

## Ex-Post Monitoring of Completed ODA Loan Project

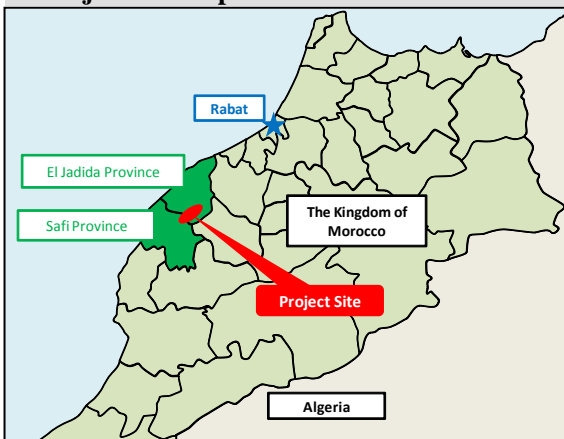
Kingdom of Morocco

Abda-Doukkala Upper Scheme Irrigation Project

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### 1. Project Description



Project Location Map



Main Canal

#### 1.1 Project Objective

The purpose of this project was to construct irrigation facilities in Abda-Doukkala for the supply of irrigation water, to increase agricultural production and create employment and thereby increase farmer income and promote rural economic development.

#### 1.2 Outline of the Loan Agreement

Approved Amount/ Disbursed Amount	13,548 million yen / 13,426 million yen
Loan Agreement Signing Date / Final Disbursement Date	June, 1996 / November, 2001
Ex-post Evaluation	2005
Executing Agency	Office Regional de Mise en Valeur Agricole des Doukkala (ORMVAD)
Main Contractor	BECAM(Morocco) / STAM(Morocco)(JV) / GRUPOACCIONA.S.A.( Morocco) / S.T.A.I.P.(Morocco)(JV) / S.T.A.I.P.(Morocco) / EMT(Morocco) / SOCA(Morocco) / SOGEA(Morocco)(JV) / AIC(Morocco)/ OMCE(Morocco) / SOGETRAMA(Morocco)(JV) / DIAMATIT(Morocco) / SNCE(Morocco)(JV)
Main Consultant	HYDROPROJECTO(Portugal) / EWI MAROC(Morocco) / SCET(Morocco)(JV)

### **1.3 Background of Ex-post Monitoring**

Moroccan agriculture consumes over 90% of the usable water resources. Considering the increase in demand for industrial-use water and water supply as the country's industry develops and its cities grow, there is a strong possibility that in the future the proportion of irrigation water could be limited. Therefore the efficient use of water through the construction of irrigation facilities has been an urgent issue. In addition, in years when agricultural production dropped, such as during droughts, the growth of the overall Moroccan economy stalled or declined. Therefore the stable development of agriculture was the key to stabilizing the overall economy, which makes the installation of irrigation facilities to free agriculture from dependence on rainwater a pressing need.

The plan for constructing irrigation facilities in the Doukkala Plain was to irrigate 32,400ha in El Jadida Province and 31,550ha in Safi Province. Phase 1 (16,000ha) had already been executed with financial assistance from the African Development Bank, European Investment Bank, and Arab Fund for Economic and Social Development, so it was decided to use the yen loan for the 18,901ha of Phase 2.

At the time of the ex-post evaluation, the area under cultivation was below the originally planned value. This was found to be due to insufficient supply of irrigation water during the drought in the dry season and inadequate countermeasures for the efficient use of water resources. Therefore, it was desired to be considered to set appropriate water fees by the government, to appropriate the income from irrigation earned by the executing agency exclusively to irrigation-related projects, and to shift to high-profit agricultural crops, in order to efficient use of the water resources. There were also other issues for the executing agency, i.e. introduction of water-saving irrigation systems, resolution of the duplication of tasks with the Ministry of Agriculture and Fisheries, establishment of a self-supporting financial system and provision of support activities for the irrigation association.

Therefore, this project was selected for ex-post monitoring and reviewed under each criterion with the findings from the field survey and other research activities with a final conclusion being drawn.

