors in fluctuation of groundwater level, due to the fact that the groundwater level recovered its original level after pumping at the all wells where groundwater level recovery test was carried out.

The pumping test carried out at 32 wells disclosed their transmissivity coefficient on the order of $1x10^{-3}$ – $1x10^{-4}$ (m^2/sec) and their permeability coefficient on the order of $1x10^{-3}$ – $1x10^{-4}$ (m/sec). Based on these values, it is evaluated that the productivity of the aquifer relevant to the said wells remains from normal to low. The storage coefficient, on the other hand, is on the order of $1x10^{-1}$ at all wells,

which intimates that the groundwater level under unconfined aquifer is in free water surface. In summary, it is possible to conclude that the potential for development of groundwater within the Study area is low and that saving of water resources is prerequisite for sustainable utilization of water resources in this area.

(2) Available volume of sustainable water resources

The available water at the target oases of the Pilot Study is disclosed qualitatively and quantitatively, by referring to the results of the case study which consists of preparation of the simulation model and regional groundwater analysis focusing on the farms related with irrigation water.

The regional groundwater analysis is made by means of two-dimensional plane analysis, provided that the movement of groundwater is unsteady and water head distribution changes with time. The identification of the model is made by selecting the period with the least influence of rainfall from the monitoring data on water level at wells located at the oases within the Pilot Study area (**Fig. 7.2.3**) and using the aquifer constant obtained from the hydrogeological survey conducted by the Study Team. The scope for analysis on movement of groundwater level is established by dividing each oases on a grid of 100 m x 100 m. Information on the number of wells, pumping method and pumping amount in the grid is summarized in **Table 7.2.8.**

Table 7.2.8 Summary of the Number of Wells, Pumping Method and Amount in the Grid

Oasis	Number of Wells			Q (m3/day)		
	With Pump	Manual	Total	With Pump	Manual	Total
Lehoueitatt	0	32	32	0	64	64
Tidjikja	1	18	19	2	36	38
Nimlane	1	63	64	2	126	128
Tawaz	9	0	9	742	0	742
Tenllaba	44	25	69	1,893	50	1,943
Toungad	142	151	293	1,138	76	1,214

Source : The Study Team

The identification of the model was made by comparing the water level calculated on the basis of the model and the water level actually measured at wells, with a permissible value in relative coefficient of more than 0.8 and with a tolerance beyond 30%. Referring to the calculation result of such model, the quantity of the total water use (total pumping volume at wells) and that of the groundwater

fluctuation is estimated in **Table 7.2.9**.

Table 7.2.9 Quantity of Water Utilization and Groundwater Fluctuation

Oasis	Duration	Grid Area (m^2)	Total Water Use (m^3)	Groundwater Fluctuation		Ratio of Water Use
				Head (m)	Quantity (m^3)	
			A		B	A/B
Lehoueitatt	02/06/20～410 days	600,000	26,240	0.359	215,400	0.12
Tidjikja	02/12/16～200 days	160,000	7,600	0.226	36,160	0.21
Nimlane	02/10/23～290 days	1,000,000	37,120	0.067	67,000	0.55
Tawaz	02/12/08～190 days	300,000	149,340	1.343	402,900	0.37
Tenllaba	02/12/29～210 days	330,000	408,030	3.533	1,165,890	0.35
Toungad	02/11/05～270 days	1,400,000	327,537	1.462	2,046,800	0.16

Source : The Study Team

The above table leads to make the following observations:

- The fluctuation of groundwater level in Tagant region where pumping of groundwater is done by hand falls below 0.5 m, while that in Adrar region exceeds 1.0 m. Within Adrar region, this fluctuation is variable according with the slope of land where the well is installed. Such level is within 0.5 in Toungad and within 1.0 in Tenllaba.

- The pumping amount per pump within the limit for establishment of the grid is as follows: 15,000 m^3 in Tawaz, 8,400 m^3 in Tenllaba and 1,600 m^3 in Toungad.The benefiting area per pump is around 0.75 ha in both Tenllaba and Toungad and 3.3 ha in Tawaz.

- The fluctuation of groundwater level varies within target oases of the pilot study according with topography, pumping method, irrigation method and so on, In Tagant region in which pumping by hand prevails, water is used without being influenced by the fluctuation of groundwater level, while at other oases (except for Toungad in Adrar region in which motor pumping is predominant), the groundwater level fluctuates in accordance with the decreasing salient hydraulic gradient and where water use is limited.

The fluctuation of groundwater level caused by change in actual water use was simulated with the model established here and the following two assumptions: i) irrigation water amount is determined following the theoretical crop water requirement (in this case, irrigation water amount shall be reduced by half in Tagant

region and by 20% in Adrar region), and ii) irrigation water amount is doubled in response to expansion in demand.

- In Nimlane and Tidjikja of Tagant region where pumping by hand is commonly practiced, it is considered that prevailing water use has little influence on groundwater resources, and that groundwater level would not go down 30 cm lower than the actual level after 300 days even if the irrigation water amount would be doubled. In Lehoueitatt of the same region, on the other hand, the groundwater level would decline 60 cm lower than the actual level if the irrigation water amount would be doubled; increase in irrigation water amount thus requires re-drilling of existing wells.

- In Adrar region where motor-driven pumping prevails, lowering of groundwater level in the range of 2.5 – 4.5 m is presumed 300 days after irrigation water amount is doubled and all wells without exception require re-drilling accordingly. In Tenllaba where decreasing hydraulic gradient is salient, it is strongly recommended that actual irrigation water amount should not be increased for sustainable use of groundwater resources in the future.

- Provided that water-saving use should be come practices at motor-driven pumping wells, it is probable that lowering of groundwater level would lag about one month behind the expected schedule.

7.2.4 Administration of Groundwater

At present, water is utilized without taking account of either potential amount of water resources or control of how these water resources are used. As a consequence of water intake without control, lowering of groundwater level, deterioration of water quality, etc. were observed. In order to secure a conventional amount of water intake individual farmers must utilize such hardware-oriented countermeasures such as: i) re-drilling of well, introduction of pump with higher capacity of output, or ii) construction of new well. Nevertheless, on the assumption that use of groundwater would continue at the present trend, it is presumed that groundwater resources existing within shallow ground layers may be on the verge of being dried up and that the sustainability of the oases region would be questionable.

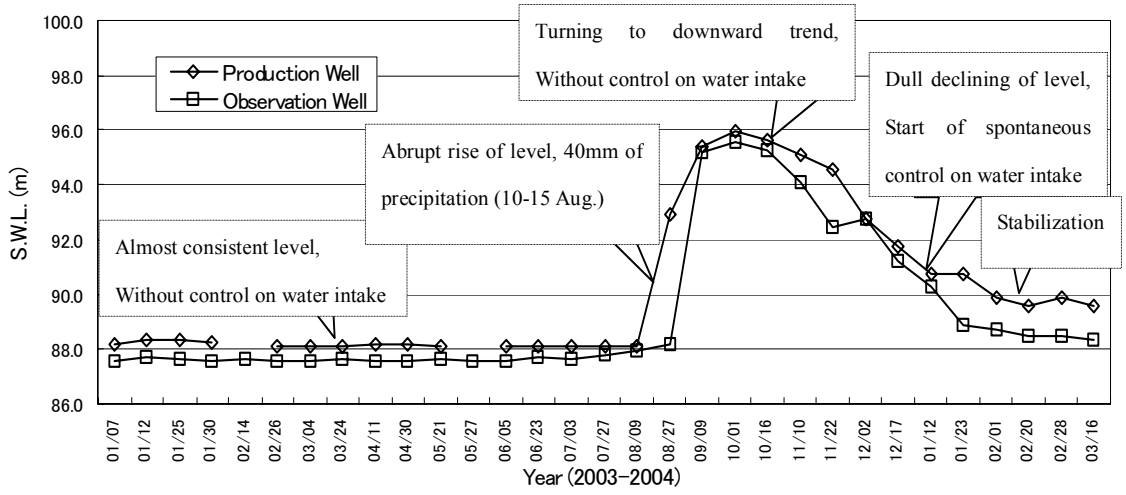
During the latter half of Stage 3, the Study Team raised the subject of adequate administration of groundwater with the participants of the Pilot Study. In response, a female association in Tidjikja, after having a meeting among the participants, took the step

on their initiative to force down the trend of the groundwater level at production wells located within pilot farms, starting from January 2004, bearing in mind that such lowering of groundwater level is closely related with pumping of groundwater without any control. They accomplished this in practice, by opening the well cover, and pumping was prohibited during two hours each in the morning and in the afternoon. Consequently, it is presumed that the following benefits were realized:

1) By limiting pumping hours, the downward trend of groundwater level was decelerated and groundwater level is being stabilized (refer to **Fig. 7.2.4**).

2) Due to limiting of irrigation hours, application of adequate irrigation water at farms was made, which, in turn, has contributed to hastening health growth of crops.

The above favorable outcome suggests that raising water-saving awareness on the initiative of the beneficiaries in the face of groundwater problems and taking necessary steps to ease adverse circumstances, as well as launching control over pumping hours would be effective for sustainable use of groundwater. This will encourage the beneficiaries to undertake autonomous administration of groundwater by their initiative and, at the same time, suggests a guideline for the future in relation with sustainable use of groundwater.



Source : The Study Team

Fig.7.2.4 Fluctuation of Groundwater Table and Utilization

Pursuant to monitoring and simulation result of the Pilot Study, recommendation is made to proceed to administration of groundwater at each oasis in the future, in compliance with the following procedure.

1) To identify two or three eligible standard monitoring wells at each oasis.

2) To conduct monitoring task on fluctuation of groundwater at wells.

3) To make monitoring date a graph and to draw groundwater level line in the chart processing monitoring data for the lapse of 2 – 3 months (This groundwater level line shall be drawn in a straight line; even though the monitoring result turns out to be uneven after processing data, the line shall be a straight one, on assumption of an average value among processed data).

4) Without cultivation of groundwater depending on rainfall (in case of no rise in groundwater level), prolonged groundwater line indicates a projected fluctuation of groundwater level in the future. The crossing point of the groundwater level with the depth of well bottom coincides with the marginal line for use of groundwater.

5) In case that the fluctuation of the groundwater level as a consequence of water use goes below prolonged projection line, steps shall be taken in such manner as limiting pumping hour, etc.

On the other hand, in order to realize the said procedure for administration of groundwater, it is essential to establish groundwater administration section within oasis association with assignment of personnel in charge of monitoring, compilation and analysis of collected data, public relations, control of illegal use of groundwater and so on.

7.2.5 Quality of Water for Irrigation Use and Its Improvement Opportunity

Aiming at evaluating suitability of water for irrigation use, three samples each of water at 18 wells were taken for their analysis relevant to: Fe^{2+}, Na^{+}, K^{+}, Mg^{2+}, Ca^{2+}, colon bacilli, electric conductivity (EC), pH and water temperature. This analysis disclosed distribution of groundwater containing extremely high Na^{+} and EC. Generally speaking, with a value of Na^{+} exceeding 200 mm, the value of EC is likely to be elevated together with higher degree of salinity and alkalinity. The suitability analysis on irrigation water taken from the wells on the basis of sodium adsorption ratio (SAR) and EC revealed that groundwater grouped as the categories of C3S3, C3S4 and C4S4 (which are applicable to salinity tolerant plants subject to drainage and leaching) are distributed in Tenllaba, Tawaz, Toungad and Lehoueitatt (Refer to **Table 7.2.10**).

Actual features of the wells categorized as C4S4 with particularly high salinity and alkalinity are presumed as reasons for the features explained below.

1) The wells with the code No. To-3 and To-7, which are located in the hinterland of natural bank along El Abiod wadi, receive excess irrigation water containing high salinity originating from upper reach and without inflow of surface water from wadis.

2) The above wells also contain bacilli due to inflow of domestic waste coming from a number of households on the slope of bedrock adjacent to these wells.

3) The well with the code No. To-5 is within a concave area located higher than wadis, where groundwater is stored from rainfall without inflow of water from wadis.

4) The well with the code No. To-12 is not used and its water is deteriorating with inflow of soluble saline water (Refer to **Table 7.2.10**).

5) The well with the code No. Le-2 is located on the concave hinterland and is less productive without receiving groundwater from wadis; in addition its water contains bacilli from domestic waste from the surrounding residential area.

The above observations suggest that the water quality of wells is closely related with location of wells, surrounding topography, actual use of wells, relative distance from wells to wadi and to residential area.

At the farms on which irrigation is made with deteriorated well water, the progress of sodification within soils is worrisome; some of these farms were forced to suspend cultivation of vegetables due to depressed productivity. It is also reported that the growth of dates on these farms is likely to lag behind the anticipated schedule. Farmers, having confidence in their cultivation experience of dates, have the opinion that owing to its leaching effect irrigation water with deteriorated quality has less influence on growth of plants, provided that its amount is abundant.

It is not practical to attempt improvement of quality for water existing within shallow layers in the oases where irrigation farming is commonly practiced. Instead, it is recommended to curb dissemination of contaminated water to other wells containing good quality of water, and only maintain the prevailing water use of the wells suffering from inferior quality of water.

The main point is to undertake periodic (monthly and/or in every season) observation on water quality without interruption at oases with problematic wells, aiming at identifying parameters causing problems one by one and to take immediate steps against unfavorable situations, together with making relevant information open to the public.

7.2.6 Increasing Productivity of Poultry Farming

Poultry farming was carried out in the past at a number of the oases under technical cooperation programs rendered by other donors. The leading raising method in these programs was to leave chickens within farmer garden yards. This method is advantageous because chickens are fed when they seek insects and other natural feeds, but the number of raised chickens did not increase because chickens were vulnerable to attack by raptors, harmful animals, etc.

In order to tackle these problems, the present pilot study was made to raise chickens within a hen house. Major issues which were identified in the course of the pilot study are presented below.

1) i) Emaciation of chickens due to attack of hot winds/shifting sand, ii) Spreading of disease, iii) Conflict among chickens within hen house, and iv) Injuries caused by attack of harmful animals.

2) Low profitability of farming due to dependence on feeds such as grains, protein, calcium, green feed, etc. supplied from external sources.

3) Unfavorable egg production circumstances restraining normal productivity of farming.

Faced with the above-mentioned problems, the following countermeasures were taken during the pilot study.

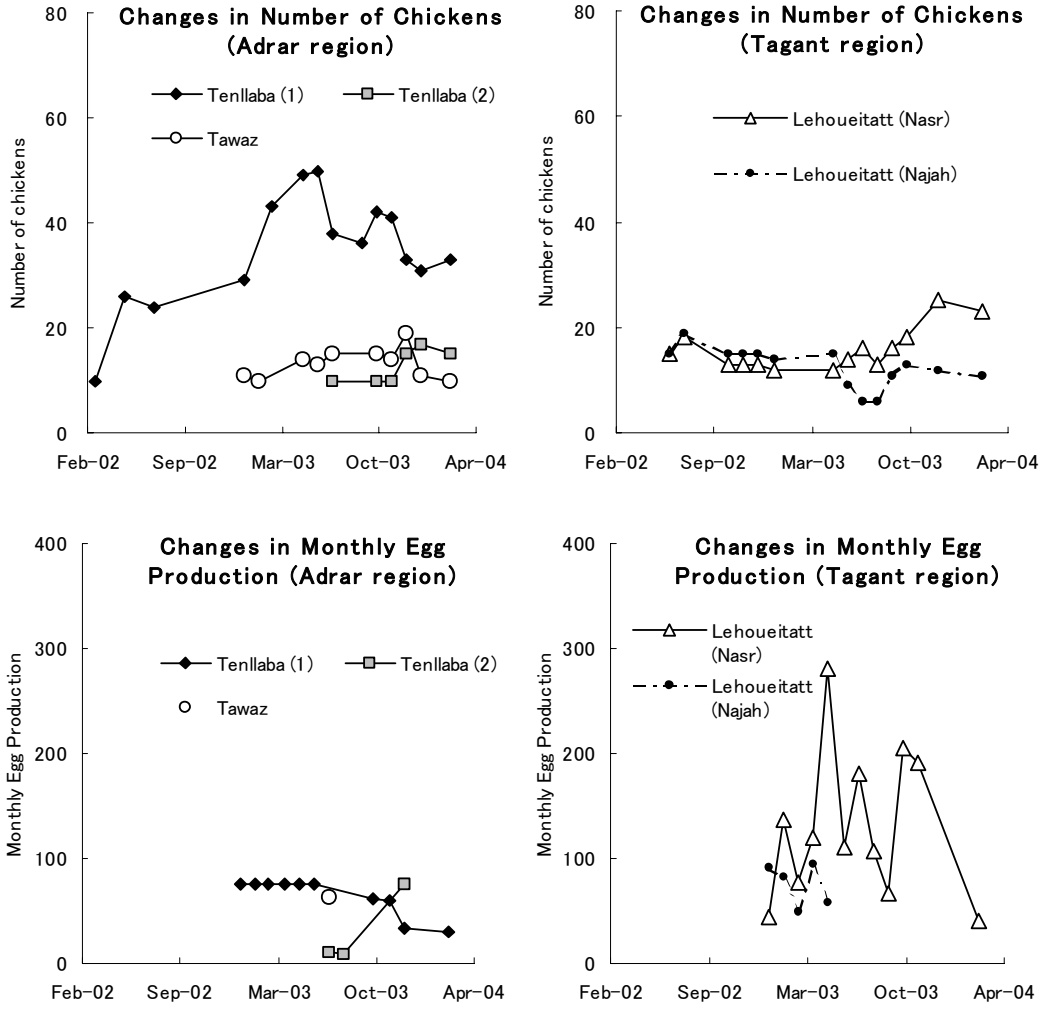
1) i) Installation of windbreaks/placement close to break shifting of sand, lowering of temperature with sprinkling, ii) Vaccination, spraying of pesticides, cleaning/disinfecting of hen house and its outer part, iii) Isolated raising of vicious chickens and neonatal chicks, and iv) Renovation of hen house structure, spraying of pesticides, laying of snares, etc.

2) Profitability was improved by using substitutive feeds (date seeds, meat/bone meal, food wastes/vegetables) that could be procured locally, and at the same time, by decreasing the proportion of feed supplied from external sources.

3) Productivity of eggs was raised owing to installation of hatching boxes, improvement of devices within hen house, easing of chickens' stress with construction of open hen

house.

Change in number of raised chickens as well as change in egg production as a consequence of application of technologies proposed under the pilot study are illustrated in **Fig. 7.2.4**. As indicated in this chart, the number of chickens raised increased during the implementation of the pilot study in Tenllaba and in Lehoueitatt (Nasr), which was followed by increased production of eggs. The participants in the pilot study realized sale of eggs and adult chickens.



Source : The Study Team

Fig. 7.2.5 Results of Monitoring on Chicken Raising

7.2.7 Shifting of Sand Dunes

The great majority of the oases are located along wadis that are extended in a passage of wind, hence, a number of sand dunes are formed and then shift caused by winds of sand mixed with silt and fine sand. Sand dunes are distributed over the main valley of a wadi

as well as over its slope, and date palm farms, houses roads, etc. are sometimes buried accordingly with the shifting of sand dunes. Sand shifting often damages production activities within the oases. Some farms have lost plants and others have suffered from elevated operation and maintenance cost for their infrastructure.

Prior to taking measures against sand shifting, fixed observation of sand shifting aiming at grasping forms and movements of sand dunes was conducted at four sand dune sites in three oases over a period of one year throughout the Pilot Study. Two of these sites had forest strips for breaking wind and others were without vegetation (Refer to **Table 7.2.11**).

Table 7.2.11 Fixed Observation Point of Sand Shift

Observed Oasis		Latitude Longitude	Direction of Sand Dune	Survey Line		Characteristics	Principal shifting Direc.
				Direction	Length (m)		
Toungad	A	20°04'16"N 13°08'26"W	NE-SW	NW-SE	65	Large scale sand dune intersects to wadi in acute direction	SE
	B	20°03'31"N 13°08'19"W	NNE-SSW	WNW-ESE	95	Small scale sand dune with afforestation in the wadi side	ESE
Tidjikja		18°31'28"N 11°24'25"W	NW-SE	NE-SW	53	Sand dune between 2 wadis without afforestation	SW
Lehoueitatt		18°39'24"N 11°34'30"W	NNW-SSE	NE-SW	100	Sandy leeve with afforestation in the residential side	Almost stable

Source : The Study Team

Sand dune forms are influenced by minute topography, wind direction & velocity, moisture content of soil, vegetation, etc. The observation results by oasis are as explained below.

1) The sand dune at the Oasis Toungad A is a large scale one located at the slope of the wadi valley and intersects obliquely with wadi to its valley direction. Predominant wind direction is NW, but secondary wind direction varies clockwise from NWN to S. Due to this variation of wind direction, the sand dune ridgeline in general shifts slightly to the direction of SE and movement volume in a year falls in the range of 2 – 3 m after repeating extension and shrinkage to other directions.

2) The sand dune at the Oasis Tidjikja extends in parallel with valley topography and predominant wind direction is from NW. About 5 m were shifted during 3 months. The wind direction to SE has prevailed since June 2003 and the sand dune ridgeline shifted remarkably to the direction of NE.

3) The sand dune at the Oases Toungad B and Lehoueitatt, which comprises forest strips for breaking sand shifting, had little change in topography owing to mitigation effect of sand shifting and sedimentation of the said countermeasure.