## **2. Outline of the Monitoring Study**

### **2.1 Duration of Monitoring Study**

Duration of the Study: March 2011 – October 2011

Duration of the Field Study: Not conducted

### **2.2 Constraints during the Monitoring Study**

Since follow-up studies had already been conducted, this monitoring was conducted by analysis without any field survey. The following reports with the latest information were

used as reference for analysis and development of this report:

- ODA Loan Collateral Project, “Abda-Doukkala Irrigation Project” – Report on Detailed Design Study (I), July 2010
- ODA Loan Collateral Project, “Abda-Doukkala Irrigation Project” – Report on Detailed Design Study (II), December 2010

Hereinafter, both reports are referred to as the “Report on Detailed Design Study”.

### 3. Monitoring Results

#### 3.1 Effectiveness

##### 3.1.1 Quantitative Effects

###### (1) Results from Operation and Effect Indicators

The effects produced by the project after the ex-post evaluation were analyzed by the operational effect indexes such as the irrigation water volume, the area of cultivation and the yields of main crops.

###### 1) Irrigation Water Volume

As shown in Fig. 1, the irrigation water has never exceeded the necessary volume in Doukkala Region since the construction had been implemented (2002), and it has been on the decline since the time of the ex-post evaluation (2005). Only 25% - 55% of the necessary water volume has

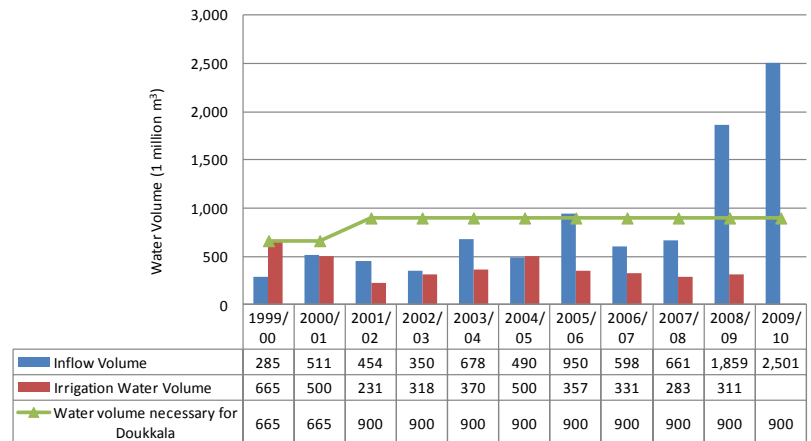


Fig. 1 Changes in Annual Irrigation

been obtained since the construction. There was no irrigation water supply in summer from 2001 to 2008.

Regarding the water volume in the area concerned, the precipitation<sup>1</sup> in the reservoir areas has declined continuously since the 1980s and therefore the water volume<sup>2</sup> flowing into the four dams along the river has also declined. Due to this situation, the water storage rates of the dams have decreased. In addition, the entire watershed area has not been able to supply

<sup>1</sup> According to the “Report on Detailed Design Study”, precipitation in the upper basin of the Oum Er-Rbia River has been on the decline since the 1980s and the average annual precipitation from 1934 to the mid 1970s was 590mm and after that the average annual precipitation till 2006 decreased by 164mm to 426mm (28% decrease).

<sup>2</sup> According to the “Report on Detailed Design Study”, the annual average water volume flowing into the four dams along the river was 3,817 million m<sup>3</sup> from 1940 to 1980, but it was 2,511 million m<sup>3</sup> from 1981 to 2006, a decline of 34%. The inflow water volume to some of the dams decreased by 50%.

enough water for the irrigation since the 1980s.

In such a situation, the Government of Morocco has promoted water-saving irrigation systems as a countermeasure for low rainfall and a means of saving irrigation water, and as part of this effort, it has executed drip irrigation projects. For instance, the drip irrigation system has been introduced for agriculture in the coastal region to grow vegetables such as tomatoes. While the area of cultivation and the production volume in this coastal region have declined, the yield per unit has increased slightly. This could be due to the spread of the drip irrigation system.

## 2) Area of Cultivation

The area of cultivation expanded from 2002 to 2006, as shown in Fig. 2. However, it has fluctuated between 15,000 and 18,000ha since 2007, remaining rather flat. Since the construction of the irrigation system (2002), the actual results have never exceeded the annual planned values. This could be due

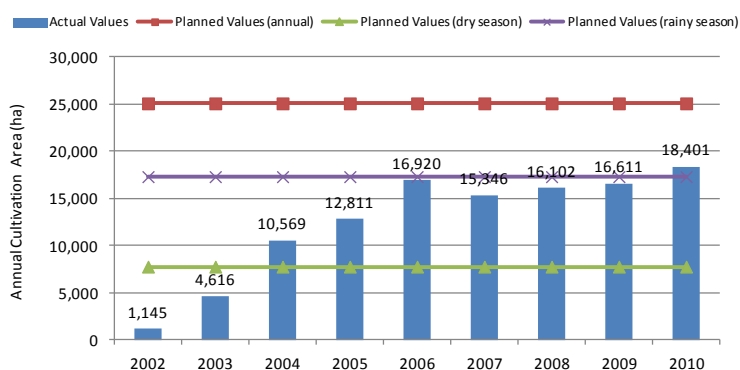


Fig. 2 Changes in Annual Cultivation Area

to the fact that sufficient water for irrigation was not available as mentioned above, and especially there was no water supply in the dry season (summer).

## 3) Yields of Main Crops

The total yield of the main crops increased until 2006 after the construction (2002) as shown in Fig. 3. However, it has fluctuated between 300,000 and 400,000 t/year since 2007.

The yields have increased since the ex-post evaluation (2005), although the yields of wheat and sugar beet vary from year to year. Compared to other products, the yield of sugar beet is particularly high, and the shifts in the yield of sugar beet show the same tendency as the shifts in the total yield.

Although there was a plan to cultivate soybeans, there are no records of any soybean harvests. The actual yield of corn is less than the planned value. The possible reasons for such low yields are that soybeans and corn require a lot of irrigation water; ORMVD prioritizes the crops for cultivation in an environment where irrigation water is insufficient; and in particular it is difficult to obtain soybean seeds.

While the original target for pasture was not high, the actual yields are much higher than the planned values. Vegetables, which were not included in the original plan, had high yields especially in 2006, 2007 and 2009.



Fig. 3 Shifts in Annual Yields of Main Crops

## **(2) Beneficial Area**

According to the “Report on Detailed Design Study”, there was no change in the beneficial area of 18,901ha in which irrigation system was constructed by the ODA loan project. Only 25 - 55% of the normally required volume of irrigation water has been obtained because droughts have continuously occurred every year since the completion of the ODA loan project (2002). Water distribution is prioritized in a situation of water shortages; for instance, vegetables are given the lowest priority because they are considered to be subsidiary food in Morocco. So vegetables cannot be double-cropped in times of water shortage, resulting in a difficulty of stable cultivation. Due to the above-mentioned reasons, double cropping which was planned at the time of the appraisal is not carried out at present.

Whether double cropping is possible or not depends on the available water volume in the area. Even if the water volume increases, the irrigation water volume does not increase. Because the irrigation water is limited as just described, in order to practice double-crop farming, it is considered necessary to execute more effective use of water by the introduction of water-saving irrigation systems, improvement of existing irrigation techniques, improvement of the water management system, etc.

## **(3) Results of Calculations of Internal Rates of Return (IRR)**

Neither the Financial Internal Rate of Return (FIRR) nor Economic Internal Rate of Return (EIRR) was calculated, because there were no data available.

### **3.1.2 Qualitative Effects**

At the time of the ex-post evaluation, it was reported that water-consuming livestock feed such as sugar beet and alfalfa were cultivated after the construction of the irrigation facilities and the production of milk increased in line with the increase of the yield of livestock feed, which was contributing to creation of local employment.

Then, the following points were studied, (1) whether there had been any changes in the cultivation of livestock feed, and (2) the operation and employment situation of milking and milking facilities. The results are as described below.

#### **(1) Cultivation of Livestock Feed**

According to the “Report on Detailed Design Study”, alfalfa requires more irrigation water than wheat. Such crops as alfalfa and sugar beet which require a lot of water were cultivated only in the irrigated areas and crops which do not require a lot of water were cultivated in the rain-fed areas.

In this sense, there were no changes in the cultivation method.

## (2) Operation and Employment Situation of Milking and Milking Facilities

The number of dairy cows was 3,000, the production volume of milk was 8,500 kiloliters and milk sales were worth 1.5 billion dirhams in 2008 in the ODA loan project area. There are 255 agricultural associations (194 active and 61 inactive) related to milk production under the jurisdiction of ORMVAD in Doukkala District. The membership is 17,455 (14,873 active members). The milk association is the largest of the agricultural associations in the area concerned in terms of the number of active associations and members. The main tasks of the milk association are to collect raw milk and pass it to the milk collection vehicles from the dairy product companies and to distribute the payment from the dairy product companies to the association members.