The above observations may be summed up in the following manner:

1) The shifting and expansion of sand dune is variable even at the one oasis, so it is not advisable to propose standardized countermeasures.

2) The most commonly employed measure for stabilization of sand dune and prevention of sand shifting/sand sedimentation is afforestation, and the effect of this measure has been positively confirmed as a result of fixed observation.

3) The most effective afforestation method is to establish a forest strip at right angle to prevailing wind direction. In case of sand dune area with unstable wind direction、the forest should be established directly against principal wind direction, with arrangement of distance between forest zones.

4) If target farms are small-scale ones, the installation of palisades/fences on the perimeter of farm may be an effective proposal (Refer to **4.4.6**).

5) Due to flooding caused by heavy rainfall in August 2003, extraordinary damages were recorded in Adrar region; consequently, a principal part of the sand dune at the Oasis Toungad A had been blown out and the sand dune at the Oasis Toungad B had been total blown out. At these oases, afforestation was carried out on the soft ground of slope, but no measure was taken against excavation from water. It is thus recommended to design protection works at the trunk portion of forest for prevention of sand shifting to be established adjacent to wadi.

7.3 Evaluation of the Pilot Study

7.3.1 Five Evaluation Items

The evaluation of each pilot study was conducted in line with 5 items as shown in **Table 7.3.1** and a comprehensive evaluation of these pilot studies is described below.

1) Relevance

- The Pilot Study is highly relevant because its larger goals coincide with the principal targets of the national policy in Mauritania: namely, poverty reduction and, at the same, it satisfies expectations of the inhabitants under influence of the Study.

2) Effectiveness

- The outcomes of the Pilot Study suggest that it is probable to attain the project's goals, which, in turn, shall contribute to accomplishment of the national target. To hasten the accomplishment of the national target, it is essential to hand over the results of the Pilot Study to the Oasis Project, Phase (III) so that the technologies verified in the Pilot Study can be widely disseminated among local people.

- The external circumstances like meteorological conditions within target region of the Pilot Study are conspicuously variable. Therefore, it is recommended to take steps against such variance to minimize its negative impact.

3) Efficiency

- The technologies and materials/implements employed in the Pilot Study can be procured locally with economical price and without depending on troublesome work for their operation and maintenance. Considerable results have come from these technologies and materials/implements, supported by high willingness of beneficiaries for their use. The components of the Pilot Study are appraised to be efficient in this viewpoint.

4) Impact

- The majority of the participants in the Pilot Study, in particular female participants, began to have confidence in engaging in farming activity, putting faith in the outcome of the Pilot Study.

- Spontaneous activities by the participants were observed at each pilot study, resulting in production of considerable benefit.

- Some farmers tend to follow the technologies applied to the pilot studies in undertaking their own faming activity.

5) Sustainability

- The participants are anxious for continuation of all of the pilot studies.

- It is anticipated that future assistance to this region should be rendered from other donors; as an example, it is proposed that most of the components in the pilot studies should be handed over to the Oasis Project, Phase (III).

- The Pilot Study was carried out with aggressive participation of existing organizations like AGPO, female associations, etc. and it is considered thereby that focal organizations for implementation of the projects in the future should be consolidated.

  Therefore the sustainability of each pilot project is evaluated to be high.

7.3.2 Recommendations and Lessons

(1) Recommendations

1) Importance for organized administration of water resources

The present Pilot Study was implemented from January 2002 to March 2004. During this period, both abundant and low rainfall years were recorded. Based on the past trend of rainfall, it the is supposed that the amount of rainfall will fluctuate sharply year by year. From the experience through the Pilot Study, it is observed that an organized administration is of importance for sustainable use of water resources. In this connection, it is advisable to realize administration of water resources at each oasis by expanding and strengthening participatory oasis associations.

2) Continuous implementation of monitoring on groundwater level

Valuable basic data for administration of water resources has been compiled thanks to implementation of monitoring on both groundwater level and pumping amount under the present Pilot Study. In addition, projection of available quantity for water resources was made by means of analytical simulation method. In order to verify adequacy of this projection and to make more approximate projection, continuous implementation of monitoring on groundwater level is prerequisite.

(2) Lessons

1) Close communication with the participants

At the initial stage of the Pilot Study, none of its components had apparent results and it was commented by the participants that this unfavorable outcome was attributable to lack of communication between the Study Team and the participants. In response to this opinion, the Study Team made an effort to stay with the participants at the target oases for longer period as possible, which was followed by prolongation of the time for joint work between the concerned parties. Consequently, the participants began to acquaint themselves with the technologies applied in the Pilot Study and apparent results began to appear accordingly.

Long-term communication and cooperation with the inhabitants are very important in technical extension.

2) Excess is indispensable at the initial stage of extension

At the beginning of the pilot studies, most of vegetables withered and died without realizing harvest and chickens became emaciated and died caused by diseases, attack of hot wind, etc. Soils of land provided at the beginning of the Pilot Study by beneficiaries were featured by low productivity and were likely to be hardened under arid condition; furthermore, these farms without vegetation were vulnerable to attack of strong wind. In summary, these lands were not suitable for vegetables cultivation without permitting healthy growth of plants.
In the meantime, the number of the participants remained constant without increase and some oases expressed their intention to terminate the pilot study. But, with appearance of apparent results later on, the number of the participants gradually rose.
The majority of inhabitants at the target oases were willing to acquaint themselves with efficient technologies applied by the Study Team to the pilot studies, by observing enthusiastically on the tasks of the Study Team through implementation of the pilot studies. In the light of this, the main point for success in extension of technologies lies in identification at the initial stage of the Pilot Study of eligible farms to be used as demonstration farms for extension of technologies, after taking account of availability of water, productivity of soils, geographical conditions, willingness of beneficiaries and their experience in farming.

3) Land acquisition

The pilot study for vegetable cultivation was started at first on the land provided voluntarily by the director of an association, but it was suspended mid way due to death of the director.

Thereafter, a farm for exclusive use of female association was acquired with financial assistance rendered by the Oasis Project for the sake of continuation of the pilot study. With acquisition of this farm, the awareness of the participants was raised and produced considerable benefit afterward. This fact implies that land acquisition for farming activity is a prerequisite in promoting activities targeted to female beneficiaries.

7.3.3 Comprehensive Evaluation

Comprehensive evaluation of the Pilot Study in terms of its contribution to attainment of project's goals as well as to the national policies is as discussed below.

1) Enhancement of nutritional conditions and increase in income

The technologies applied to the pilot studies were verified as highly beneficial for water saving and for raising yield of vegetables (in the range of 5 – 10 times higher than the conventional practice). Raised yield, in turn, contributed to boosting profitability, resulting in an increase in income of the beneficiaries. On the other hand, diversification of cropping period brought about prolongation of harvest period; thanks to this prolonged harvest period, local people could consume fresh vegetables for a longer period. In this context, extension of the technologies applied to the pilot studies is highly relevant for attainment of poverty reduction and enhancement of nutritional condition envisaged in the national policies.

2) Rational water use

For cultivation of dates as well as vegetables, irrigation water amount under cropping method proposed in the pilot study as well as under theoretical method was largely different from that under actual cropping practice. Therefore, with approximation of irrigation water amount to be used for farms under influence of the pilot study to the theoretical requirement, it is probable that considerable amount of irrigation water should be saved. Rational use of water resources is thus viable, provided that measures such as extension of water-saving cropping technologies on

the basis of the data, continuous implementation of education on water-saving, and raising of awareness of local people are taken.

3) Improvement of health and hygiene conditions

Enhancement of nutritional conditions is suggested by expanding vegetable cultivation, production and sale of bread, etc. By contrast, reform in practice of local people relevant to health and hygiene was hardly attained, except for raising awareness for use of toilet, etc.

Evaluating comprehensively the above outcomes, it is concluded that most of the goals of the Pilot Study have been attained, which in turn, suggests high probability for attainment of the national policies, subject to dissemination of the technologies applied to the present Pilot Study to local people in this region in the future.

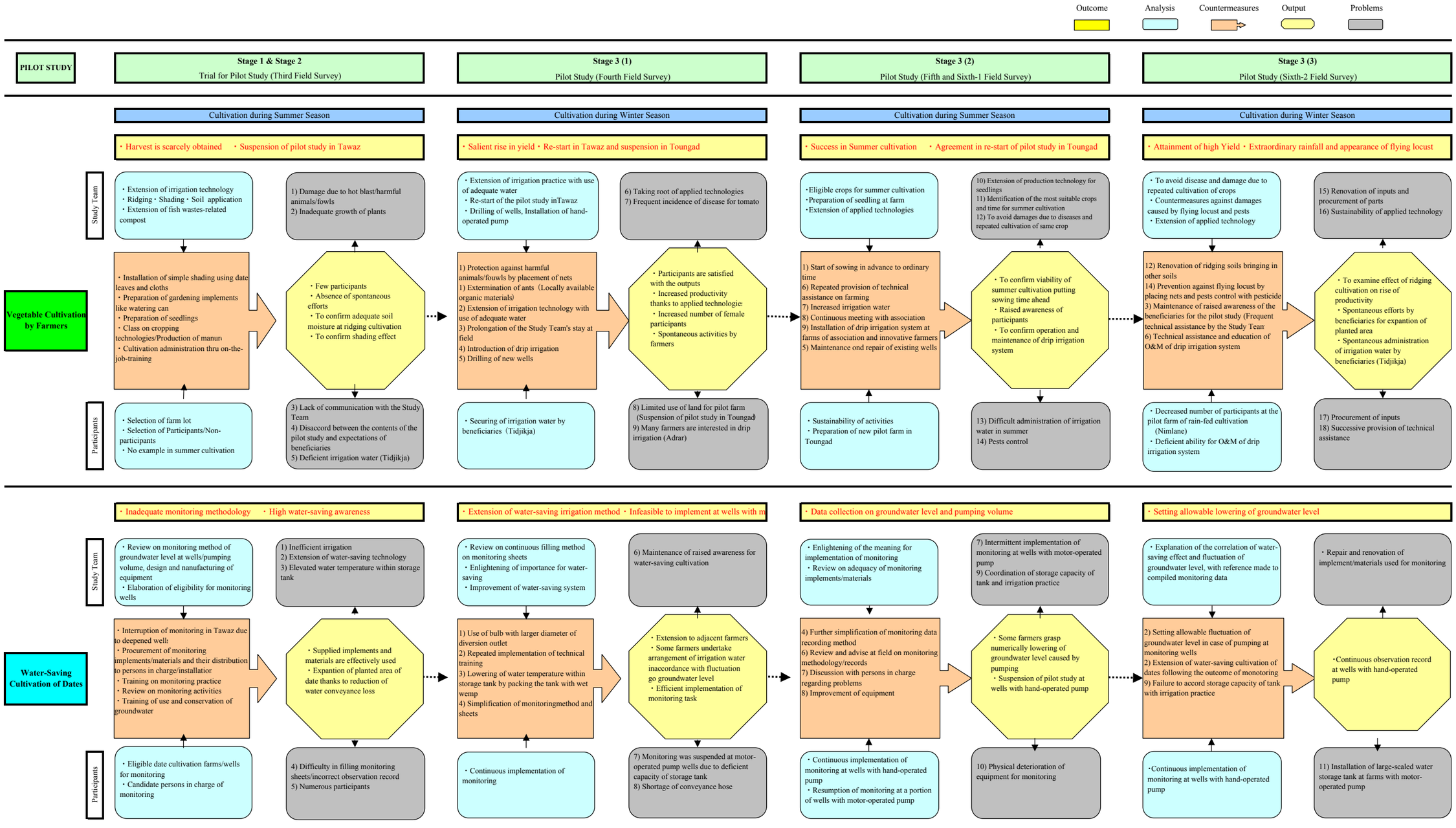


Fig. 7.1.1 Process of Pilot Study (1/2)

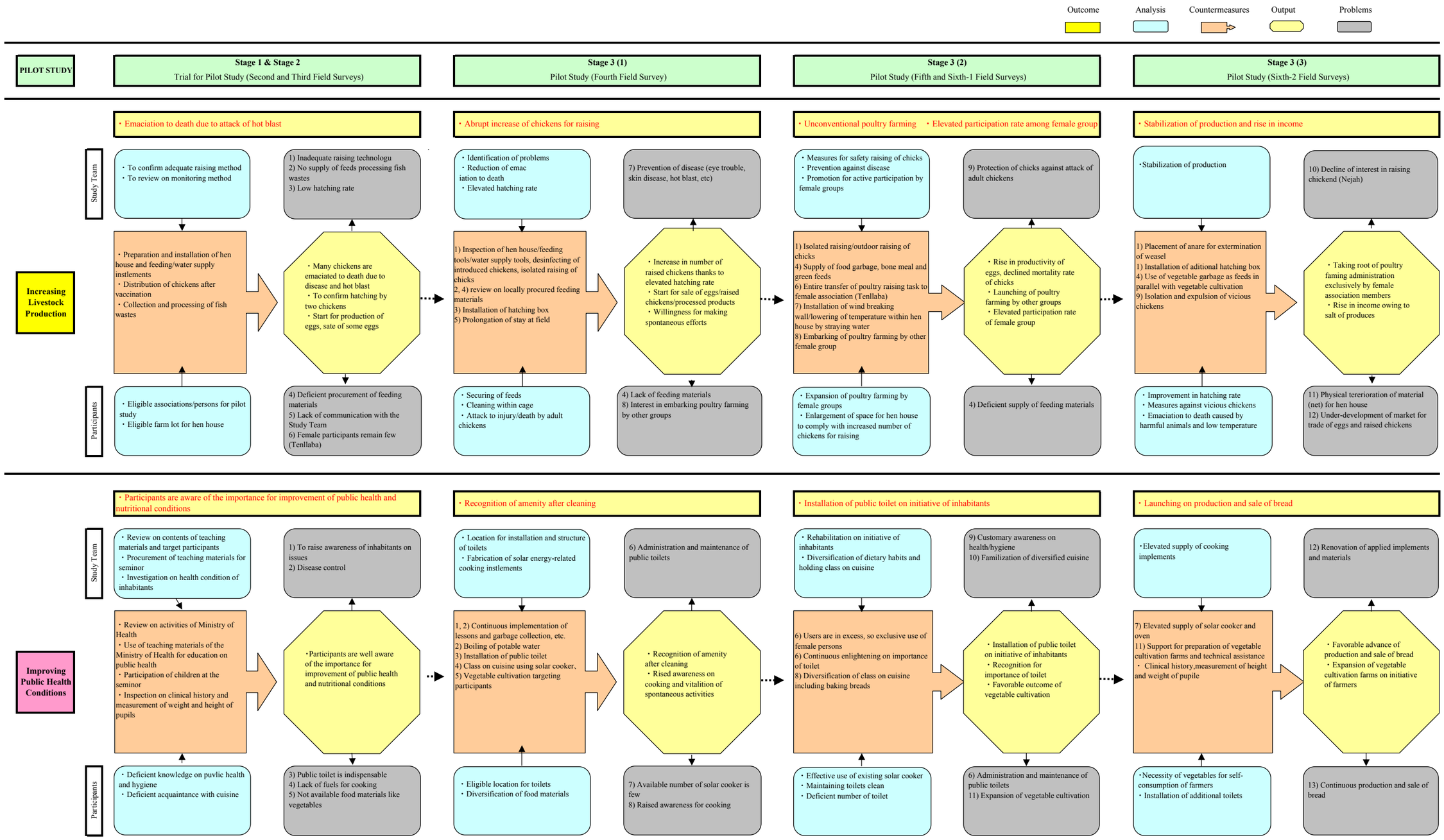
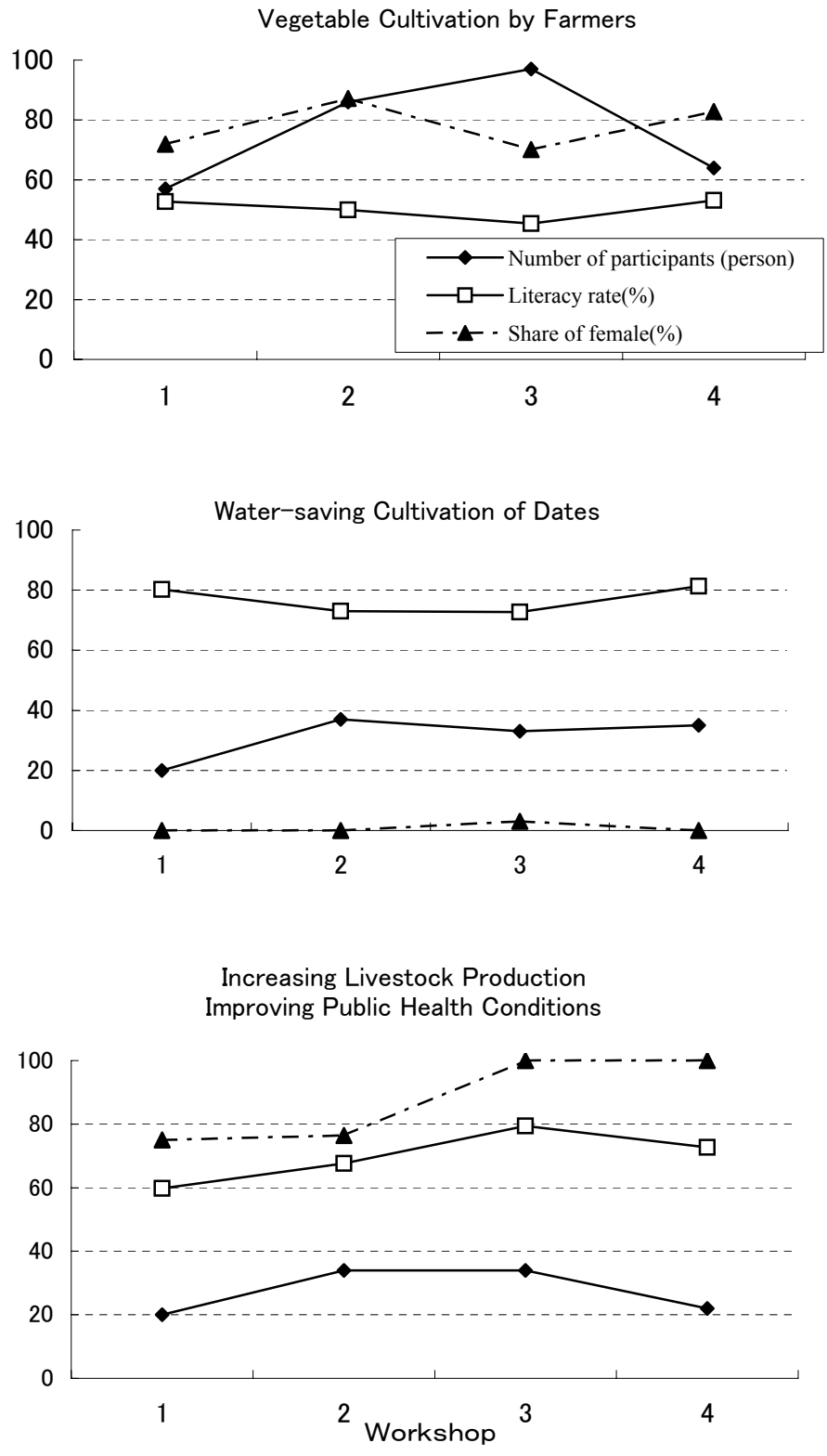
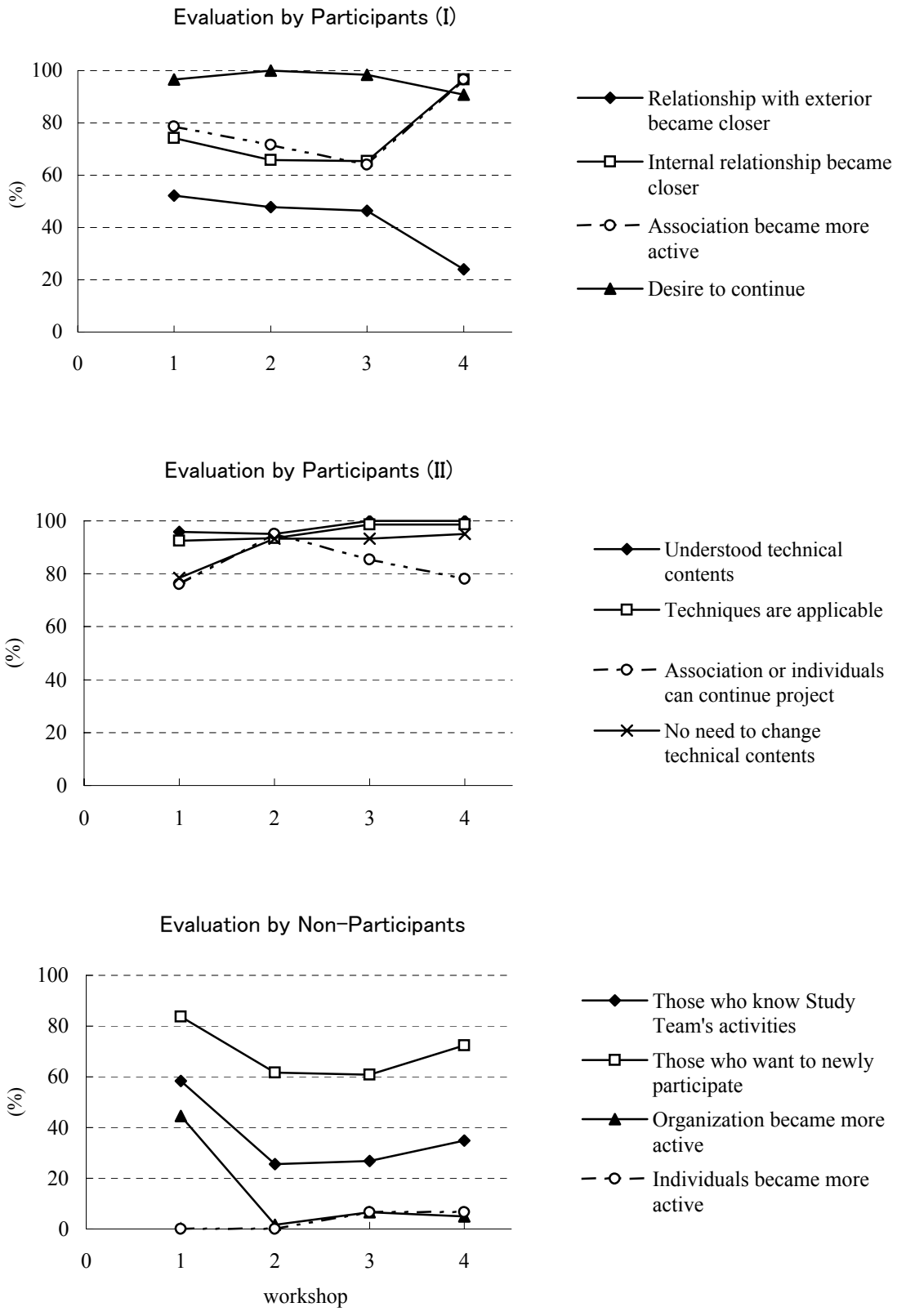