The production volume of milk has almost doubled since the time of the ex-post evaluation and the number of milk-related associations has increased nearly ten-fold to 194. It can be said that milk-related activities hold an important position as the main industrial and economic activities in the area.

In conclusion, while the area under cultivation has increased slightly since the execution of the irrigation project, it has not reached the planned value. Double cropping has not been practiced due to irrigation water shortages. However, the project was highly effective because it has contributed to improvement in agricultural incomes, by cultivating livestock feed in the irrigated area, leading to more milk production.

## **3.2 Impact**

### **3.2.1 Intended Impacts**

Increase in farmers' incomes was considered to be one of the impacts of this project. At the time of the ex-post evaluation, it was thought that sugar production by cultivation of sugar beet supported local industry and influenced farmers' incomes. Thus, the situation of sugar production and the shifts in farmers' incomes were studied.

#### (1) Sugar Production

##### 1) Condition of Sugar Production

Regarding the overall situation of agriculture in Abda-Doukkala District, the number of farming households that benefited from the ODA loan has increased to 9,230 from 7,099 at the time of the ex-post evaluation. The estimated population that benefitted from the ODA loan is 55,000 (approximately 9% of the population of the district concerned), and the poverty ratio is approximately 15%, lower than the national average (19.0%). Sugar beet is considered to be a characteristic crop in the area and sugar production supports local industry. There is one sugar factory in Sidi Bennour, which is operated by COSMAR SA Corporation.

The processing capacity of the Sidi Bennour sugar factory was improved to 15,000 t/day with an investment of 850 million dirhams in 2008.

The sugar production company has increased in line with the yield of sugar beet. This is because the yield has increased after construction of the irrigation facilities as mentioned earlier, and the sugar processing capacity of the sugar factory has been improved.

## 2) System of Sugar Beet Cultivation and Trade

Sugar beet farmers in the district concerned ship all their products to the Sidi Bennour factory. Sugar beet is cultivated for wholesale purchase by COSMAR SA Corporation: fertilizers and seeds are provided by the corporation to the farmers and the farmers cultivate the seeds, and after shipment, the farmers receive payment after deduction of the cost of the fertilizers, seeds and irrigation water fees.

## 3) Superiority of Sugar Beet Cultivation

The irrigation farmers always include sugar beet in their cultivation system. This is because the sugar company is there as the buyer and there is no change in the price as long as the sugar is the same quality. In addition, the highest priority of water rights is given to sugar beet farmers by an agreement between the sugar company and the National Office of Potable Water.

Although the yield is high, the profitability is not necessarily high, because the buying price does not go hand-in-hand with the yield since the sugar company may beat down the price due to the exclusive contract, and/or the profits may disappear due to loans, payment to laborers, etc.

## (2) Farmers' Incomes

The statistical data on sugar beet farmers' incomes per ha is as shown in Fig. 4. Regarding the details of production expenses, "labor cost" is around 8Dh/day during the busy harvesting and sowing seasons, the "rental fee for agricultural machinery" is around 600Dh/ha and the "land rent" is 2,500 - 5,000Dh/ha/year (in some cases, 50% of the harvest). The total payment by COSMAR SA Corporation to sugar beet farmers is increasing as shown in Fig. 5.

The total yield in the area remains at around the originally planned value. Because the yield of

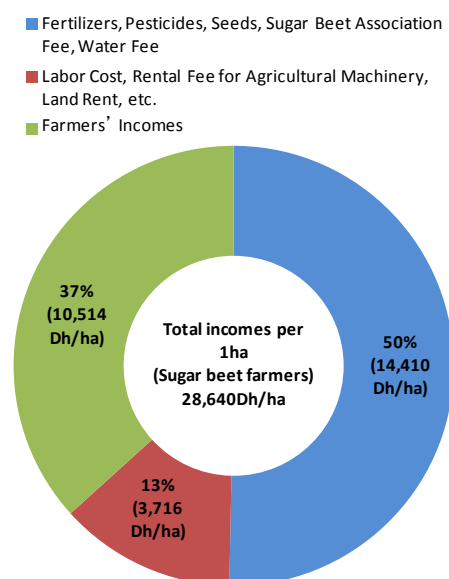


Fig. 4 Breakdown of Sugar Beet Farmers' Incomes



sugar beet is especially high, the yield and prices of sugar beet seem to have a big impact on agricultural management in the area. The price of sugar beet is unknown, but it should be rising, considering the changes in the total payments to the sugar beet farmers.