Fig. 7.1.1 Process of Pilot Study (2/2)



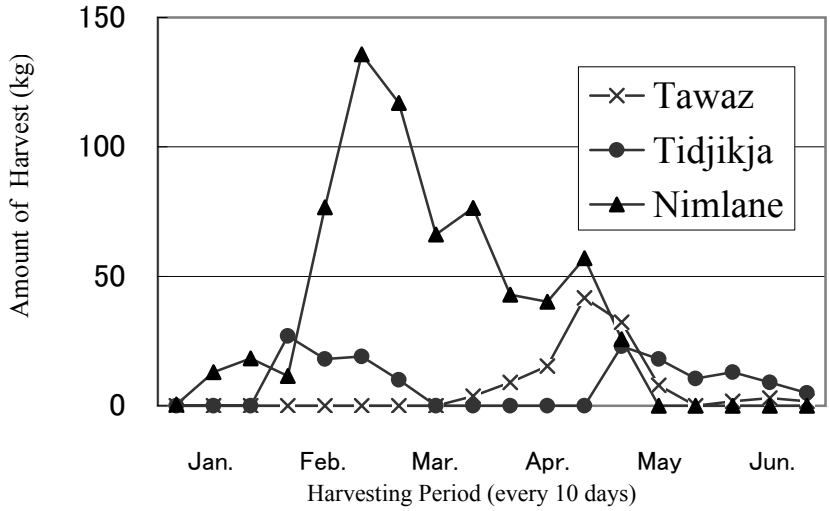
Source : The Study Team

Fig. 7.1.2 Number of Participants in Workshops



Source : The Study Team

Fig. 7.1.3 Results of the Questionnaire Survey



Source : The Study Team

Fig. 7.2.2 Harvesting Period of Vegetables by Oasis

Table 7.2.1 Yield and Profitability by Cultivation Method

1) Tomato

Oasis	Tawaz	Tenllaba	Tidjikja	Nimlane-1	Nimlane-2	Nimlane-1	Tenllaba	Tidjikja
Irrigation method	Drip	Drip	Watering	Watering	Watering	Watering	Basin	Basin
Cropping Season	Winter	Winter	Winter	Winter	Winter	Summer	Winter	Winter
Yield (t/10a)	6.0	5.3	2.7	2.4	3.1	3.2	0.5	0.3
Profitability (1,000UM/10a)	755	650	280	235	340	355	-41	-44

2) Beet

Oasis	Tidjikja	Nimlane-1	Nimlane-2	Tidjikja	Nimlane-2	Tidjikja
Irrigation method	Watering	Watering	Watering	Watering	Watering	Basin
Cropping Season	Winter	Winter	Winter	Summer	Summer	Winter
Yield (t/10a)	2.3	2.6	2.4	1.5	2.9	0.3
Profitability (1,000UM/10a)	321	366	336	201	411	26

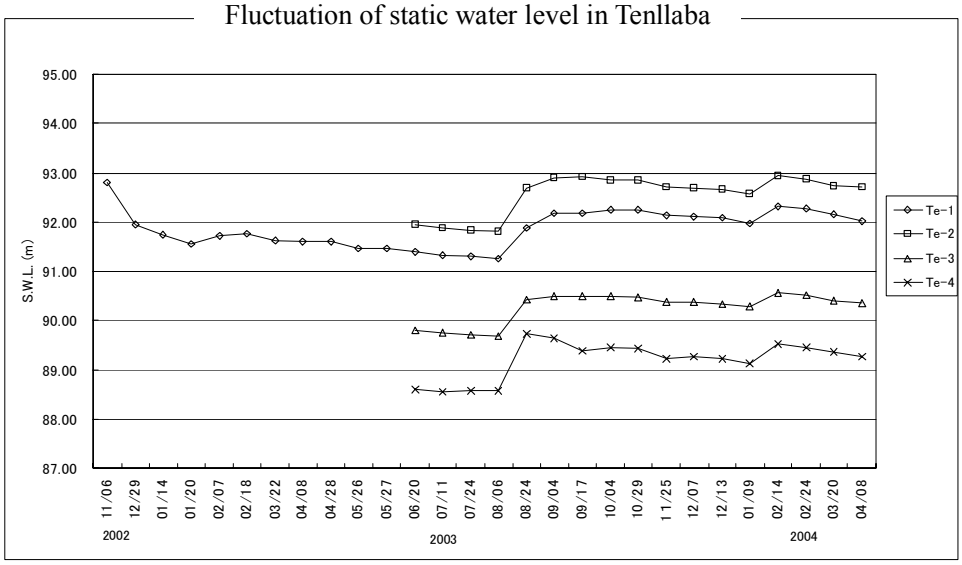
3) Eggplant

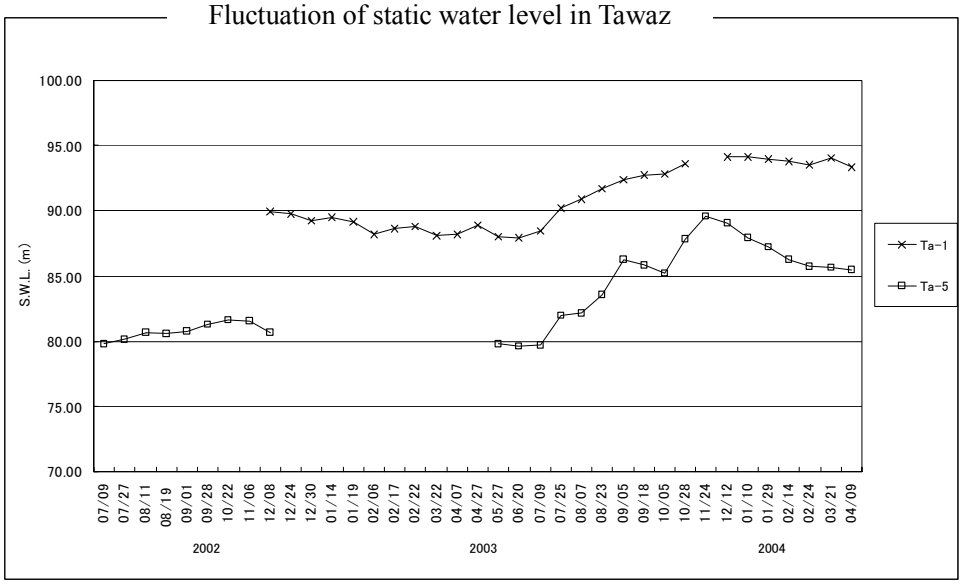
Oasis	Tenllaba	Tidjikja	Nimlane-1	Nimlane-2	Tidjikja	Nimlane-2	Tidjikja
Irrigation method	Drip	Watering	Watering	Watering	Watering	Watering	Basin
Cropping Season	Winter	Winter	Winter	Winter	Summer	Summer	Winter
Yield (t/10a)	3.7	8.6	5.8	2.1	2.9	3.6	0.3
Profitability (1,000UM/10a)	410	1165	745	190	310	415	-44

4) Carrot

Oasis	Nimlane-1	Nimlane-2	Nimlane-2	Tidjikja
Irrigation method	Watering	Watering	Watering	Basin
Cropping Season	Winter	Winter	Summer	Winter
Yield (t/10a)	2.7	2.5	2.6	0.3
Profitability (1,000UM/10a)	379	349	364	25

Nimlane-1: Field managed by the Study Team -2: Field managed by Cooperation
Watering: Irrigation by Watering Can
Source : The Study Team





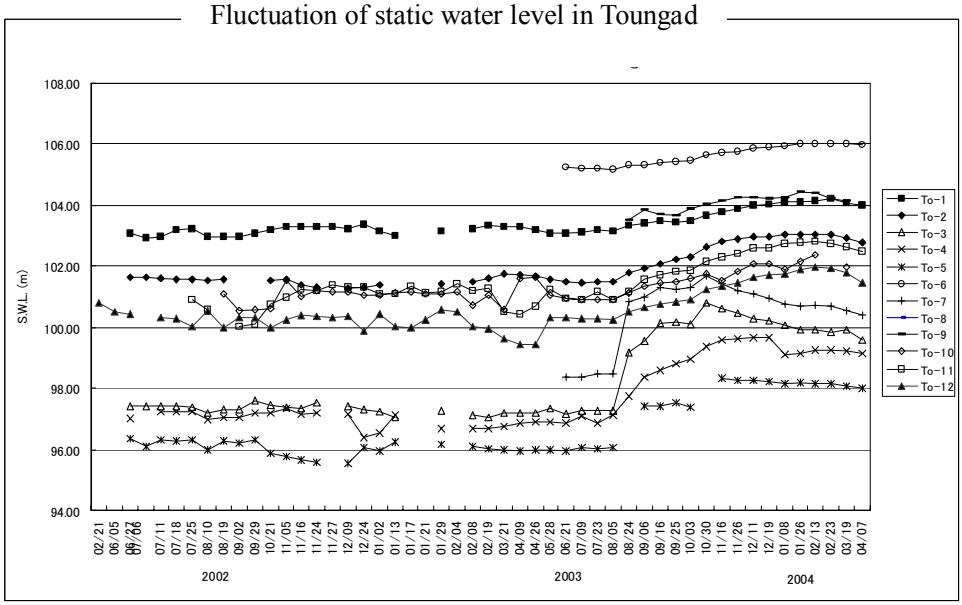
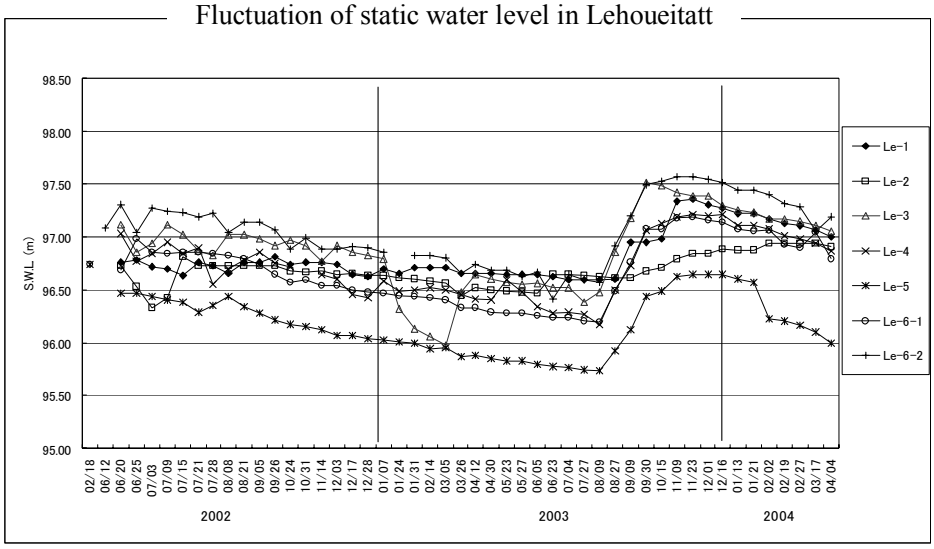
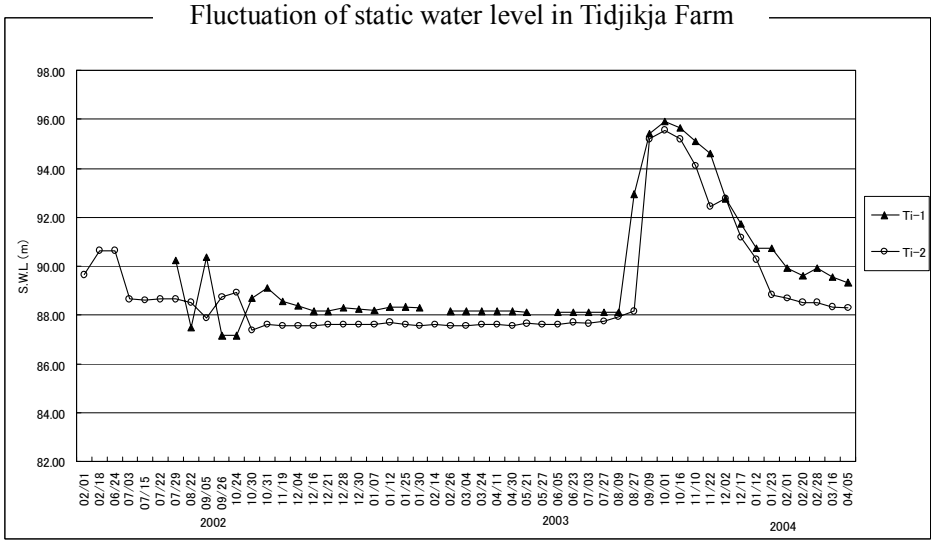
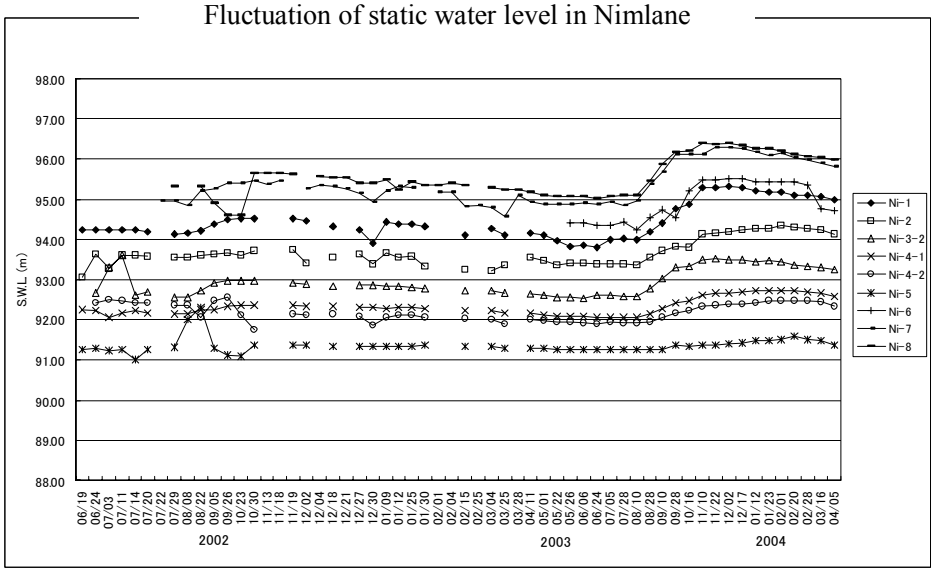


Fig. 7.2.3 Fluctuation of Static Water Level (1/2)







Source : The Study Team

Fig. 7.2.3 Fluctuation of Static Water Level (2/2)

Table 7.2.4 TRAM Value at Each Oasis

unit:mm

Region	Adrar							Tagant								
Oasis	Tawaz			Toungad			Tenllaba	Nimlane			Lehoueitatt			Tidjikja		
Location	D	P.F.	U	D	P.F.	U	P.F.	D	P.F.	U	D	M	U	D	M	U
Vegetable Field	25	35	35	10	15	13	23	15	20	13	10	18	10	10	40	13
Dates Field	58	78	100	28	79	13	56	106	58	13	13	46	13	15	-	175

D: Downstream U: Upstream M: Middle Reach P.F.: Pilot Farm

Source : The Study Team

Table 7.2.5 Present Irrigation Interval

Date Palm

Type	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	1 time / 1 to 3 days											
2	1 time / 7 to 10 days											
3	1 time / 7 to 10 days				1 time / 3 days					1 time / 7 to 10 days		

Vegetable

Type	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	1 time / 2 days								1 time / 2 days			
2	1 time / 8 days								1 time / 3 days		1 time / 8 days	

Source : The Study Team

Table 7.2.6 Crop Evapotranspiration

Unit : mm/day

Region	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Adrar	6.6	7.6	9.1	10.1	10.9	11.8	10.9	10.1	9.4	8.4	6.9	6.2
Tagant	6.3	7.5	8.4	9.2	9.9	10.1	9.1	8.1	8.1	7.9	6.9	6.2

Source : The Study Team

Table 7.2.7 Comparison of Irrigation Amount

Date Palm Caltivation — Unit: m^3

Source	Type	Interval	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Conventional Method	Type 1	(1/1)	6.20	5.60	6.20	6.00	6.20	6.00	6.20	6.20	6.00	6.20	6.00	6.20	73.00
		(1/3)	2.20	1.80	2.20	2.00	2.00	2.00	2.00	2.20	2.00	2.00	2.00	2.00	24.40
	Type 2	(1/7)	1.00	0.80	0.80	0.80	1.00	0.80	1.00	0.80	0.80	1.00	0.80	1.00	10.60
		(1/10)	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.80	0.60	0.60	0.60	0.60	7.40
	Type 3	(1/7,1/3)	1.00	0.80	1.00	0.80	2.00	2.00	2.00	2.20	2.00	1.00	0.80	0.80	16.40
		(1/10,1/3)	0.80	0.60	0.60	0.60	2.00	2.00	2.00	2.20	2.00	0.60	0.60	0.60	14.60
Irrigation Requirement	Adrar		0.48	0.50	0.66	0.71	0.79	0.83	0.80	0.74	0.67	0.62	0.49	0.45	7.75
	Tagant		0.46	0.50	0.61	0.65	0.72	0.72	0.67	0.59	0.58	0.58	0.49	0.46	7.02

Vegetable Caltivation (Carrot) — Unit: m^3

Source	Type	Interval	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Conventional Method	Type 1	(1/2)	2.64									2.20	3.30	3.30	11.44
	Type 2	(1/3,1/8)	0.66									1.54	0.88	0.88	3.96
	Ridge	(1/1)	0.69									0.58	0.86	0.89	3.02
Irrigation Requirement	Adrar		0.65									0.85	0.80	0.84	3.14
	Tagant		0.63									0.79	0.80	0.85	3.07

Source : The Study Team

Table 7.2.10 Problematic Water Quality for Irrigation

Oasis		Ten.	Tawaz			Toungad															Lehoueitatt			
Well Code No.		Te-4	Ta-1			To-3			To-4		To-5			To-7			To-12			Le-2			Le-5
Date		1/20	9/7	12/17	1/22	9/7	12/18	1/20	12/18	1/20	9/7	12/18	1/20	9/7	12/18	1/20	9/7	12/18	1/20	9/13	12/11	1/29	9/13
SAR	me/l	12.3	14.9	18.0	18.5	50.2	37.4	50.6	14.3	18.0	29.7	26.0	20.2	24.5	63.7	51.8	6.1	30.1	42.8	101.0	42.4	81.0	17.3
EC	μ s/cm	1189	1852	2070	2050	3150	3690	4740	1755	1800	2250	2330	2390	2530	4680	4630	1091	2890	3470	7050	5640	4270	2790
Quality classif.		C3S3	C3S4	C3S4	C3S4	C4S4	C4S4	C4S4	C3S3	C3S4	C4S4	C4S4	C4S4	C4S4	C4S4	C4S4	C3S1	C4S4	C4S4	C4S4	C4S4	C4S4	C4S4
Coliforms	colony	5	-	2	3	-	0	1	0	1	-	15	4		30	5	-	3	5	-	23	2	-

Source : The Study Team

Table 7.3.1 Final Evaluation with 5 Evaluation Items by Pilot Project (1/4)

(1) Vegetable Cultivation by Farmers
(Benefited Oases: Tawaz, Toungad, Tidjikja, Nimlane)

Evaluation Items	Evaluated Results
Relevance	- Realization of vegetable cultivation with high productivity depending on applied technologies and inputs coincides with poverty alleviation and incremental food production, both of which are focal policies of the central government. - Rise in yield and increase in sales income of vegetable attributable to applied technologies satisfy the expectation of the participants in the pilot study.
Effectiveness	- Boosted yield and improved profitability of vegetables thanks to applied technologies are expected to serve an expansion of irrigated farms to which the technologies verified through this pilot study will be applied suggesting viability for attainment of poverty alleviation. - Boosted yield and prolongation of cultivation period of vegetables thanks to applied technologies shall enable constant consumption of vegetables leading to improvement of nutritional condition of local people. - Irrigation water amount under the applied technologies shall be reduced by close to half in comparison with that under prevailing cultivation practice, which indicates that applied technologies would benefit sustainable use of water resources.
Efficiency	- Farming inputs (drip irrigation system, watering can, materials for improvement of soils, fish wastes as compost, etc.), which are featured by economical cost and can be procured locally, serve to elevate productivity and profitability, if used for vegetable cultivation. - The productivity per unit of irrigation water under applied technologies is remarkably higher than that under prevailing farming method.
Impact	- Acquaintance of cropping technologies and fruits of this pilot study raised confidence and self-reliance of members of female associations participated in the pilot study. - Vegetable cultivation with employment of the technologies proposed in this pilot study has been expanded in the vicinity of the pilot farms. - Extension of vegetable cultivation envisaging technologies applied to this pilot study is proposed in the Oasis Project, Phase III, as a priority project.
Sustainability	- Farmers are eager to continuous implementation of vegetable cultivation with employment of technologies applied to this pilot study. - The Oasis Project Phase III expressed its intention to disseminate the technologies applied to this pilot study (financial assistance for procurement of inputs and technical assistance). This is an example of foreign aid in the future related with this pilot study. - Equipment and materials used for this pilot study may be operated and maintained by beneficiaries without difficulty. - Unstable rainfall pattern is likely to jeopardize crop farming due to deficiency of irrigation water.