According to an interview survey of the farmers, as shown in Fig. 4, the farmers earn 10,000Dh/ha from sugar beet and 5,000Dh/ha from wheat. This indicates that agricultural activities are increasing in the case of sugar beet, although there was no yield increase by double cropping because there was no water distribution until the summer of 2009.

The annual agricultural income per hectare of the beneficiary farmers was 9,538Dh in 2009 and the annual income per farming household was 18,000Dh. This indicates that there has not been much change from the level of 8,500 - 9,000Dh (excluding expenses for agricultural input material) at the time of the ex-post evaluation. It had not reached 15,000 - 19,740Dh at the time of the appraisal but a straight comparison was not appropriate because yield increases from double-cropping were expected at the time of the appraisal.

The profitability of tomato farmers is said to have increased 1.5 times by changing from furrow irrigation to drip irrigation, which is contributing to savings on irrigation water fees, labor saving and yield increases.

According to the “Report on Detailed Design Study”, many farmers mentioned in individual interviews that their profits disappeared due to payment of debts, payment to laborers, etc. and that they were making a living with their earnings from milk sales, although the situation varied depending on the area (large-scale irrigation area, coastal area or rain-fed area), the scale of the fields and the cultivated crops.

### 3.2.2 Other Impacts

After the execution of the project, the number of livestock increased and the number of truck owners also increased. As for the changes experienced by farmers, the number of farming households who own satellite dishes, TVs and refrigerators increased. On the other hand, it has become difficult to secure a workforce for agricultural work because agricultural work has increased due to the irrigation project and thus the employment opportunities have increased for laborers. In this manner, the irrigation project has had the effect of indirectly improving the economic conditions of the farmers.

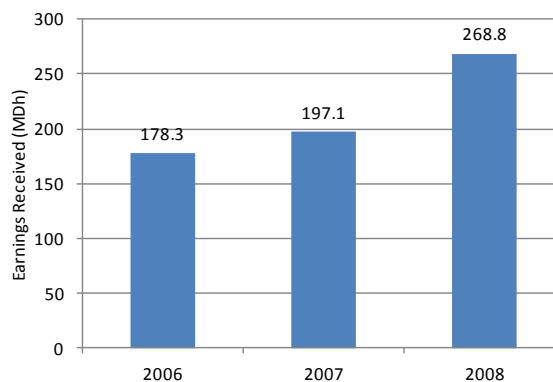


Fig. 5 Changes in Total Payments to Sugar Beet Farmers

In conclusion, in terms of impact, agricultural activities for sugar production have increased and the incomes of the sugar beet farmers have increased. However, the profitability is not necessarily high.

### **3.3 Sustainability**

The systems, technologies/techniques and finances of the executing agency ORMVAD and the irrigation committee were studied to analyze sustainability of the project.

#### **3.3.1 Structural Aspects of Operation and Maintenance**

##### **(1) ORMVAD**

The farmlands under the jurisdiction of ORMVAD are mostly located in El Jadida Province. In the province, there are also areas which come under the jurisdiction of the Provincial Department of Agriculture (DPA), a local administrative organ of the Ministry of Agriculture and Fisheries. The whole of Safi Province, another province in Doukkala District, comes under the jurisdiction of Safi Province DPA. ORMVAD and the DPAs of the above-mentioned two provinces were integrated and restructured around 2009 into the “Doukkala-Abda Regional Department of Agriculture”. This is an embodiment of the country’s policy of decentralization and integration of related organizations. However, the director of ORMVAD has been appointed as the director general of the new organization (Department of Agriculture) and holding the two posts concurrently. The DPAs (Provincial Department of Agriculture) of the two provinces still have their own offices and director generals.

The organization is largely divided into the head office and branch offices. There are four branch offices in the jurisdictional area and the jurisdictional area is divided into 28 sub-areas, with 28 Agricultural Development Centers (CDA) and 28 Irrigation Network Management Centers (CGR). These centers are located at almost the same places. There are four CDAs in the Phase 2 irrigation area.

ORMVAD has five divisions. Three of the five divisions, (1) Agricultural Improvement Division, (2) Irrigation Network Management Division, and (3) Agricultural Development Division, are responsible for the execution of projects. The remaining two divisions, (4) Personnel and Training Division and (5) Planning and Finance Division, are responsible for organizational management. The total number of staff in the head office and branch offices is approximately 540.

The total number of staff in the Irrigation Network Management Department is approximately 260 and 16 of the 260 staff (excluding secretaries, etc.) are assigned to the head office in El Jadida City. The remaining 240 are assigned to branch offices, field-level offices or remote control centers.

The restructured organization “Doukkala-Abda Regional Department of Agriculture” has 540 staff, fewer than the 780 staff at ORMVAD at the time of the ex-post evaluation. There were no clear materials to prove whether the issue of duplicated tasks with the Ministry of Agriculture and Fisheries had been resolved or not. The duplicated tasks are expected to be resolved due to integration, though there are some worrisome elements; for instance, the DPAs (Provincial Department of Agriculture) still have their own offices and director generals.

## (2) Irrigation Committee

No irrigation association was established in the upper irrigation area covered by the ODA loan project.

In the lower irrigation area which is outside of the ODA loan project, an irrigation association was established 15 years after the construction was completed. As for the background, an irrigation association was organized at the end of 1980 as part of the activities of the PAGI program (World Bank loan) aimed at rehabilitation, management and improvement of the irrigation facilities. This irrigation association has 39 organizations (association membership: 7,202 people) but only two of the 39 organizations are essentially active.

The association relies on ORMVAD for the technical and financial aspects of irrigation facility management and it neither performs operation or maintenance of the irrigation facilities nor collects water fees.

### **3.3.2 Technical Aspects of Operation and Maintenance**

ORMVAD is responsible for maintenance of the tertiary canals and no training in maintenance of the irrigation facilities is provided for the farmers.

There are training courses aimed at the staff of the Irrigation Network Management Division of ORMVAD, many of which are not conducted due to budget constraints, and it often happens that training courses planned in the previous year were not conducted in the following year. (For instance, eight training courses were planned in 2010 but only two courses were conducted.)

Training courses for improvement and maintenance of the technical level were planned and conducted for the staff of the Irrigation Management Division. This is recognized as activities to maintain the technical level. However, attention should be paid to the fact that not many courses have been conducted due to budget constraints.

Regarding the operation and maintenance conditions, there is no major damage to the facilities and machines such as the concrete structure and pumps, and the effectiveness of the project is not impaired due to the functional decline of the facilities and machines. Thus, it

is judged that maintenance has been conducted to some extent. The technical level is assured to carry out basic maintenance.

### **3.3.3 Financial Aspects of Operation and Maintenance**

The budget system of ORMVAD is divided into two: revenue from the collection of irrigation water fees and the budget from the Ministry of Agriculture and Fisheries. Revenue from the collection of irrigation water fees is used for items related to execution of the project such as vehicles, electricity costs for pump stations and personnel costs. Collection of irrigation water fees (revenue) and expenditure are handled independently. However, due to less information, it is not known if the irrigation water fees collected are enough to cover the operational expenses.

On the other hand, improvement of the facilities and canals and procurement of the necessary equipment are covered by the budget from the Ministry of Agriculture and Fisheries. This indicates that operation and maintenance are conducted based on financial resources from the government. It is not known whether or not enough financial resources are available because there are no available materials about the content, frequency and expenses for inspection and maintenance of the facilities.

Regarding collection of the irrigation water fees, they are charged to the irrigation water users every three months and payment is basically made at the CGR pay station in each area. The irrigation water fees consist of two charges; the fees are calculated by combining (1) the basic water rate and (2) a pump tax for electricity costs, etc. if pumping of water is necessary. Since the actual costs were not reflected in past irrigation water fees, the law on water fees was applied from September 1, 2009. Consequently, users were notified that the basic water rate would be increased twice a year (on September 1 and February 1). Until then the basic water rate and the pump tax had been inclusive of value-added taxes, but the system was changed following the increase on September 1, 2009 to include 7% value-added tax in addition to the water rate.