Table 7.3.1 Final Evaluation with 5 Evaluation Items by Pilot Project (2/4)

(2) Water-saving Cultivation of Dates
(Benefited Oases: Toungad, Nimlane, Lehoueitatt)

Evaluation Items	Evaluated Results
Relevance	- Water-saving, which constitutes an objective of the present study, coincides with conservation of water resources, one of the policies of the central government. - Irrigation method using the implements employed in this pilot study satisfies the needs of the farmers in terms of water-saving and reduction of working hours for irrigation. - Pumping irrigation from wells is skeptical due to deficient storage capacity of the applied implements.
Effectiveness	- Water conveyance loss is to be reduced with use of applied equipments, leading to rational use of groundwater resources. - Long-term transition in fluctuation of groundwater level was disclosed as an outcome of monitoring on groundwater level at wells. This information is expected to serve as basic data in elaborating groundwater management plan. - It is also disclosed through monitoring on pumping volume that there is a disparity between actual pumping volume and theoretical pumping requirement, which intimates the possibility to realize water-saving by decreasing irrigation water.
Efficiency	- Although being featured by simple handling and low cost, farming inputs used for this pilot study is highly efficient bearing a number of fruits like reduction of irrigation water, quantitative collection of data on fluctuation of groundwater level, collection of data on actual pumping volume, etc. - At wells for pumping water, implements applied to this pilot study are disaccorded with actual irrigation water, so attainment of goals is less efficient.
Impact	- Some of the participants in this pilot study launched spontaneously to undertake water management tasks such as regulating pumping volume by observing the fluctuation of groundwater level, setting fixed pumping time among users, etc. - Some farmers are willing to follow water-saving farming with procurement of necessary implements at their own cost. - Due to disaccord between the equipments applied to the pilot study and actual irrigation water, pilot study was suspended at oases in which pumping irrigation is commonly practiced (Adrar region).
Sustainability	- Farmers participated in this pilot study are eager to follow water-saving farming on their own initiative. - The Oasis Project and National Water Resources Center expressed their interest in succeeding activities of this pilot study. - It is anticipated that the Oasis Project Phase III would render financial assistance to extension and renovation of the equipments applied to this pilot study. - At wells for pumping irrigation water, taking a step for effective use of water resources like enlargement of storage tank is indispensable.

Table 7.3.1 Final Evaluation with 5 Evaluation Items by Pilot Project (3/4)

(3) Increasing Livestock Production
(Benefited Oases: Tenllaba, Lehoueitatt)

Evaluation Items	Evaluated Results
Relevance	- Mitigation of children' malnutrition is included within focal measures of the central government's poverty alleviation policy, so this pilot study aiming at elevated consumption of chickens and eggs coincides with the said central government's policy. - Poultry raising technologies applied to this pilot study enjoys higher productivity than prevailing raising method represented by raising without hen house, and satisfy participants' expectation accordingly.
Effectiveness	- Increased reproduction of chickens for raising by means of the technologies applied to this pilot study contributes to raising consumption of chickens and eggs. - Chickens and eggs produced at pilot farms are used not only for self-consumption of farmers but also for sale at markets; poultry raising in this pilot study is thereby meaningful both in improvement of nutritional condition and in elevating income. - Although quantitative data such as lowering frequency for being contracted a disease, decline in infant mortality rate, etc are not available, not a few inhabitants are aware of the merit of consuming eggs for improvement of their nutritional condition. - Proposal for use of fish wastes as feed for raising chickens was failed, but application of fowl droppings as compost for crop cultivation is expanded.
Efficiency	- The implements and technologies applied to this pilot study bore fruits such as elevated egg production and increased number of raised chickens. - Due to implementation of poultry raising in parallel with vegetable cultivation, vegetable wastes may be used as feed for chickens. - Use of fish wastes as feed turned out to be infeasible. - Fowl droppings, by-product of poultry raising, began to be used for vegetable cultivation.
Impact	- With sale and consumption of eggs and chickens, farmers enjoy an increase in income as well as diversification of dietary habits. - Some female association expressed their interest in embarking poultry raising.
Sustainability	- Local people's awareness for successive implementation of this pilot study and for expansion of poultry farming is raised; as an example some farmers started newly poultry farming. - Expansion of poultry farming is foreseen thanks to overall support of the Oasis Project which envisages extension of poultry farming in its Phase III. - Following technical manual for poultry raising elaborated by the Study Team, an extension of poultry farming in the said Oasis Project Phase III shall be hastened leading to spontaneous embarking of this farming by local people.

Table 7.3.1 Final Evaluation with 5 Evaluation Items by Pilot Project (4/4)

(4) Improving Public Health Condition
(Benefited Oases: Tenllaba, Lehoueitatt)

Evaluation Items	Evaluated Results
Relevance	- Poverty alleviation policy of the central government envisages as one of its focal targets enhancement of hygiene and living circumstances, so this pilot study coincides with the said central government's policy. - Because diseases represented by diarrhea and malnutrition prevail in the oasis region, local people are anxious for improvement of health and hygiene condition.
Effectiveness	- No apparent effect such as building-up of height and weight, decreased frequency to be contracted a disease, etc. was attained during this pilot study period, but awareness of the local people on public health and hygiene under daily life was raised through public health education. - The public health education also enlightened local people an importance for consumption of vegetables and to elevate frequency for eating cooked vegetables, resulting in an improvement of their nutritional condition. - Class on cuisine served launching of production and sale of bread. - Public toilets have been installed through public health education.
Efficiency	- Awareness on public health (cleaning custom, recognition on importance of toilet) as well as cooking and cuisine practice by using solar cooker and gas oven are taken root among local people. Goals of this pilot study are thus almost attained evaluating theispilot study to be highly efficient.
Impact	- Spontaneous activities such as construction of toilets around school on initiative of PTA and installation of water tank/distribution of sterilized potable water on initiative of local people are reported in Tenllaba. - Diversification of dietary habits among local people owing to production and cooking of eggs and vegetables is observed.
Sustainability	- Interest in successive implementation of the components of this pilot study after its completion is expressed and non-participants in the pilot study and inhabitants at oases alienated from the pilot study are eager to acquaint themselves with the outcome of this pilot study. - It is probable that the beneficiaries would undertake operation and maintenance of implements and materials applied to the pilot study on their own initiative. - Financial assistance to the beneficiaries is prerequisite for procurement of new implements and renovation of deteriorated ones.

CHAPTER 8

APPRAISAL OF MASTER PLAN AND SELECTION OF PRIORITY PROJECTS

CHAPTER 8 APPRAISAL OF MASTER PLAN AND SELECTION OF PRIORITY PROJECTS

8.1 Appraisal of Master Plan

The Master Plan formulated under the present Study aims at the following basic development concepts, which take into account the prevailing development constraints and potentials in the oasis region, the needs of the inhabitants in the oasis region and the national development plan: namely,

1) Poverty alleviation
2) Improvement of social infrastructure
3) Sustainable use of resources

Specially, the development goals of the Master Plan are as follows:

1) To reduce by half the poverty-level strata of rural population by raising farm productivity
2) To improve overall public heath and hygiene condition with development of social infrastructure
3) To construct management system of water resources with participation of beneficiaries

To reach these goals, the Master Plan focused on the following strategies:

- Poverty alleviation (increase in income) by:
  Vegetable cultivation, Date cultivation, Livestock farming and Rational use of unexploited resources.

- Development of social infrastructure by:
  Health and hygiene education, Improvement of health and educational facilities and Extension of agriculture-related technologies.

- Sustainable use of resources by:
  Water-saving irrigation technology and groundwater management.

The pilot studies in the following four areas were carried out to verify the effectiveness of these strategies to accomplish the goals of the Master Plan.

1) Vegetable cultivation by farmers: Increase in income, improvement of nutritional condition and use of unexploited resources.
2) Water-saving cultivation of dates: Groundwater management and water-saving irrigation technology.
3) Increasing livestock production: Improvement of nutritional condition, increase in income and use of unexploited resources.
4) Improvement of public health conditions: Health and hygiene education.

The pilot studies were examined in terms of their applied technologies, suitability of inputs (materials and implements), participation of beneficiaries and probability for extension of their outputs. They were evaluated from the viewpoints of: relevance, effectiveness, efficiency, impact and sustainability. The conclusion of the evaluation was that all of the pilot studies are highly viable for accomplishment of the goals of the Master Plan.

The viability to attain reduction of poverty by half, which is a quantitative target of the Regional Master Plan proposed under the present Study, is appraised below, on the basis of the values verified in the course of the pilot studies. The purpose was to evaluate quantitatively the probability to satisfy the framework envisaged under the Master Plan.

Provided that the regional economy can be developed by 2015 following the scenario shown in **Table 5.5.2**, the value of the GRDP to reduce poverty by half needs to be 464.2 million UM in Adrar region and 423.9 million UM in Tagant region, estimated both at the constant price of 1998. Provided further that this disparity comes exclusively from the GRDP in agricultural sector, the GRDP in agricultural sector in 2015 needs to grow at minimum 1,868.9 million UM in Adrar region and 600.7 million UM in Tagant region, which are equivalent to 1.71 times in Adrar region and 4.38 times in Tagant region higher than the respective GRDP in agricultural sector of 1998.

It is estimated that in order to attain the incremental agricultural output mentioned above, the irrigated area should be expanded to 72 ha in Adrar region and to 125 ha in Tagant region, calculated on the basis of the yield levels obtained in the course of the relevant pilot study.

In Adrar region, the total irrigated area at present remains 950 ha, with average unit yield of 14.6 ton/ha recorded for vegetable cultivation, which is about a third of the accomplishment at the pilot farm. The leading crop cultivated in the region is carrot, but its farm-gate price is low, depressing its profitability to about one-tenth of the

accomplishment at pilot farm. In the light of this situation, it is presumed that the projected agricultural output in 2015 can be attained by boosting productivity and profitability of about 10% of actual irrigated area to the levels accomplished at the pilot farm. Furthermore, water resources-related survey in the pilot study revealed that irrigation water amount may be saved, provided that reforms in cropping method are put into force. In summary, rational administration and use of water resources also partly serve to raise agricultural output leading to reduction of poverty by half.

The prevailing irrigated area in Tagant region is 44 ha in total, which is used for vegetables cultivation with a unit yield of 1.1 ton/ha on average. This unit yield is below one twentieth of the accomplishment at the pilot farm and net benefit now is hardly obtained from this farming. If the target value of the GRDP in 2015 required for reduction of poverty by half can be fulfilled by nothing but an expansion of agricultural output, the irrigated area with production of highly profitable crops should increase to 125 ha, which is equivalent to about 3 times more extensive than the actual area, or equivalent to an expansion of about 80 ha as newly irrigated area. This target may be attained within context of a desk projection, but it entails intensive effort for its realization at field. Anyhow, dissemination of vegetable cultivation is expected to play a leading role among economic activities of the region. It is thereby required to strengthen assistances to farmers in the region represented by extension services of agriculture-related technologies and provision of necessary inputs for farming.

As verified by positive outcomes of the relevant pilot study, the attainment of the goals of the Master Plan was evaluated to be highly viable in technical terms. Nevertheless, in practice, the said attainment is subject to easing prevailing constraints such as an absence of adequate technical assistance to farmers, underdevelopment of collection and forwarding facilities for agricultural products, other relevant marketing system, etc. On the other hand, if vegetable cultivation is conducted in parallel with promotion for improvement of productivity for dates and livestock, the viability for the attainment of the goals of the Master Plan shall be boosted.

It is probable that vegetables cultivation will play an important role not only in poverty alleviation, but also in the improvement of the nutritional condition of farmers if harvests should be destined for self-consumption of farmers. In this regard, it is recommended to promote vegetables cultivation for self-consumption of farmers at remote oases, apart from for commercial purpose.

8.2 Priority Projects/Programs

Based on the discussion made in **Section 8.1** and in due consideration of eagerness of local people for development, a list of projects/programs (which are essential for reduction of poverty by half and which is a specific target under the present Master Plan) together with their objectives and components is presented in **Table 8.2.1.** The implementation schedule for these projects is shown in **Fig 8.2.1**.

8.2.1 Projects/Programs Implementation Strategy

It is inefficient to separately implement the projects/programs proposed in this Master Plan. Instead it is recommended to group inter-related projects selected from priority projects, for urgent realization in a package prior to putting them into implementation. Basic implementation strategies are explained below.

(1) Projects for Attainment of Master Plan Specific Targets

It is not possible to expand vegetable cultivation and to disseminate medical services which contribute to attainment of the Master Plan's specific target to all oases simultaneously. In order to put the development proposal in a more efficient manner, eligible oases where there is priority for earlier implementation of projects should be determined with an emphasis on the following agenda.

1) Creation and encouragement of core oases

Eligible oases with comparatively larger territory and more population, as well as endowed with better traffic accessibility, shall be identified aiming at getting higher effect from implemented projects/programs on surrounding oases.

2) Support of women's economic activities

The oases that have higher proportion of female population, female heads of households, as well as destitute female head of household. In view of focal role for sustainability of the oases by women residents, special attention shall be paid to render support to women residents.

3) Capacity building of existing associations

Existing associations have played an important role for the development of oases

and it is likely that contribution of these associations to future development of oases will remain critical. Therefore, priority for earlier implementation of projects is given to the oases already having organized associations.

(2) Enhancement of Living Circumstances at Oases

In terms of efficiency for implementation of projects/programs, priority should be given to the eligible oases mentioned above. Nevertheless, it is of concern that economic disparity may be enlarged between eligible oases and the rest of the oases which are likely to be alienated from development due to their geographical handicap. In the light of redressing this imbalance, some measures shall be taken for the small-scale and geographically handicapped oases.

8.2.2 Priority Projects

In line with the basic development concept and development strategies for attainment of specific regional development plan targets, eligible priority projects are proposed as listed below. The eligible oases for each priority project are classified according to the strategies mentioned above, and indicated in **Table 8.2.2**. Location of the oases with AGPO is shown in **Fig. 8.2.2**, and **Fig. 8.2.3** shows the distribution of the oases where the priority projects 1, 2 and 3 should be implemented.

(1) Priority Project Profile 1

1.	Project Title	:	Extension of Vegetable Cultivation Technology
2.	Location	:	11 oases in Adrar region and 7 oases in Tagant region selected in line with development strategies, implementation of demonstration farm, etc. (Refer to **Table 8.2.2**).
3.	Implementation Agency	:	Oasis Project, Secretary of States for the Feminine Condition in cooperation with technical assistance under foreign aid
4.	Objective	:	To render economic support for reduction of poverty, with target given to female group.
5.	Expected Effects	:	Rise in income among poor strata and improvement of their nutrition condition.
6.	Project Cost	:	40 million UM
7.	Implementation Schedule	:	3 years from 2004

8. Project Description:

In order to disseminate vegetables cultivation technologies comprising furrow, shade and drip irrigation carried out in the course of the pilot study to women's associations and individual farmers, the following measures shall be taken in terms of sustainability of the technologies verified in the course of the pilot study and extension of these technologies to major oases. It is also proposed to use the ripple effect of these technologies on surrounding oases setting core oases as base for dissemination.

1) Donation of shovels, seeds, watering cans and drip irrigation equipments

2) Provision of technical assistance with regard to vegetable cultivation

3) Implementation of monitoring on outcome of vegetable cultivation

4) Collection and distribution of fish garbage for production of compost

5) Implementation of monitoring and analysis on quality of water to be taken for irrigation

6) Arrangement for collection and forwarding of agro-products

7) Extension of processing technique of agro-products

(2) Priority Project Profile 2

1.	Project Title	:	Improvement of Public Health Condition
2.	Location	:	Oases located within departmental capital and oases with population more than 1,000, both of which are without physicians (Meddah, M'haireth, Kseir Torchane, Tawaz in Adrar region and N'beika, El Gheddiya, Rachid in Tagant region)
3.	Implementation Agency	:	Oasis Project, Secretary of States for the Feminine Condition in cooperation with technical assistance under foreign aid
4.	Objective	:	Improvement of hygiene conditions
5.	Expected Effects	:	Prevention of diseases, lowering of infant mortality rate and prolonging average life expectancy
6.	Project Cost	:	200 million UM
7.	Implementation Schedule	:	3 years from 2005

8. Project Description:

Almost all oases except for those located within the regional capital are suffering from an absence of physicians, and local people at remote oases hardly have a chance to receive any kind of medical services. Within the context of extension for medical services, this project envisages as first step to arrange the necessary system for provision of periodic medical services to local people living at the oases mentioned above including their surrounding oases. In addition, critical hygiene education on prevention of diseases shall be given periodically. Indispensable equipment and materials as well as human resources for this project are as follows:

1) Regional center:	Equipped with consultation room, meeting room, lodging facility, etc. which enable provision of medical services and hygiene education to local people. Lodging facilities shall be used by local people coming from surrounding oases for receiving medical services and hygiene education, attending meetings and other purposes
2) Traveling clinic:	One physician, two nurses, one driver, one vehicle and one set of medical equipment for each region.
3) Hygiene education:	To be provided in parallel with above-mentioned medical services, including practice of cooking, etc. and if necessary two specialists and materials and equipments for the education.

To be given at the same time: preview of videotape on hygiene education, videotapes for children, etc.
The components 1) Regional center and 2) Traveling clinic will require not only medical facilities and materials but also professional staffs. Therefore, cooperation with the Ministry of Health and Social Affaires is quite indispensable for its implementation.

(3) Priority Project Profile 3

1.	Project Title	:	Enhancement of Living Circumstances at Small and Remote Oases
2.	Location	:	In principle for small-scale oases located in geographically handicapped areas as listed in **Table 8.2.2**
3.	Implementation Agency	:	Oasis Project
4.	Objective	:	To encourage self-support efforts of oases through enhancement of living circumstances
5.	Expected Effects	:	Accomplishment of autonomy among oases
6.	Project Cost	:	100 million UM

7. Implementation Schedule : 3 years from 2005

8. Project Description:

The majority of the target oases are located geographically in handicapped areas and so the following measures shall be taken to redress their unfavorable circumstances.

1) Vegetable cultivation:	With donation of seeds, shovels, etc. together with provision of extension services of technology on small-scale cultivation of vegetables, to produce vegetables for self-sustenance and to improve nutrition condition of local people accordingly.
2) Poultry farming:	With donation of inputs accompanied by provision of extension services of relevant technology to hasten improvement of nutrition condition of local people.
3) Installation of lights:	To install this equipment, depending on solar energy at the central part of oases, to enable meeting of local people at night, etc.
4) Supply of potable water:	To drill wells equipped with hand-powered pump at the central part of oases for supply of potable water to local people.
5) Enhancement of nutrition condition:	Making use of solar cooker to boil water pumped from wells for its safe use for drinking. To install toilet to improve hygiene conditions.
6) Improvement of physical facility for primary education:	To diagnose actual situation of materials and equipment like desks, chairs and so on, and to renovate obsolete ones.

(4) Priority Project Profile 4

1. Project Title : Rehabilitation and Development of Rural Water Supply System

2. Location : Oases equipped with water supply system and oases with population more than 500

3. Implementation Agency : Regional and Departmental Government Office or SNDE

4. Objective : To rehabilitate existing rural water supply works and to install new works

5. Expected Effects : Security of healthy and comfortable life among local people living at oases attributable to consistent supply of safe potable water
.