The sugar beet farmers can get seeds, pesticides and fertilizers in advance from COSMAR SA Corporation and pay the irrigation water fees later to COSMAR SA Corporation. This is possible because of a system based on a contract between COSMAR SA Corporation and ORMVAD whereby the farmers harvest and sell the sugar beet to COSMAR SA Corporation and receive the balance after deduction of expenses for seeds, pesticides and fertilizers as well as irrigation water fees from the sales of the sugar beet. This collection system is expected to ensure that the expenses are collected without omission and the collected amount is large because the yield of sugar beet is the largest of the crops in the area concerned and there are many sugar beet growers.

If farmers do not grow sugar beet, ORMVAD does not provide them with irrigation water.

So cultivation of sugar beet is almost compulsory. It was found that, as a result, most of the farmers cultivate sugar beet in large-scale irrigation areas and pay irrigation water fees and there are few cases of no payment.

### **3.3.4 Current Status of Operation and Maintenance**

ORMVAD is in charge of maintenance of the main canals, relevant facilities and tertiary canals. The farmers are in charge of maintenance of the quaternary canals (earth canals).

If there are any problems with the facilities, the staff of CGR contact the irrigation network maintenance office of the Irrigation Network Management Office and the maintenance staff handle it. If major repairs are required, the repair work is outsourced to a private company.

The diversion gates, secondary and tertiary canals, low-pressure pipelines, etc. in the area covered by the ODA loan project were generally well maintained. Water leakage from some of the joints in the concrete canals was observed, but the amount of leaking water was not big.

The most serious problem in maintenance of the irrigation facilities was intentional damage to the facilities. During times of water shortage, some farmers try to get irrigation water outside of the allocated hours and open the gates on their own, damaging the facilities. In addition, children throw stones at the pipes for fun, damaging the pipes. People from other areas also sometimes come and steal the metal gates, damaging the facilities. In the sprinkler irrigation area which is not part of the ODA loan project, many of the flow meters had been broken by farmers who did not want to have the flow measured.

### **3.4 Others**

At the time of the ex-post evaluation, the following were suggested as follow-up items: (1) improvement of economic benefits by efficient use of water resources and irrigation facilities, (2) confirmation of review of irrigation operation and (3) securing of the stability of the irrigation project. The monitoring results of these items are as described below.

#### **(1) Improvement of Economic Benefits by Efficient Use of Water Resources and Irrigation Facilities**

##### Conservation of Water Resources

Water conservation is treated as an important element in the policies and strategies of the “Green Morocco Plan (PMV)”, “Regional Agricultural Plan (PAR)”, “National Water-Saving Irrigation Program (PNEEI)”, etc. PNEEI was developed to actively save water (irrigation water) through a plan to convert a total of 555,090ha of irrigated cultivation area nationwide to “drip irrigation”, with a detailed plan formulated for each locality.

Regarding drip irrigation, a pilot project and an implementation project were executed by other donors (FAO, USAID/ Coca-Cola Educational and Environmental Foundation, the

World Bank and the African Development Bank) in order to achieve efficient use of water. It is possible to reduce the volume of water required for irrigation by introduction of drip irrigation. However, careful investigation and study are considered necessary before introduction because it may require a lot of labor and money for operation and maintenance.

PNEEI for conversion to drip irrigation in Doukkala District started in 2008 and is expected to be completed in 15 years, aimed at changing 76,600ha to drip irrigation. At the same time, it also aims to improve the irrigation facilities for 4,200ha, covering 80,800ha in total. Since the large-scale irrigation area in Doukkala District covers 96,000ha, it is planned to convert 80% of the entire irrigation area to drip irrigation.

In conclusion, it is considered that due measures to promote efficient use of water resources by conservation of water have been implemented.

#### Water Demand Management

Since the water stored in the reservoir dams is used not only as irrigation water in Doukkala District but also as drinking and industrial water and irrigation water in and outside the basin, how much water should be distributed to which user is decided by the Oum Er-Rbia River Basin Authority through discussions with the parties concerned. After the water distribution for agriculture has been decided through this process, ORMVAD studies multiple scenarios regarding what types of crops are to be cultivated and the size of the cultivation areas in such a way as to ensure maximum benefits for the areas concerned. On the scenarios, the strategic (priority) crops in Doukkala District, sugar beet, livestock feed crops and wheat, are taken into consideration. Water distribution is decided in consideration of the maximum benefits produced and avoidance of damage to investments (minimum material supply to the sugar company, investment in livestock feed to raise livestock, etc.).