6. Project Cost : 1,200 million UM

7. Implementation Schedule : 5 years from 2006
8. Project Description:

Supply of safe potable water makes up one of the basic human needs. Although a total of 31 oases in both regions are equipped with water supply works that have been constructed in 1985 and 1986, these works face drawback in supply of proper service due to physical deterioration caused by an absence of proper operation and maintenance practice. In addition, some systems are not in a position to fulfill their services, being confronted with burgeoning beneficiaries, and thereby call for renovation and expansion of their works. Meanwhile, local people at the oases without water supply system are likely to jeopardize their health by consuming impure drinking water. The first phase of the present project targets the existing water supply system and implementation works consist of re-drilling of pumping wells, cleaning works of existing pumping wells by means of air-lift and other tools, repair and renovation of pumps, generators and solar panels, replacement of conveyance pipes and replacement of damaged and deteriorated parts of the water supply works and partial renovation of the system. In the second phase, the goal is to develop new water supply systems targeting nine oases with population more than 500: namely, Timinit, Tirebane, Taizent, Ziret Lekcheb and Tenllaba in Adrar region and Goum Lekhneg, Lekhdeime, Tichinane and Ouad Jmel in Tagant region (see **Fig. 8.2.4**). Prior to implementation of construction works, hydro-geological survey, geo-technical survey, and other pre-construction investigations and surveys need to be performed.

(5) Priority Project Profile 5

1. Project Title : Basic Infrastructure Development
2. Location : Oases located within departmental capital and oases with population more than 1,000
3. Implementation Agency : Oasis Project
4. Objective : To develop basic infrastructure relevant to consolidation of road and transportation network, mitigation of flooding damage and cultivation of water resources in and around the oases.
5. Expected Effects : Alleviation of damaged agro-products at the time of collection and forwarding, and savings in transportation time. Improvement of serviceability by securing periodic transportation means. Relief of farmlands and residential areas from vulnerability to flooding damage and cultivation of groundwater resources to be supplied to oases.
6. Project Cost : 2,640 million UM

7. Implementation Schedule : 5 years from 2005

8. Project Description:

The essential components of the present project are: consolidation of main roads network, provision of periodic transportation means, flood control and cultivation of groundwater resources. The project aims to raise serviceability depending on roads and transportation means, to mitigate flooding damages against farmlands and residential areas, and to accelerate cultivation of water resources.

As for consolidation of main road network, the plan is to develop connecting roads between the regional main trunk roads and the central part of community that has been already elaborated by MRDE for the greater portion of the oases of the departmental capital and the large-scale oases without such connection roads. Hence, the present project shall target connection roads selected from the said connections roads already elaborated (such as Atar – Aoujeft, Atar – Tawaz and Tidjikja – Rachid). In addition, the project aims to rehabilitate existing sections of the roads network which have been damaged seriously as a consequence of recent flooding. The development level under the present project shall be, in principle, limited to gravel pavement, but the damaged sections of existing roads shall follow the same pavement level that they actually have. It is anticipated that this project will contribute not only to alleviation of damage to agro-products during transportation and savings in transportation time but also to improvement of access to the surrounding small and medium oases located adjacent to the roads to be consolidated (refer to **Fig. 8.2.5**).

Periodic transportation will operate in the initial stage between the oases of the departmental capital and the regional capitals and shall expand their operation later on leading to the oases with more communities. The vehicles to be used for the operation shall be pick-up trucks and the frequency of operation shall be about three or four times a week. With provision of this transportation, access of local people from their oases to the regional capitals shall be distinctively improved.

The proposal on mitigation of flood damage shall consist of construction of dikes (earth embankment and gabion works) for preventing farmlands of dates and residential areas from inflow of flood water. The proposal on increasing water resources shall be implemented by constructing simple weirs (gabion works) on riverbeds in an attempt to encourage discharged flood water infiltrate into the ground for serving to the oases located around the weirs. At first, the development works under the present project target the oases around the departmental capitals and large oases, and the works shall be expanded to other oases in due order from the standpoint of the population.

8.3 Projects Implementation Organization

Priority projects proposed in the present Study shall be implemented under the jurisdiction of the Oasis Development Project Bureau. As for source of finance for cost of these

projects that are estimated at UM 4,180 million in total, it is proposed to earmark part of the budget of the Oasis Development Project, Phase III (to be scheduled to start in 2004) with a sum of UM 8,021 million to the said projects. In view of the fact that the components of the priority projects coincide with proposed projects for the Oasis Development Project, Phase III, it is evaluated that an implementation of priority projects is highly viable.

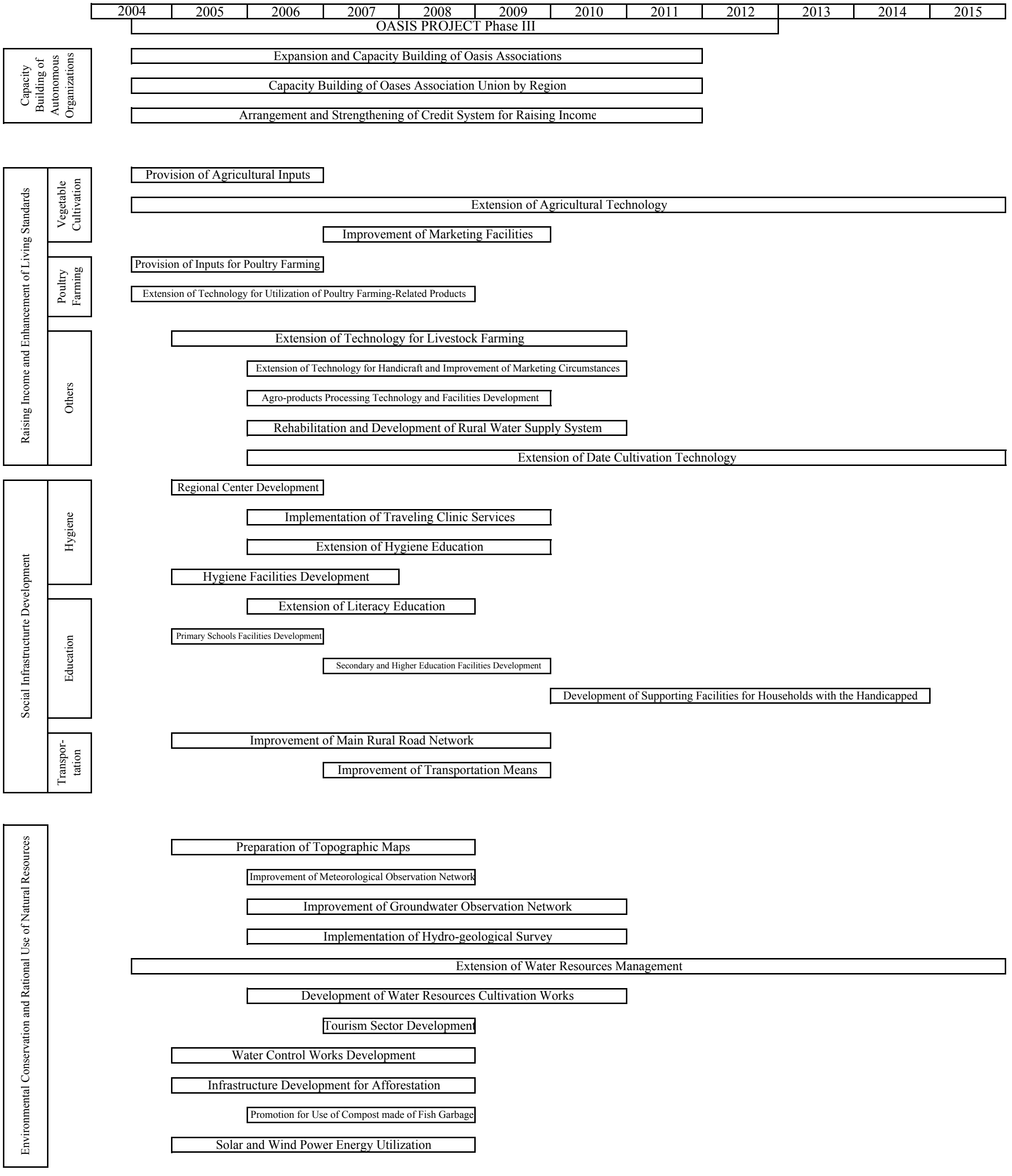
Investigation, design and construction works of water supply system, roads network, water resources recharging structures, etc. shall hardly face with constraint in terms of technical aspects, because accumulated accomplishments of similar works in the past together with human resources of experience engineers shall be of use for implementation of these tasks. By contrast, experienced engineers are deficient in the field of technical extension of such enterprises as vegetable cultivation and poultry raising, so implementation of relevant projects should be made in due consideration of the following points:

1) It is strongly recommended to make a request donor country(ies) a technical cooperation for the projects in question as early as possible due to the fact that implementation of projects relevant to extension and agricultural technologies is more effective if technical cooperation from donors should be rendered at its initial stage.
2) In so far as vegetable cultivation and poultry raising envisaged the priority projects are concerned, effective use of technical extension manuals to have been complied in the course of the Pilot Study shall be hastened by distributing them to the target oases of the priority projects.
3) Capacity building of engineers in charge of technical extension services shall be undertaken by giving technical training with use of the said technical extension manuals to the leaders of each oasis.
4) Farms that had borne apparent fruits as a result of the Pilot Study shall be used as demonstration farms to be open to public among farmers of as many oases as possible.
5) Personnel who had played a focal role in the course of technical training of the Pilot Study such as engineers trained and educated at each oasis, innovative farmers at each oasis in which the Pilot Study was carried out, officers of the Oasis Development Project, extension workers, assistant technical staff employed by the Study Team, etc. are well acquainted with the technical accomplishments of the Pilot Study. In this connection, extension services of the said technical contents are requested be rendered by making good use of these human resources. In addition, it is advisable to put these human resources as

eligible personnel in employment of offices for the Oasis Development Project, Phase III.

Operation and maintenance of the structures (regional center, water supply/water resources recharging works, roads network, etc) to be constructed under the priority projects as well as materials and equipment to be used in these projects shall be entrusted to each implementation agency (associations' union, associations of each oasis, regions, communes, etc.) for respective structures and materials/equipment.

Fig. 8.2.1 Implementation Schedule of the Proposed Projects and Programs



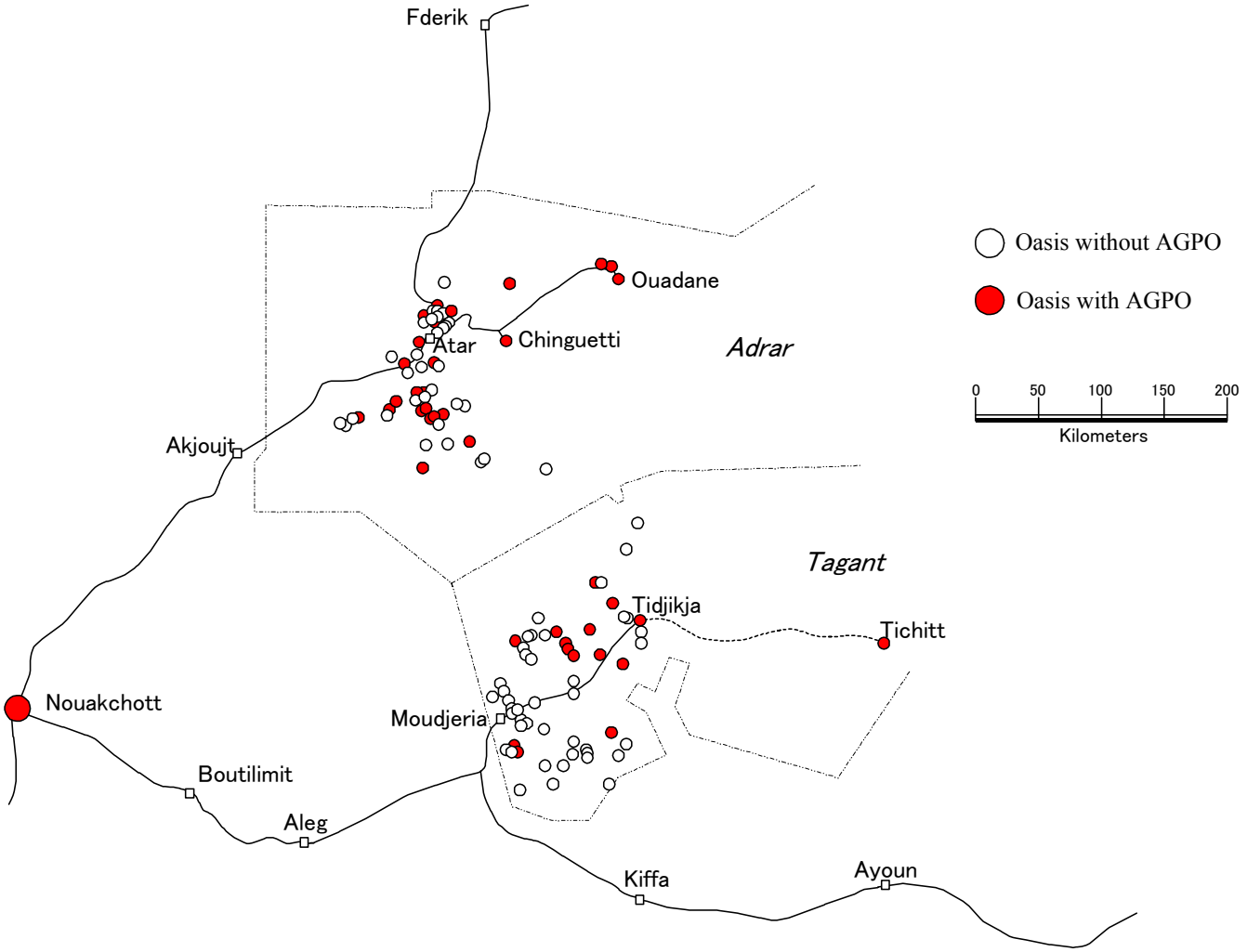
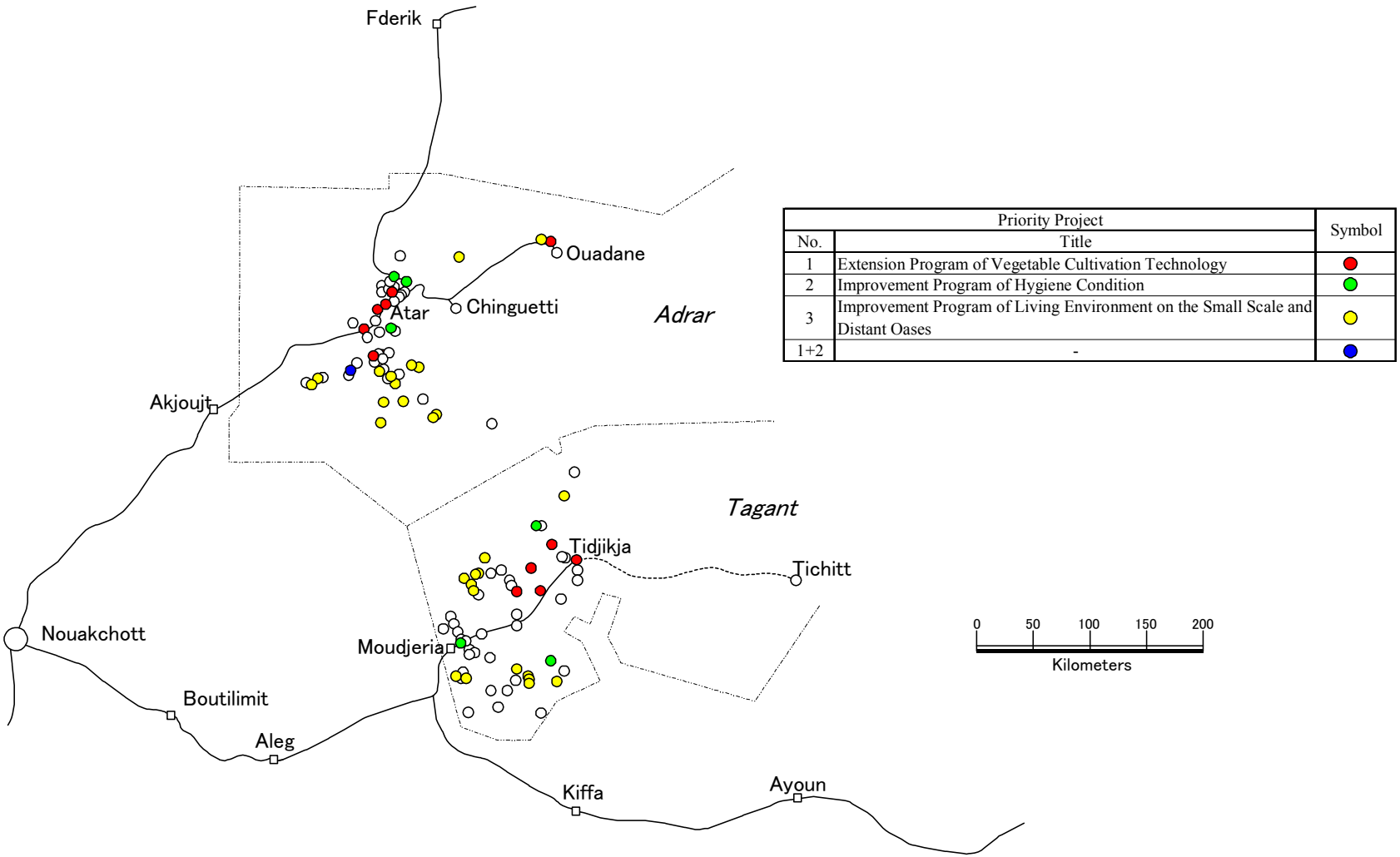


Fig. 8.2.2 Location of the Oasis with AGPO



Priority Project		Symbol
No.	Title	
1	Extension Program of Vegetable Cultivation Technology	
2	Improvement Program of Hygiene Condition	
3	Improvement Program of Living Environment on the Small Scale and Distant Oases	
1+2	-	

Fig. 8.2.3 Distribution of Priority Oasis by Priority Project

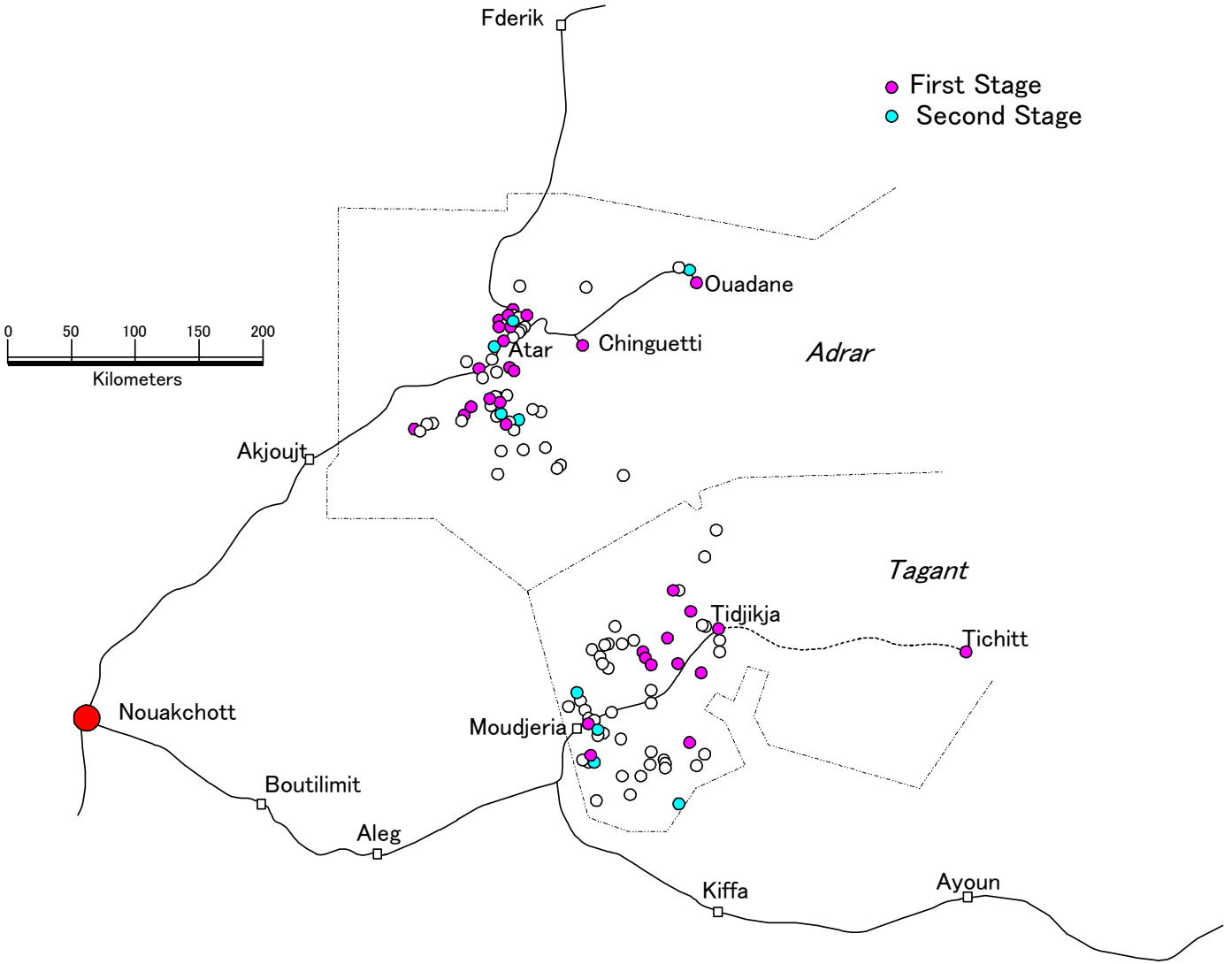
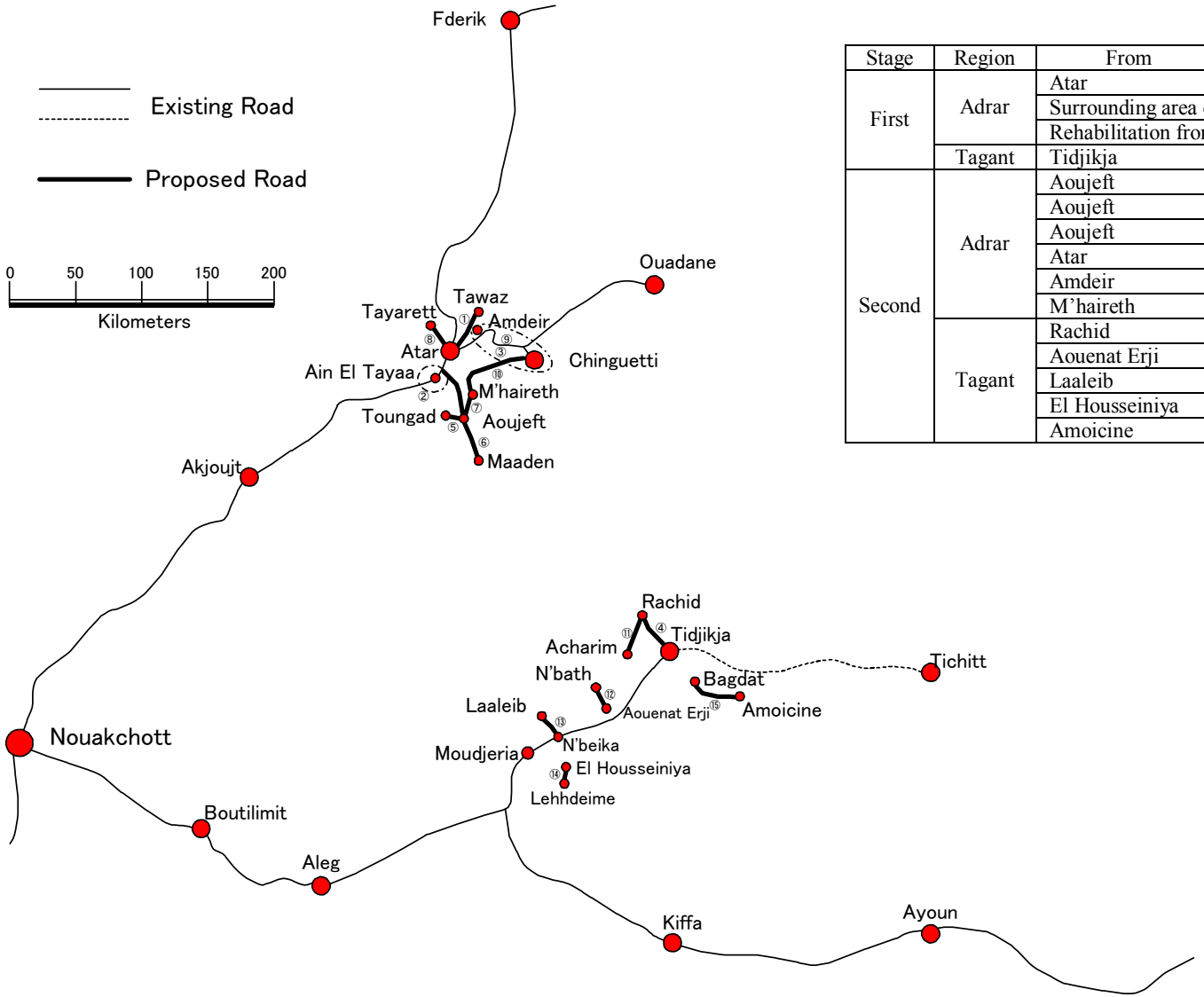


Fig. 8.2.4 Improvement Program of Regional Water Works Facilities



Stage	Region	From	To	Length (km)	Ref.
First	Adrar	Atar	Tawaz	24	①
		Surrounding area of Ain Ehl Tayaa		2	②
		Rehabilitation from Atar to Chinguetti		10	③
	Tagant	Tidjikja	Rachid	60	④
Second	Adrar	Aoujeft	Toungad	8	⑤
		Aoujeft	Maaden	23	⑥
		Aoujeft	M'haireth	15	⑦
		Atar	Tayarett	25	⑧
		Amdeir	Chinguetti	6	⑨
		M'haireth	Chinguetti	25	⑩
	Tagant	Rachid	Acharim	40	⑪
		Aouenat Erji	N'bath	5	⑫
		Laaleib	N'beika	8	⑬
		El Housseiniya	Lehhdeime	3	⑭
		Amoicine	Bagdat	17	⑮

Fig. 8.2.5 Major Regional Road Improvement Program

Table 8.2.1 Proposed Project and Program (1/3)

Projects/Programs		Objective	Scope	Detailed Implementation Proposal	Estimated Investment Cost (1,000 UM)
CAPACITY BUILDING OF AUTONOMOUS ORGANIZATIONS	Expansion and Capacity Building of Oasis Associations	To hasten programs aiming at enhancement of living circumstances in oases and to attain sustainable development of the region	To support for organization of associations at the oases in an absence of association and to reinforce administrative and managerial capacity building of existing associations	To organize a total of 82 associations in Adrar and in Tagant regions represented by 123 oases and to foster capacity building of existing associations in these two regions.	60,000
	Capacity Building of Oases Association Union by Region	To strengthen coordination function for linkage of associations of each oasis for attainment of balanced and sustainable development among oases.	To arrange action base of the associations union and to strengthen coordination function of the union for respective activity of each association. To strengthen training program of human resources in charge of administration and management of each association. To realize joint operation for sale of agro-products and for procurement of inputs.	To construct a headquarter for Adrar Region and another one for Tagant Region. To procure necessary equipment/vehicles and materials for offices and for research. To promote capacity building of responsible persons of association realize by sending them for domestic and overseas training course.	50,000
	Arrangement and Strengthening of Credit System for Raising Income	To strengthen supporting services to hasten implementation of projects/programs relevant to raising income and enhancement of a way of life.	To expand the covering area of credit services rendered at present by project office.	To expand credit services relevant to such unconventional areas for use of credit as procurement of agricultural inputs, poultry farming and production and processing of solar cooker, etc.	50,000
				Sub-total	**160,000**

Projects/Programs			Objective	Scope	Detailed Implementation Proposal	Estimated Investment Cost (1,000 UM)
RAISING INCOME AND ENHANCEMENT OF LIVING STANDARDS	VEGETABLE CULTIVATION	Provision of Agricultural Inputs	To support for dissemination of vegetables cultivation	Donation of basic agricultural inputs to farmers	To donate as a first phase to 11 oases in Adrar region and 7 oases in Tagant region, taking account of existence of association, accessibility, experience in vegetable cultivation and the number of inhabitants, etc. (Refer to Table 8.2.2) such agricultural inputs as seeds, shovels for horticulture, watering cans, wheelbarrows, equipments for drip irrigation; in the second phase to expand this donation to the oases located adjacent to the said target oases of the first phase.	20,000
		Extension of Agricultural Technology	To disseminate appropriate technology aiming at raising agricultural productivity.	In view of raising productivity of vegetables, to disseminate to each oasis such technologies as ridging, shading , technique of watering and drip irrigation and so on which have been proved to be relevant in the course of the pilot study.	In the first phase for 18 oases selected as explained in Table 8.2.2 and in the second phase for the oases located adjacent to the target oases of the first phase. To be selected 5 or so farms for each oasis in which technical extension services shall be provided under foreign-aided technical cooperation program; in the second and subsequent phases the said farms selected in the first phase shall be used as demonstration farms aiming at extending their technical accomplishments to other oases.	74,000
		Improvement of Marketing Facilities	To secure collecting channel and sales bases of agro-products aiming at supporting on dissemination of vegetables cultivation.	To construct collection network from major oases to the capital city of the region and to install necessary facilities and to consolidate logistic system required for construction of the network.	The target oases shall be the same oases as selected in the first and second phases of vegetable cultivation-related program. T construct warehouse equipped with refrigerator (if necessary), at core oases for collection of agro-products (mainly at target oases for the first phase). The agro-products piled at each oasis shall be collected periodically by trucks to transport them to regional capital for sale at markets. To support this marketing system two units of small trucks shall be provided at first for each region. Operation and administration of this marketing system shall be entrusted to the union of oasis associations	140,000
	POULTRY FARMING	Provision of Inputs for Poultry Farming	To attain raising of income and improvement of nutritious condition attributable to poultry farming.	To donate initial inputs necessary for embarking poultry farming to women's associations for rendering technical assistance to them	To provide women's association eager to poultry farming with initial inputs (fowls, henhouses, feed, chemicals, etc.) in association with technical assistance; in the first phase, for women's associations locating at remote and small-scaled oases selected in Table 8.4.2 and in the second phase, to expand this attempt gradually to women's associations of other oases.	2,500
		Extension of Technology for Utilization of Poultry Farming-Related Products	To disseminate technology for utilization of produces in an attempt of raising of income owing to rational use of resources.	To disseminate processing and cooking means of chicken and egg and technology for making use of fowl droppings	To extend cooking and processing technologies of chickens and eggs at the oases in which poultry farming is actually done thanks to provision of inputs for poultry farming mentioned above..	30,000
	OTHERS	Extension of Technology for Livestock Farming	To introduce hy-brid species in view of raising productivity.	To disseminate hy-brid species of goats and sheep to farmers by means of artificial insemination.	To provide materials and equipment necessary for procurement and preservation of hy-brid spermatozoa of goats and sheep; at th initial stage, to make a periodic tour of inspection during breeding term at the regional center to be established at large-scaled oases having associations, so that hy-brid species to be produced by means of artificial insemination of hy-brid spermatozoa may be extended.	35,000
		Extension of Technology for Handicraft and Improvement of Marketing Circumstances	To disseminate handicraft technology for supporting economic activities of women.	To promote education and training on handicraft and development of unconventional handicraft works; to establish exhibition and sales center to help manufacturing and marketing activities.	In first phase, to disseminate handicraft technologies to the female associations of the oases with organized associations as selected i Table 8.2.2 and to realize production of handicrafts. As production of handicraft expands, in view of expanding sales destination, to establish exhibition and sales center in regional capital and at tourist attractions so as to construct collecting system of products. In the second phase, to render technical assistance to the female associations of the oases located adjacent to the target oases of the first phase. It is proposed that associations union should undertake technical assistance, and management for exhibition and sale of handicraft products.	50,000
		Agro-products Processing Technology and Facilities Development	To raise profitability, preservation ability and value-added of agro-products owing to extension of related processing technologies.	To promote extension of processing technologies of agro-products and to supply necessary materials and equipment.	To disseminate processing technologies and to supply related materials and equipment for production of desiccated vegetables, date jam, breads, confectionary, etc; in the first phase, technical assistance shall be rendered to the female associations of the oases selected in Table 8.2.2 and this technical assistance shall be expanded to adjacent oases.	470,000
		Rehabilitation and Development of Rural Water Supply System	To rehabilitate and to develop water supply system for improvement of living circumstances.	For securing and supply of safe potable water to local people, to rehabilitate existing water supply facilities and to construct new water supply facilities.	In the first phase, priority is given to rehabilitation of water supply system to have been constructed at 31 oases in 1985 - 86 in Adra and Tagant regions and are suffering from physical deterioration; in concrete manner, to carry out re-drilling/cleaning of existing pumping wells, to repair/renovate pumps, to repair and renovate generator and solar panel, to replace conveyance/distribution pipes, to renovate storage tank, to install/expand hydrant, etc.; in the second phase, to develop construction of water supply system at 9 oases (Timinit, Tirebane, Taizent, Ziret Lekcheb and Tenllaba in Adrar region, Toum Lekhneg, Lekhdeime, Tichinane and Ouad Jmel in Tagant region), with population more than 500 and under-development of this system; dimention of drilling wells, water conveyance, storage and distribution shall be designed making reference to existing system of other oases. To be conducted hydro-geological investigation and geo-technical survey in advance	1,200,000
		Extension of Date Cultivation Technology	To disseminate appropriate technology for date cultivation leading to raising productivity.	To introduce hy-brid varieties, to produce and supply their seedlings, and to raise productivity attributable to extension of appropriate technologies.	To establish seedlings production center in Atar and in Tidjikja for production and supply of hy-brid seedlings by importing stunted varieties, disease-resistant varieties, diversified harvesting varieties, anti-salinity varieties, etc.	70,000
					Sub-total	**2,091,500**

Table 8.2.1 Proposed Project and Program (2/3)

Projects/Programs			Objective	Scope	Detailed Implementation Proposal	Estimated Investment Cost (1,000 UM)
SOCIAL INFRASTRUCTURE DEVELOPMENT	HYGIENE	Regional Center Development	To develop core facilities serving for welfare of local people living at oases.	To construct regional center at major oases to be served as a place for meeting & training, traveling clinic, lodging, etc. of inhabitants at oases.	In the first phase to be constructed regional center at the oases with population more than 1,000 and without physician (5 oases in Adrar region and 3 oases in Tagant region); this regional center is to be used for meeting, training and traveling clinic of the oasis inhabitants and for lodging of inhabitants of adjacent oases for receiving examination of traveling clinic and for participation of meeting. In the second and subsequent phases this development shall be extended to other oases taking geographical conditions into account.	100,000
		Implementation of Traveling Clinic Services	To facilitate access to medical services so as to undertake routine health-care of population in remote rural areas.	To make periodic traveling to the regional centers by medical staff to render medical services to local people	For providing medical services at the regional center and at the adjacent oases, to be traveled by a group of one physician and two nurses to regional centers using one four-wheeled vehicle to be provided for each region with a frequency of twice per month and so the number of vehicles and medical staff as well as the frequency for traveling shall be increased gradually.	60,000
		Extension of Hygiene Education	To reduce an outbreak of diseases by means of disseminating basic hygiene knowledge on prevention of diseases to local people.	To make periodic traveling to the regional centers by medical staff who shall undertake hygiene education to local people of surrounding area..	To be traveled by a group of two specialists to regional centers one by one for rendering medical services together with hygiene education.	20,000
		Hygiene Facilities Development	To improve hygiene conditions of local people and to prevent an outbreak of diseases.	To construct public toilets around principal structures of each oasis and to support introduction of toilets for individual households.	To construct three or so public toilets for each oasis; in addition, to support for introduction of toilet at individual household. Priority is given to the oases with organized associations.	10,000
	EDUCATION	Extension of Literacy Education	To conduct literacy education for illiterates.	To conduct literacy education at primary school of each oasis.	To strengthen prevailing literacy education.	10,000
		Primary Schools Facilities Development	For upgrading the quality of primary education, to improve facilities of primary schools.	To upgrade education circumstances by means of rehabilitation of obsolete structures/equipment.	To investigate actual structures of facilities and equipments and to rehabilitate obsolete facilities and to renovate or procure deteriorated equipments.	160,000
		Secondary and Higher Education Facilities Development	For raising enrolment rate of secondary and higher education, to improve facilities of secondary and higher education..	With construction of new secondary and higher education schools, to raise enrolment rate for secondary and higher education.	To increase the number of secondary and higher education schools twice as many as actual one; thus, to construct 5 high schools and 9 secondary schools n Adrar and one high school and 8 secondary schools in Tagant.	690,000
		Development of Supporting Facilities for Households with the Handicapped	To establish public services provision system for the households with the handicapped.	To undertake counseling in terms of economic situation and health-care for the households with the handicapped and to construct facility for short-term stay of the handicapped and their family members.	To recruit personnel and to prepare facility and equipment required for physical and mental examination, rehabilitation and obstetrics and gynecology for physically handicapped persons; the facility shall be also equipped with lodging facility for about ten families of the physically handicapped at the same time, at least one for each region.	50,000
	TRANSPORTATION	Improvement of Main Rural Road Network	To facilitate access to main oases.	To consolidate the road network to connect trunk roads with main oases at the grade of gravel pavement.	In the first phase, to rehabilitate the road near Ain Ehl Tayaa and the road between Atar and Chingetti, both of which had been damaged as a consequence of the heavy rainfall in 2003; at the same time, priority is given to the roads development to have been already projected like: Atar-Aoujeft(40Km)、Atar-Tawaz(24Km)、Tidjikja-Rachid(60Km), among others. In the second phase, road development shall be put into implementation in connection with the sections: Toungad-Aoujeft (8 km), Aoujeft-Maaden (23 km), Aoujeft-M'haireth (15 km), Atar-Tayarett (25 km), Amdeir-Chinguetti (6 km) and M'haireth-Chinguetti (25 km) in Adrar region and Rachid-Acharim (40 km), Aouenat Erji-N'bath (5 km), Laaleib-N'beika (8 km), El Housseiniya-Lehhdeime (3 km) and Amoicine-Bagdat (17km) in Tagant region. .	5,980,000
		Improvement of Transportation Means	To secure transportation means.	To operate periodically buses between main oases to facilitate access to public installations.	In the first phase, to operate for the routes connecting the oases at departmental capital and regional capitals and in the second phase for the routes between the oases with population of around 1,000. The frequency of operation shall be three or four times a week and to be increased subsequently.	60,000
					Sub-total	**7,140,000**

Table 8.2.1 Proposed Project and Program (3/3)

	Projects/Programs	Objective	Scope	Detailed Implementation Proposal	Estimated Investment Cost (1,000 UM)
ENVIRONMENTAL CONSERVATION AND RATIONAL USE OF NATURAL RESOURCES	Extension of Water Resources Management	To mitigate downward trend of groundwater level for attainment of sustainable use of groundwater, by means of administration task of beneficiaries on their own initiative.	To enlighten local people the significance and expected benefits of adequate water management by making reference to examples of the pilot study and to support local people in this task from viewpoints of technology, method, measures, etc.	Water-saving cropping technology and monitoring on fluctuation of groundwater level at wells to have been put into implementation in the course of the Pilot Study shall be disseminated to each oases; in particular, in so far as monitoring task which is highly beneficial for administration of groundwater is concerned, relevant wells shall be constructed at three sites for each oasis and operation and maintenance of these wells shall be entrusted to an organization to be formed on initiative of beneficiaries and to be in charge of periodic observation, collection and compilation of observation data, projection of groundwater level in the future to be made processing collected data and taking necessary measures agaisnt fluctuation of groundwater level. The eligible oases for the first phase of this monitoring shall be small-scale ones which depend on manual intake of groundwater, taking account of earlier realization as well as immediate effect. As target oases for this first phase of enterprise, it may be enumerated: Tirebane and Taizent in Adrar region and Lehoueitatt and Ederroum in Tagant region. And, those for the second phase shall be about ten oases, to be finalized subject to reviewing on magnitude, methodology and supporting organization, etc. with reference made to the outcomes of the first phase.	10,000
	Preparation of Topographic Maps	To prepare basic topographic maps.	To prepare basic topographic maps which are indispensable for investigation, analysis and evaluation of development plan	To prepare 8 sheets of the topographic map with a scale of 1/200,000 limiting the target area to the oasis areas in and around Tidjikja in Tagant region; topographic maps with a scale of 1/100,000 shall be also prepared for the area covering residential zone in Adrar and Tagant regions.	400,000
	Improvement of Meteorological Observation Network	To consolidate meteorological observation network.	To review the scope of the services of existing meteorological stations and to propose renovation and replacement of facilities and equipment of these stations as well as installation of new stations.	To review observation items of existing meteorological stations（Atar and Tidjikja) and to renovate facilities and equipment for observation. To upgrade existing rainfall stations located at Chinguetti, Oujeft and Quadane in Adrar region and at Achram, Moudjeria, N'beika and Tichit in Tagant region to meteorological stations adding new observation items besides precipitation.	90,000
	Improvement of Groundwater Observation Network	To conduct qualitative and quantitative observation on groundwater.	For conducting qualitative and quantitative observation on groundwater, to carry out drilling of observation wells and installation of groundwater observation stations.	To be installed in the first phase water level gauging station for continuous gausing of wate level within shallow and deep aquifers on banks of major wadis covering both Adrar and Tagant regions; drilling depth through piped wells shall be 10 m at shalloe aquifer and 30 m at deep aquifer. The target hydrological systems in this program shall be El Abiod Wadi (Toungad), Segelil Wadi (Atar) and Ouadane Wadi (Ouadane) in Adar region and Tidjikja Wadi (Rachid) and N'beika Wadi (N'beika) in Tagant region and two types of groundwater shall be observed at 5 observation stations equipped with automatic water level gauge (with divisions of 1cm) to be installed with the oases mentioned in parenthesis of the said basis that are more accessible, together with quantitative gausing of electric conductivity (EC) and pH with a frequency of about once a month. In the second phase, additional 10 or so water level gauging stations having almost the same dimension of those constructed in the first phase shall be constructed dividing upper reach of the hydrological system by groundwater catchment basin, fluid basis and cultivation basin. Operation and maintenance of observation equipment, collection, compilation analysis of data shall be entrusted to the National Water Resources Center and technology transfer of relevant task to the engineers is envisaged in this program for capacity building of these engineers.	130,000
	Implementation of Hydro-geological Survey	To collect and compile basic data indispensable for exploitation of groundwater resources.	To prepare an integrated hydro-geological layout maps and an integrated hydrological cross-sectional maps.	To conduct in the first phase hydro-geological survey on the basis located within regioal capital (Segelil Wadi in Atar and Tidjikja Wadi in Tidjkja); to carry out collection, compilation and analysis of data by consulting on registration note of existing wells, water level, water quality gei-technical data, geophysical prospecting, etc. and to conduct field works consist of topographic and hydro-geological survey, survey on groundwater level and productivity of wells with a purpose of elaborating hydro-geological mas as output of this field work; this map elaborated on the basis of the topographic map with a scale of 1/200,000 is already for Atar area, so the eleboration of the hydro-geological map within this program shall be limited to Tidjikja Wadi basin in Tagant region. To carry out the same surveys in the second phase regarding remaining wadi basins: El Abiod, Ouadane and N'beika for elaboration of hydro-geological maps. These information is expected to serve in giving priority among potential groundwater development basins.	50,000
	Development of Water Resources Cultivation Works	To develop necessary works for cultivation of groundwater.	To rehabilitate, enlarge and construct water stop weir and water resources cultivation dam.	Large-scaled dams and weirs located in Adrar region and Tagant region are 16 and 66, respectively, but most of these structure do not function adequately due to a variety of damages. In the first phase, to implement rehabilitation works (embankment works, conveyance canal, bank protection works, etc.) regarding high priority structures (about 30 in total) which call for immediate rehabilitation to have been identified as a result of diagnosis survey on actual situation. the same rehabilitation works shall be carried out in the second phase, regarding eligible structures (about 40 in total) from geographical and social conditions of their location.	200,000
	Tourism Sector Development	To preserve tourism resources of the areas endowed with attractive resources as focal spot for desert tourism.	To establish tourism resources monitoring system by means of zoning of tourism resources, assignment of monitoring staff, etc.	To determine eligible preservation area, to conduct training of monitoring staff, to assign two staff to be stationed for each region, and to supply one vehicle. For financing necessary fund to be earmarked to this activity, introduction of environmental tax shall be discussed.	50,000
	Water Control Works Development	To protect farmlands and residential areas which are vulnerable to damages stemmed from heavy rainfall and flooding.	To mitigate damages on farmlands and residential areas attributable to flooding and other natural disasters by means of reinforcement and construction of dikes and dams.	In the first phase, to give priority to rehabilitation of river structures located in Ain Ehl Tayaa and N'beila to have been damaged due to flooded water from wadis caused by heavy rainfall in August 2003; to carry out short-cut excavation, embankment, bank protection works, water control works, etc. on the river bank section featured by low and soft embankment located adjacent to residential areas and to important public facilities. In the second phase, to implement bank protection works, water control works, riverbed compaction works, etc. targeting wadi sections adjacent to farmlands in Tenllaba, Atar, Toungad, Rachid, Lehoueitatt, Tidjikja, etc. because of having been damaged date farms and communities under influence of these oases.	700,000
	Infrastructure Development for Afforestation	To develop infrastructure for afforestation useful for mitigating damages due to sandy storm.	To provide technical assistance on afforestation, to supply seedlings and to establish Afforestation Extension Center which shall play the role of a core place for protection on major public facilities and training of extension workers in charge of afforestation.	To establish small-scaled afforestation extension center for promotion of afforestation projects, one in Adrar region and the other one in Tagant region. The center shall embark production of seedlings to be supplied to associations and individuals and shall engage in training of specialists in afforestation. This seedlings production center shall be upgraded to afforestation extension center in the foreseeable future. Each center to be assigned a couple of specialists in afforestation shall be responsible for planning of long-term disaster prevention program, provision of technical assistance on afforestation to oasis associations and utilization of felled wood as well as for implementation of afforestation projects for protection of roads and other major public structures.	20,000
	Promotion for Use of Compost made of Fish Garbage	To make a use of fish garbage as compost aiming at raising productivity of vegetables cultivation and, as a result, increasing income of farmers.	To collect fish garbage at fishery market in Nouakchott and to design the system to desiccate and distribute them to oasis associations and individuals for their use in vegetables cultivation as compost.	To collect dried fish meal garbage at the volume of 1,000 tons a year and to design the system to desiccate them in the sun and to distribute them to oasis associations and individuals; in the first phase, to the oases with organized associations and in the second phase, to other oases without associations.	15,000
	Solar and Wind Power Energy Utilization	To make a rational utilization of natural resources contributing to enhancement of living circumstances of local population at oases.	To disseminate the use of equipment depending on solar or wind power energy such as lighting equipment, cooking equipment and pump	To expand the objective of use under prevailing credit system provided by project office to procurement of equipment with energy depending on natural resources.	20,000
				Sub-total	**1,685,000**
				Total	**11,076,500**

Table 8.2.2 Classification of Oasis for Selection of the Priority Oasis (1/2) (Adrar)

N°	Oasis	Accessibility a)	Experience b)	Population c)	Limiting factor	Profile 1		Profile 3		Profile 4
						Point (a+b+c)	Priority oasis	Point (a+c)	Priority oasis	Priority oasis
	AOUJEFT									
AD 01	Aghad	3	1	0				3	○	
AD 07	Aoujeft	3	3	5				8		◎
AD 10	Azweiga et El Hessiane	1	1	2		4		3	○	
AD 14	El Awja	1	1	1				2	◎	
AD 15	El Maaden	2	1	3		6		5	△	◎
AD 16	El Maleh	1	1	1				2	◎	
AD 17	Faress	2	1	3				5	△	◎
AD 18	Gasar Nema	1	1	2				3	○	
AD 19	Gleitat	2	1	2		5		4	△	◎
AD 20	Graret Lefrass	1	3	3				4	△	◎
AD 23	Jeweilet	1	4	0				1	◎	
AD 27	Loudey	3	1	2		6		5	△	
AD 28	Meddah	1	1	4		6		5	△	◎
AD 30	M'haireth	2	4	4		10	◎	6	△	◎
AD 31	N'beika	1	1	0				1	◎	
AD 32	Noueib Itmarne	1	1	1				2	◎	
AD 33	N'teirguent	1	1	1		3		2	◎	
AD 37	Tadriessa	1	1	0				1	◎	
AD 45	Terjite	3	1	2				5	△	
AD 49	Tignal	2	1	0				2	◎	
AD 51	Timinit	1	5	3	accessibility	9		4	△	○
AD 52	Tirebane	2	1	3				5	△	○
AD 54	Toungad	4	5	3		12	◎	7		◎
AD 55	Tweyrga	2	1	1				3	○	
AD 56	Wekchedatt	1	2	1				2	◎	
	ATAR									
AD 02	Ain Ehl Tayaa	5	1	3		9	○	8		◎
AD 04	Amariya	5	1	0				5	△	
AD 05	Amder lekbir	5	3	2				7		
AD 06	Amder Sghir	5	3	2				7		
AD 08	Atar	5	5	5		15	◎	10		◎
AD 09	Azougui	5	1	3				8		◎
AD 12	Char	1	1	1				2	◎	
AD 21	Hamdoune	5	1	1				6		
AD 22	Jalla	4	2	2				6		
AD 24	J'reif	1	1	0		2		1	◎	
AD 25	Kseir Torchane	4	4	4		12	◎	8		◎
AD 29	Meyleh	4	1	0				4	△	
AD 34	Ote	5	2	0				5	△	
AD 36	R'keine	5	1	1				6	△	
AD 38	Taizent	5	1	3		9	○	8		○
AD 39	Taryouvet	5	4	2				7		
AD 40	Tawaz	5	5	5		15	◎	10		◎
AD 41	Tengharada	4	2	2				6	△	
AD 46	Terwen	5	2	3		10	◎	8		◎
AD 47	Teyaret	5	3	3	mine	11		8		◎
AD 48	Tezegrez	5	4	2				7		
AD 53	Toueizekt	5	4	3				8		◎
AD 57	Ziret Lekhcheb	5	5	3				8		○
	CHINGUETTI									
AD 03	Ain Savra	1	2	2				3	○	
AD 11	Berbara	1	1	1				2	◎	
AD 13	Chinguetti	4	3	5		12	◎	9		◎
AD 26	Lebheir	1	1	1				2	◎	
AD 44	Tenwemend	1	1	2		4		3	○	
AD 50	Timagazine	1	1	1				2	◎	
	OUADANE									
AD 35	Ouadane	2	5	3		10	◎	5		◎
AD 42	Tenllaba	2	5	3		10	◎	5		○
AD 43	Tenouchert	1	1	0		2		1	◎	

Source : The Study Team

Population: 0= 100>, 1=100-250, 2=250-500, 3=500-1000, 4=1000-1500, 5=1500<

Priority: ◎ > ○ > △

Accessibility:The time needed from Atar: 5=1hr>, 4=1-1.5hr, 3=1.5-2.0hr, 2=2-3hr, 1=3hr<

Experience: 5=Pilot project oasis, 5=4ha<, 4=4-3ha, 3=3-2ha, 2=2-1ha, 1=1ha>

*: ◎:Oasis equipped with water supply facility, ○:Oasis with population more than 500

Table 8.2.2 Classification of Oasis for Selection of the Priority Oais (2/2) (Tagant)

N°	Oasis	Accessibility a)	Experience b)	Population c)	Limiting factor	Profile 1		Profile 3		Profile 4*
						Point (a+b+c)	Priority oasis	Point (a+c)	Priority oasis	Priority oasis
	MOUDJERIA									
TG 02	Achram et Tenyesser	1	5	2				3	○	
TG 03	Aghaoujeft	3	1	2				5	△	
TG 05	Aghouditt Azguelem	1	1	0				1	◎	
TG 06	Ajoueir	1	1	1				2	◎	
TG 07	Amejerji	4	1	2				6	△	
TG 10	Aouenatt Tijit	2	1	1				3	○	
TG 15	Dakhlet El Vejha	3	1	1				4	△	
TG 16	Dekhde	3	1	1				4	△	
TG 21	El Housseiniya	2	1	3		6		5	△	◎
TG 23	El Vije	1	1	2				3	○	
TG 26	Foum Lekhneg	3	1	3				6	△	○
TG 28	Hssey Maghtaa et Yagref	1	1	0				1	◎	
TG 29	Ibimbi Lahmar	2	1	2				4	△	
TG 33	Kasr El Barka	1	1	0		2		1	◎	
TG 34	Knegh Ehel Elewa	3	1	1				4	△	
TG 35	N'titam/Laaleib	3	1	2		6		5	△	
TG 36	Leereiguibe	4	1	1				5	△	
TG 38	Lekhdeime	1	1	3		5		4	△	○
TG 39	Lemreivigue	3	1	0				3	○	
TG 40	Leweina	4	1	1				5	△	
TG 41	Mzeilgue	1	1	0				1	◎	
TG 43	N'beika	4	5	5				9		◎
TG 47	Oumlehnouk	4	1	2				6	△	
TG 52	Tichinane	2	1	3				5	△	○
TG 55	Tieboutt	3	1	2				5	△	
TG 56	Vourage	1	4	2				3	○	
TG 57	Vowghatt	1	1	0				1	◎	
TG 58	Yaghref	1	1	0				1	◎	
	TICHITT									
TG 53	Tichitt	1	1	4		6		5	△	◎
	TIDJIKJA									
TG 01	Acharim	4	1	3		8	◎	7		◎
TG 04	Aghlembit	3	1	2		6		5	△	◎
TG 08	Amizeweft	1	1	2				3	○	
TG 09	Aouenat Erji	4	1	2		7	○	6	△	◎
TG 11	Baghdad	5	1	1				6	△	
TG 12	Ben Yahmike	1	3	1				2	◎	
TG 13	Boussreiouil	1	1	1				2	◎	
TG 14	Choueikh	1	1	1				2	◎	
TG 17	Eddendane	2	1	1				3	○	
TG 18	Ederroum	3	1	2		6		5	△	◎
TG 19	El beijouj	4	1	1				5	△	
TG 20	El Gheddiya	1	5	4		10	◎	5	△	◎
TG 22	El Meinan	2	1	1				3	○	
TG 24	Ennejame	5	1	1				6	△	
TG 25	Etteyert	1	5	1				2	◎	
TG 27	Guendel	1	1	2				3	○	
TG 30	Iriji	3	1	1				4	△	
TG 31	Ivirchaye	2	1	1				3	○	
TG 32	Joueilet Ehl Habott	5	1	1				6	△	
TG 37	Lehoueitatt	5	5	3		13	◎	8		◎
TG 42	N'bath	3	1	2		6		5	△	◎
TG 44	Nimlane	5	5	3		13	◎	8		◎
TG 45	Nouachid	1	1	1				2	◎	
TG 46	Ouad Jmel	1	4	3				4	△	○
TG 48	Rachid	3	3	5		11	◎	8		◎
TG 49	Talmest	1	1	1				2	◎	
TG 50	Teidoumatt Edeuz	1	1	0				1	◎	
TG 51	Tenyesser	1	1	2				3	○	
TG 54	Tidjikja	5	5	5		15	◎	10		◎
TG 59	Zouere	2	1	1		4		3	○	
TG 60	Zrayeb Lahouache	5	1	1				6	△	

Population: 0= 100>, 1=100-250, 2=250-500, 3=500-1000, 4=1000-1500, 5=1500< Priority: ◎ > ○ > △

Accessibility:The time needed from Tidjikja: 5=1hr>, 4=1-1.5hr, 3=1.5-2.0hr, 2=2-3hr, 1=3hr<

Experience: 5=Pilot project oasis, 5=4ha<, 4=4-3ha, 3=3-2ha, 2=2-1ha, 1=1ha>

*: ◎:Oasis equipped with water supply facility, ○:Oasis with population more than 500

CHAPTER 9

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

(1) Oases region play an important role in terms of cultural and traditional aspect of Mauritanian society. Nevertheless, meteorological change in recent years represented by deceasing trend rainfall has brought about salient decline in agriculture and livestock output, a mainstay of economic activity of the country, which, in turn, resulted in an increase of marginal households, deterioration in living circumstances, exploitative use of water resources, etc. Hence, the regional development plan forged under the present Study consists of components of development projects that aim at satisfying the needs of local people at oases, on the basis of the basic development concepts of poverty alleviation, development of social infrastructure, and sustainable use of resources closely related with the national policies.

(2) To examine the viability to implement and to attain targets of the development projects envisaged in the present Study, pilot studies relevant to raising farm productivity, improving public health and hygiene conditions, and rational use of water resources were implemented at 6 oases in Adrar and Tagant regions. In these pilot studies, oasis associations act as the recipient agency, and methodologies and technologies matching natural and socio-economic circumstances of the oases region were applied to enable local people to become familiarized with them without difficulty. As a result of these applied methodologies and technologies, rise in productivity of vegetables and poultry farming as well as effective use of water resources have come true.

(3) To pursue of the outputs of pilot studies, practical measures for regional development indicate social infrastructure development, conservation of eco-system and rational use of natural resources that can produce rise in income, improvement of living standards, public health and hygiene, education and transport have been proposed, with focus laid on capacity building of spontaneous organization, vegetable cultivation, poultry farming and extension of technologies. Among them, the following projects have been selected as eligible priority programs to be urgently implemented.

1) Extension of vegetable cultivation technology
2) Improvement of public health and conditions

3) Enhancement of living circumstances at small and remote oases
4) Rehabilitation and development of rural water supply system
5) Basic infrastructure development

(4) An exodus from the oases of many men in the Study area has resulted in elevating the proportion of women within the total population as well as in increasing the number of the household represented by female head. These households represented by female head are likely to suffer from destitution, which makes up a major social concern in the oasis region. Easing destitution of the households represented by female head is thereby a prerequisite so as to attain the goal of the present regional development plan - reduction of poverty by half. The outcome of the pilot projects targeting exclusively female strata such as vegetable cultivation and poultry farming suggests a high viability for attainment of the said goal. In this regard, raising social status of women by means of rendering support to activities of women like production activities is a pressing issue in hastening development of the oasis region within the framework of the regional development plan.

9.2 Recommendations

(1) The Oasis Project Phase (III) is scheduled to be implemented from 2004 with finance provided by IFAD, FADES and the Mauritanian Government. There are several projects/programs that duplicate each other between the Oasis Project Phase (III) and the present regional development plan. To produce the expected benefits of these projects/programs as much as possible, it is recommended to review the contents of the projects/programs proposed in the Oasis Project Phase (III), making reference to the present development plan.

(2) Priority projects proposed under the present development plan are expected contribute to poverty reduction, improvement of living circumstances and enhancement of the nutritional condition of local people. This is recommended to implement these projects as early as possible, for sustainability of the oasis society. On the other hand, it is an urgent prerequisite to prepare the request for technical cooperation to relevant foreign government(s) or international agency(ies) in connection with the project on vegetables cultivation and other projects that call for technical cooperation under ODA program.

(3) The monitoring data on fluctuation of groundwater collected in the course of the

pilot studies is highly useful for administration of water resources and for estimation of available water for development of projects. Thus, it is recommended to extend the covering area for monitoring of groundwater so that more effective administration of water resources can be realized.

(4) The Geographical Information System (GIS) constructed during this Study is an important data bank that can be used for planning a number of development projects in the oasis region in the future. It is recommended to update the GIS data periodically as a valid and current source of data and information on oases.

APPENDIX

Appendix

LIST OF PARTICIPANTS

COUNTERPART MEMBERS

Name	Assignment
Mr. Mohamedou Ould Mohamed Mahmoud	Chief Coordinator of Oasis Development（Projet Oasis）
Mr. Bassirou Diagana	Water Resources（CNRE）
Ms. Fatimatou Mint Lekhlifa	Gender（SECF）
Mr. Cheikh Ould Moustapha Chabarnoux	Oasis Development（Adrar）（Projet Oasis）
Mr. Brahim Ould Bah	Oasis Development（Tagant）（Projet Oasis）
Mr. Mahfoud Mohamed Amou	Development Extension（Adrar）（Projet Oasis）
Mr. Bah Mohamed	Development Extension（Tagant）（MDRE）
Mr. Cheikh Ahmed Ould Sidi Abdellah	Livestock and Agriculture（MDRE）
Mr. Mohamed Ould El Ghaouth	Livestock and Agriculture（MDRE）
Mr. Mohamed Abdallahi Ould Mohamed Moloud	Livestock and Agriculture（MDRE）
Mr. Limam Ahmed Ould Mohamedou	Economic Cooperation（MAED）
Mr. Mohamed Lemine Ould Ahmed	International Cooperation（MAED）
Ms. Anne Mamadou	Technical Cooperation and Planning（MDRE）
Mr. Mohamed Moustapha Idoumoun Ould Abdi	Policies, Monitoring and Evaluation（MDRE）
Mr. Tall Abdoulaye	Monitoring and Evaluation（MDRE）
Mr. Diop Baba	Protection of Crop plants（MDRE）
Mr. Cheikh El Benani	Protection of Date Palms（Projet Oasis）
Mr. Mohamedou Zehraoui	Protection of Date Palms（Projet Oasis）

JICA STEERING COMMITTEE

Name	Position
Dr. Satoru TAKAHASHI （Committee Chief／Agriculture in Arid Zone）	PROFESSOR Faculty of Regional Environment Science, Tokyo University of Agriculture
Mr. Hisao USHIKI （Groundwater）	SENIOR ADVISOR Institute For International Cooperation, Japan International Cooperation Agency
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Dr. Ryo OGAWA （Rural Society）	PROFESSOR Graduate School of Area and Culture Studies, Tokyo University of Foreign Studies

Dr. Ken YOSHIKAWA （Green Area Design）	PROFESSOR Faculty of Agriculture, Okayama University
Mr. Ryuzo NISHIMAKI （Oasis Development）	GENERAL ADVISOR Rural Development Department, Japan International Cooperation Agency

JICA STUDY TEAM MEMBERS

Name	Assignment
Dr. Michiaki HOSONO	Team Leader／Oasis Development
Dr. Katsuhito YOSHIDA	Hydrogeology／Artificial Groundwater Recharge A
Mr. Toshinori KAWAMURA	Water Utilization Analysis and Management Plan
Mr. Hisamitsu TAKAHASHI	Vegetable Cultivation
Mr. Yoshihisa ZAITSU	Sand Stabilization／Afforestation／ Resources Management／Extension
Mr. Yoshiteru SUNAGO	Regional Economy
Mr. Iwami ORITA	Livestock Farming／Pastureland Management
Mr. Jiro SUGINO	Oasis Agriculture／Agriculture in Sandy Area A
Mr. Tomoo FUKAZAWA	Oasis Agriculture／Agriculture in Sandy Area B
Ms. Akemi ISHIKAWA	Participatory Development（Moderator）／Oasis Society A
Mr. Christian POTIN	Oasis Society／Gender A
Ms. Kimiko KAMATA	Oasis Society／Gender B
Ms. Emi SHIMIZU	Cultivation Instruction／Oasis Society B
Mr. Denis CARRA	GIS
Mr. Naoki YASUDA	Hydrogeology／Artificial Groundwater Recharge B
Mr. Taku GOKAN	Participatory Development
Mr. Kiharu SERIZAWA	Interpreter

Scope of Work
for
the Study on
The Development of the Oasis zone
in the Islamic Republic of Mauritania
agreed upon between
Ministry of Rural Development and Environment,
Project for the Development of the Oasis
and
Japan International Cooperation Agency

Nouakchott, December 6, 2000

Mr. Zeidane Ould SIDI BOUBACAR
Principal Secretary
Ministry of Rural Development and Environment

Mr. Ryuzo NISHIMAKI
Leader
Preparatory Study Team
Japan International Cooperation Agency

Mr. Seyfoullah Ould ABBAS
Coordinator
Project for Development of the Oasis

I. INTRODUCTION

In response to the request of the Government of Mauritania (hereinafter referred to as "the GOM"), the Government of Japan decided to conduct the Study on the Development of the Oasis Zone in the Islamic Republic of Mauritania (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with the authorities concerned of the GOM.

The present document sets forth the scope of work with regard to the Study.

II. OBJECTIVES OF THE STUDY

The objectives of the Study are:

(1) to formulate a master plan for integrated rural development in terms of appropriate utilization of oasis resources for stabilization of livelihood in study areas through: (a) rational management and development of water resource, (b) appropriate land use, (c) improvement of the living environment, (d) farming and (e) understanding of actual situation of groundwater and improvement of participated surveillance system and their management of groundwater;
(2) to establish a oasis zone environment monitoring method; and
(3) to carry out technology transfer to Mauritanian counterpart personnel through on-the-job training in the course of the study.

III. STUDY AREA

The study area shall cover the oasis zone in Adrar region and Tagant region. A location map is attached as ANNEX-1.

IV. SCOPE OF THE STUDY

In order to achieve the objectives mentioned above, the Study shall consist of the following items:

[Phase 1]

1. To collect and analyze by reviewing existing data, information and indexes, and by carrying out field surveys including interviews with relevant authorities as well as with local communities. These activities will be carried out at the study area above mentioned. The main components of the first stage of the Study are stated as below:
   (1) Natural condition, political, social, economical situation;
   (2) Oasis environment such as available volume of groundwater, erosion control forest, etc.;

(3) Basic agricultural situation such as hydrology, water quality, water use, soil, land use, farming technology, stock farming, agricultural infrastructure, cultivated items, marketing, etc.;
(4) Living standard such as water supply, water use, water quality, education, health, housing, roads, income source, life style, etc.;
(5) Organizations and /or institutions based on communities, if any;
(6) Public assistance and/or self reliance systems;
(7) Human resources of the governmental institutes and communities;
(8) Global Issues (environmental aspects, gender issues, etc.)

2. Understanding of the actual situation and analysis of problems in the Study areas
(1) Research into the actual condition and evaluation of development investment related to projects of IFAD, FADES, the EU and WB
(2) Evaluation and estimation of resources in the oasis zones

3. Tentative formulation of a master plan of integrated rural development on appropriate utilization of oasis resources for stabilization of livelihood in the Study areas with the following components:
(1) Appropriate management and development of a water resource plan
(2) Land use plan
(3) Living condition improvement plan
(4) Farming and agro-pastoral program
(5) Oasis area environment monitoring plan

[Phase 2]
(Selection of the priority areas and management of the implementation of pilot projects)

4. Implementation of pilot projects in the priority areas to demonstrate the master plan

5. Final Formulation of the master plan and making up a schedule of implementation of the projects

6. Monitoring and evaluation of projects

7. Formulation of results and recommendations

V. STUDY SCHEDULE

The Study shall be carried out in accordance with the Tentative Work Schedule attached as ANNEX-2.

VI. REPORTS

JICA shall prepare and submit the following reports to the GOM which consists of two versions: complete English version and French version with English appendices.
In case of doubt arises in interpretation, English text shall prevail;

Inception Report: Five(5) copies in English and twenty (20) copies in French at

	the commencement of the Study
Progress Report (1):	Five(5) copies in English and twenty (20) copies in French on cource of the first field work in Mauritania
Progress Report (2):	Five(5) copies in English and twenty (20) copies in French at the end of the first field work in Mauritania
Interim Report:	Five(5) copies in English and twenty (20) copies in French at the commencement of the second field work in Mauritania
Progress Report (3):	Five(5) copies in English and twenty (20) copies in French at the end of the second field work in Mauritania
Draft Final Report :	Five(5) copies in English and twenty (20) copies in French at the commencement of the forth field work in Mauritania The Mauritanian side shall submit written comments on the Draft Final Report to JICA within one (1) month of the receipt of the report.
Final Report:	Ten(10) copies in English and forty (40) copies in French within two (2) months of the receipt of comments on the Draft Final Report (2) from the Mauritanian side

VII. UNDERTAKINGS OF THE GOM

1. To facilitate the smooth conduct of the Study, the GOM shall take the necessary measures as listed below:

(1) Secure the safety of the Study Team,
(2) Permit the members of the Study Team to enter, leave and sojourn in Mauritania for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees,
(3) Exempt the members of the Study Team from taxes, duties and other charges on equipment, machinery and other materials to be brought into and out of Mauritania for the conduct of the Study,
(4) Exempt the members of the Study Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Study Team for their services in connection with the implementation of the Study,
(5) Provide necessary facilities to the Study Team for remittance as well as utilization of the funds introduced into Mauritania from Japan in connection with the implementation of the Study,
(6) Secure permission for the Study Team to enter private properties or restricted areas for the conduct of the Study,
(7) Secure permission for the Study Team to take all data and documents, including photographs and maps, relevant to the Study out of Mauritania to Japan, and
(8) Provide medical services as needed. Related expenses will be chargeable to the members of the Study Team.

2. The GOM shall bear claims, if any arise, against members of the Study Team resulting from, occurring in the course of, or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of the Study Team.

3. The Ministry of Rural Development and Environment (hereinafter referred to as "the MRDE") shall act as the counterpart agency to the Study Team and also as the coordinating body in relations with other governmental and non-governmental organizations for the smooth implementation of the Study.

4. MRDE shall, at its own expense and in cooperation with other organizations concerned, provide the Study Team with the following:

(1) Available data and information related to the Study,

(2) Counterpart personnel,

(3) Suitable office space and necessary equipment in Nouakchott and the Study areas, and

(4) Credentials or identification cards.

VIII. UNDERTAKINGS OF JICA

For the implementation of the study, JICA shall take the following measures:

(1) Dispatch, at its own expense, study teams to Mauritania, and,

(2) Pursue technology transfer to Mauritanian counterpart personnel in the course of the study.

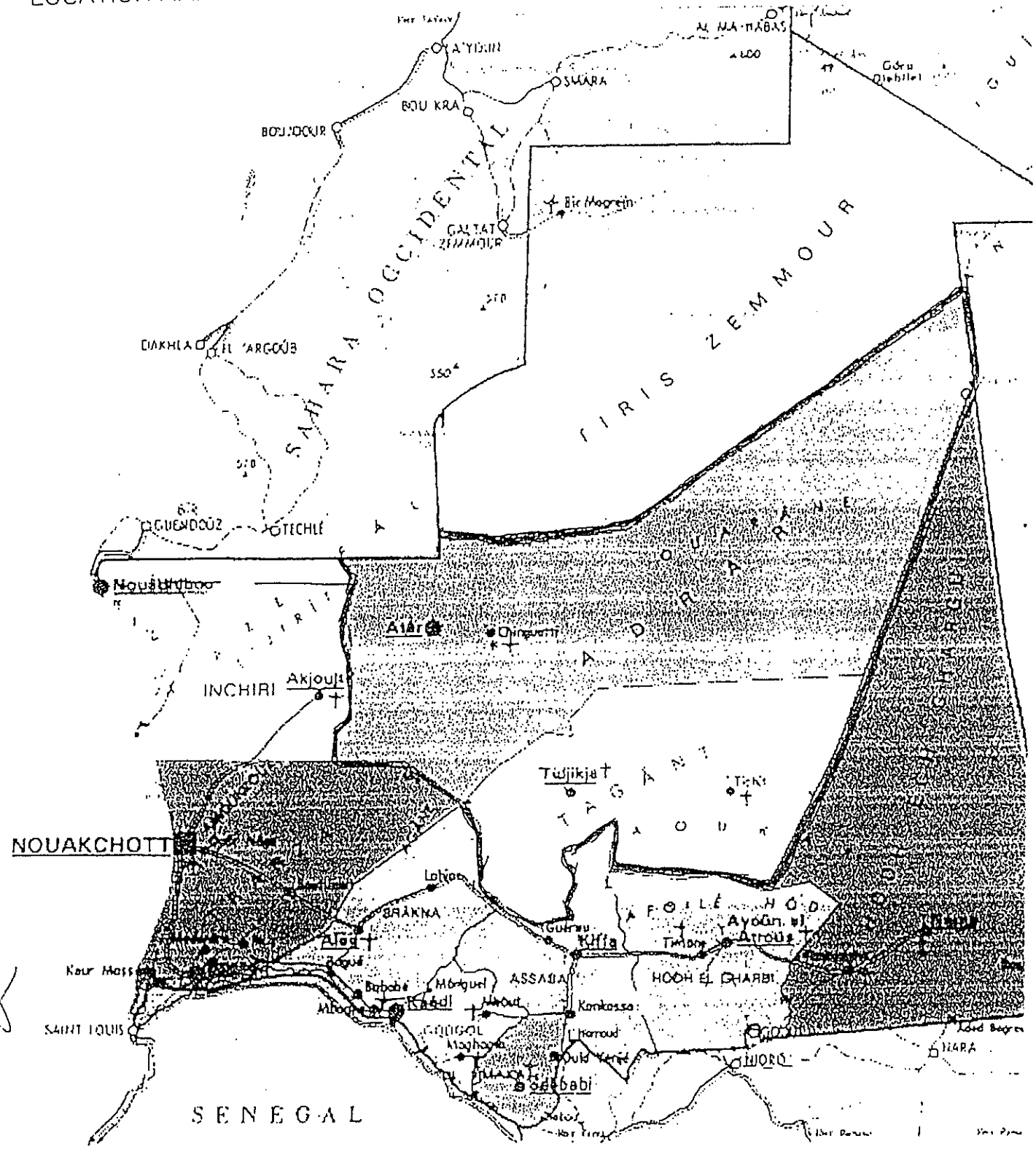
IX. LANGUAGE

In any divergence arises about interpretation of this Scope of Work, which is done in English and French, the English text shall prevail.

X. CONSULTATION

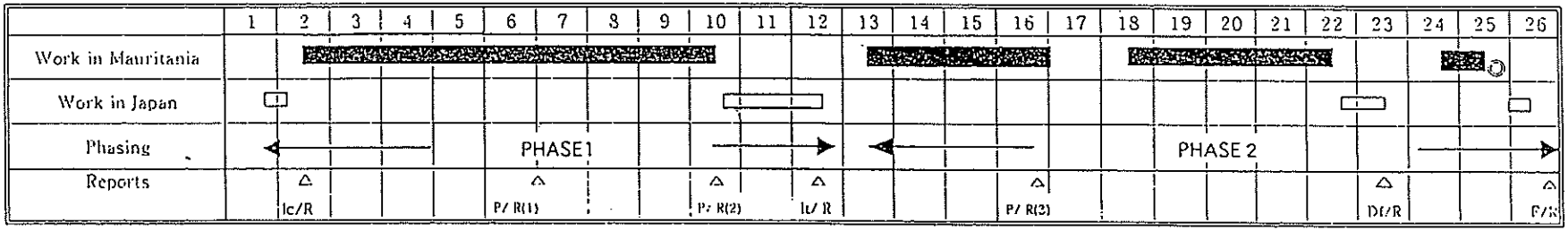
JICA and the MRDE shall maintain constant communication and consult with each other in respect of any matters that may arise from, or in connection with, the Study.

LOCATION MAP



ANNEX- II

TENTATIVE WORKING SCHEDULE



Ic / R	:	Inception Report
P / R(1)	:	Progress Report (1)
P / R(2)	:	Progress Report (2)
It / R	:	Interim Report
P / R(3)	:	Progress Report (3)
Df / R	:	Draft Final Report
F / R	:	Final Report
◎	:	Comments on DF/R by the Mauritanian side

Minutes of Meeting
on
the Scope of Work
for
the Study on
The Development of the Oasis zone
in the Islamic Republic of Mauritania
agreed upon between
Ministry of Rural Development and Environment,
Project for Development of the Oasis Zone
and
Japan International Cooperation Agency

Nouakchott, December 6, 2000

Mr. Zeidane Ould SIDI BOUBACAR
Principal Secretary
Ministry of Rural Development and Environment

Mr. Ryuzo NISHIMAKI
Leader
The Preparatory Study Team
Japan International Cooperation Agency

Mr. M. Seyfoullah Ould ABBAS
Coordinator
Project for Development of the Oasis Zones

The Preparatory Study Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Mr. R. NISHIMAKI, visited the Islamic Republic of Mauritania from November 23 to December 10, 2000.
The Team discussed and exchanged views with regard to the Scope of Work for "the Study on The Development of the Oasis Zone in the Islamic Republic of Mauritania" (hereinafter referred to as "the Study") with the officials from the Ministry of Economy and Development and Ministry of Rural Development and Environment (the Project of the Development for the Oasis) as well as others concerned.
As a result of the discussions, both sides agreed on the Scope of Work for the Study.
The following are the important issues that were discussed and agreed upon.
The list of participants and resource persons related to the discussions is attached as Annex 1.

1. Demonstration in the sites of pilot projects
The necessity and details of the demonstration shall be discussed during the Phase I study. Both sides should make a decision regarding this issue at the meeting for the interim report.

2. Counterpart Personnel
Both sides agreed that the officials of the Project of the Development for the Oasis Zone (hereinafter referred to as "PDO") will be available of the study team during their stay in Mauritania. In case that such officials are not available, PDO shall assist the Study team to employ the local consultant.

3. Relevant Ministry
The Ministry of Rural Development and Environment (hereinafter referred to as "MRDE") shall make participate relevant officials from other Ministries of the GOM under its responsibility for smooth implementation of the Study.

4. Office space and equipment
The Mauritanian side promised to provide the Japanese study team(s) with a suitable office space in Nouakchott, as well as at the study areas. The Mauritanian side shall obtain a frequency of the wireless radio communication in accordance with the request of the study team(s).The Mauritanian side requested the equipment and materials listed in the ANNEX-2 which are necessary to carry out the Study. The Study team promised to convey this request to the Government of Japan for consideration.

5. Exemption of Equipment
JICA shall send the list of the equipment and materials of the Study, which should be exempted, to the GOM later.

6. Counterpart-training in Japan
The Mauritanian side requested the training of counterpart personnel in Japan or other countries. The Japanese side promised to convey this request to the Government of Japan.

7. Final report
Both sides agreed that the Final Report of the Study would be accessible to all interested persons.

8. Language
In any divergence arises about interpretation of this Scope of Work, which is done in English and French, the English text shall prevail.

1. MAURITANIAN SIDE

Ministry of Rural Development and Environment

Mr. Zeidane Ould SIDI BOUBACAR	Principal Secretary
Mr. Baba Ould BOUMEISS	Director of Study Planning and Evaluation
Mr. Seifoullah Ould ABBAS	Coordinator of Project for Development of Oasis
Mr. Moma Ould HAMALLA	Delegate of Adrar

Ministry of Hydraulic and Energy

Mr. Bassirou DIAGANA	Deputy Director of Hydraulic
Mr. Kiyotsugu MURAHASHI	Technical Advisor, JICA Expert Department of Hydraulic

Ministry of Economy and Development

Mr. Limam Ahmed Ould MOHAMEDOU	Chief of Economic Cooperation Section, Financial Department

2. JAPANESE SIDE

Preparatory Study Team

Mr. Ryuzo NISHIMAKI	Leader
Mr. Hisao USHIKI	Groundwater/Water resources
Mr. Masaharu YAJIMA	Dry land farming
Mr. Akira NISHIMURA	Vegetation/Remote sensing
Mr. Yoshiharu TAKAHASHI	Social economy/Rural community
Ms. Sonoko IWAMOTO	Project Planning
Mr. Masao MATSUBARA	Interpreter

JICA Senegal Office

Mr. Takemichi KOBAYASHI	Assistant Representative Resident
Ms. Kayo SAKAGUCHI	Project Formulation Advisor

-6 vehicles 4WD (cf. double cabine)
-3 telephones with facsimile
-10 personal computors
-3 portable personal computers
-3 photocopiers
-3 telephone lines during the Study period
-1 geographic prospecter
-3 electric sondes
-5 conductimeters
-5 thermometers
-10 GPSs
-1 Computer soft to interpret the pomp test

MINUTES OF MEETING

ON

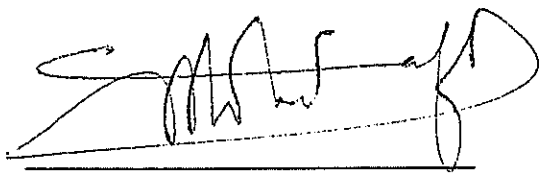
THE DRAFT FINAL REPORT

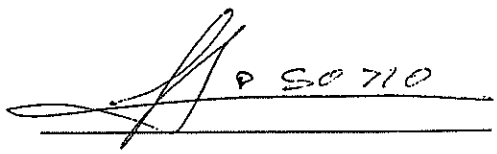
FOR

THE STUDY ON THE DEVELOPMENT OF OASIS ZONE

IN THE ISLAMIC REPUBLIC OF MAURITANIA

NOUAKCHOTT, JULY 7, 2004





Mr. Mohamedou Ould Mohamed MAHMOUD
Coordinator
Project for Development of the Oasis Zone

Dr. Michiaki HOSONO
Team Leader
JICA Study Team

The Study Team of the Japan International Cooperation Agency (JICA) has commenced the study since May 2001, based on the Inception Report that was submitted to the Ministry of Rural Development and Environment (MDRE) through the Oasis Project on May 2001 according to the Scope of Work agreed upon between MDRE and the JICA Mission for the captioned study on November 6, 2000.

The Study Team, the Counterparts and the personal of related organization held a meeting on July 7 on the Draft Final Report, which includes the results of pilot study and development project and program.

Items confirmed on the report, and the points discussed and agreed upon during the meeting are as follows:

1) The Study Team submitted following reports to the Oasis Project on July 2, 2004.

The Main Report in French	:	20 copies
The Main Report in English	:	5 copies
The Annex Report in French	:	20 copies
The Data Book of Oasis Inventory	:	2 copies
The Maps of GIS Information	:	2 copies
The GIS Operation Manual	:	2 copies
The Vegetable Cultivation Manual	:	2 copies

2) The Mauritanian side basically agreed to the contents of the Draft Final Report.

3) The Mauritanian side requested to JICA that the priority projects especially water saving cultivation should implement.

4) The comments on the Draft Final Report that could not be made during this meeting will be send to the Study Team through JICA Senegal Office by the end of July.

LIST OF ATTENDANTS

Mauritanian Side

Ministry of Rural Development and Environment

Mr. Limam ould Abdawa	General Secretary
Mr. Momma ould Hmah Alla	Director of Agriculture
Mr. Tourad ould Moikyar	Deputy Manager of the Planning
Mr. Mohamed ould Hamza	Chief of the Natural Resource Department, Direction of the Environment
Mr. Anne Mamadou	Chief of the Study and Planning Department, Direction of Politics, Follow-up and Study
Mr. Moktar ould Abdallahi	Division agro-forest
Mr. Khatry ould Atigh	Chief of Agricultural Production Department
Mr. Seyfoulah ould Abbas	Exective MDRE
Mr. Mohamdedou O/Med Mahmoud	Coordinator of Project for Development of the Oasis Zone
Mr. Brahim ould Bah	Tagant Regional Director, Oasis Project
Mr. Cheikh ould Moustapha Chabarnoux	Adrar Regional Director, Oasis Project
Mr. Ahmed Memned	Interim Representative, Agronomic Study and Agricultural Development Center
Mr. Mohamed Nasr Dine ould	Researcher, Agronomic Study and Agricultural Development Center

Ministry of Economic Affaires and Development

Mr. Limam Ahmed ould Mohamedou	Chief of the Economical Cooperation department, Direction of the Finance
Mr. Mohamed ould Baba	Direction of the Planning and the Evaluation

National Water Resource Center

Mr. Basirrou Diagana	Director
Mr. Naji ould Mami	Hydrogeological Engineer

Secretary of States for the Feminine Condition

Ms Fatimetou mint Lekhlifa	Director of the Cooperation and Project Planning

PAROA Project

Mr. Sid'Ahmed Lekbib ould Cheikh El Hourssein	Coordinator
Mr. Jean Kiss	Technical Team Leader, PAROA

Japanese Side

JICA Dakar

Mr. Kiyofumi Konishi	Resident Representative, JICA Dakar
Mr. Hiromichi Morishita	JICA Dakar
Mr. Mamadou Alliou Barry	JICA Dakar

JICA Tokyo

Mr. Kenji Shiraishi	Rural Development Section
Mr. Kazuo Ando	Tranlator

Study Team

Dr. Michiaki Hosono	Team Leader
Dr. Katsuhito Yoshida	Hydrogeology
Mr. Toshinori Kawamura	Water Use Analysis and Management Plan
Mr. Kiharu Serizawa	Translator