#### Improvement of Economic Benefits through Irrigation Facilities

Agricultural investment in the private sector and support for farmers by the national human development initiative are the principal pillars of the “Agricultural Plan for Doukkala-Abda Region” and the support for the farmers includes social and economic aspects and elimination of poverty.

As a scheme for the improvement of economic benefits, as described above, cultivation of sugar beet is actively promoted from the viewpoint of farmers’ incomes and collection of irrigation water fees. At first glance, it appears that changing to profitable crops is promoted, but it can be said that there are many restrictions on cultivation of crops other than sugar beet; for instance, there is no irrigation water supply for crops other than sugar beet. Furthermore, since the business partner in the case of sugar beet is only one company and seeds, fertilizers, etc. are supplied by that company, attention should be paid to the fact that the farmers are in a

disadvantageous position in terms of buying prices.

## **(2) Confirmation of Review of Irrigation Operation**

### Execution and Supervision of Irrigation Operation by Utilization of Private Sector

Regarding utilization of the private sector, the irrigation water fees are collected from the sugar beet farmers through the sugar company and the collection rate is high due to the payment mechanism. Of the irrigation facilities which are managed by ORMVAD, practical management work at the main facilities such as the pump stations, gates and pipelines is outsourced to the private sector and there are no major problems in terms of maintenance.

### Improvement of Technical and Financial Capabilities of ORMVAD

While training courses are provided to improve the technical capabilities of ORMVAD, it is assumed that it may be difficult to execute training plans in the long term under the financial constraints.

### Introduction of Water-saving Irrigation and Matching Support for Agricultural Production Activities

A pilot project and a project for the introduction of drip irrigation as a water-saving irrigation system have been executed by other donors and efforts to improve irrigation technology are being made. However, there are no activities to support or revitalize the irrigation association. There are also technical issues and problems to be solved in donors' pilot project as mentioned above.

### Revitalization of Irrigation Association

No particular support has been provided to the irrigation association and revitalization of its activities has not been promoted. It is necessary to reconsider the role of the irrigation association.

## **(3) Securing of Stability of Irrigation Project**

### Establishment of Self-supporting System of ORMVAD

ORMVAD uses the revenue from collection of the irrigation water fees for items related to execution of the project such as personnel costs, and revenue and expenditure are handled independently. However, it is not totally self-supporting because the budget of the Ministry of Agriculture and Fisheries is used for maintenance of the irrigation facilities.

### Usage of Water Fees

As mentioned above, the water rates were reviewed and are being changed to a new

mechanism. However, the scale of the water fee-related revenues is not clear and the detailed content of the costs is not clear either, so it is not clear to what extent operation and management can be achieved only with the irrigation water fees.

If the rates are set in such a manner that the costs for daily operation and maintenance can be covered only by the irrigation water fees, it is thought that the facilities will be maintained in a good condition in the long term. However, large-scale repairs of the facilities should be covered by the budget from the Ministry of Agriculture and Fisheries because they would involve high costs.

## **4. Conclusion, Lessons Learned and Recommendations**

### **4.1 Conclusion**

- There are no problems from the perspective that irrigation is available even for farm fields, the end canals are in place, and the facilities are not impaired in their function.
- The effectiveness of the project has been achieved to some extent; for instance, agricultural incomes are higher than before the execution of the project due to milk and sugar production, though some issues concerning agricultural productivity still remain: the cultivation rate in relation to the planned cultivation area is 70% these days and the yield per unit is around 80%.
- The reason why agricultural productivity has not improved is that sufficient irrigation water is not supplied due to strict water distribution adjustment which is made every year due to the absolute shortage of the volume of water resources for the dams. This makes it difficult to practice agriculture with the limited volume of water resources.

### **4.2 Recommendations**

The recommendations and future follow-up activities are as follows, based on the “Report on Detailed Design Study”. In addition, measures based on the following recommendations are being implemented through the technical cooperation project which started in July 2011.

#### **(1) Introduction of Water-saving Technologies**

The introduction of drip irrigation has enabled 20 - 30% water saving in the farm fields, resulting in a reduction in the burden of irrigation water fees on the farmers. Water saving could lead not only to saving of irrigation water fees but also to a possible increase in agricultural incomes through further implementation of irrigation using the saved water. This will eventually lead to promotion of the agricultural sector. Securing irrigation water for agriculture in summer will make it possible to grow highly profitable vegetables and fruits in summer, and therefore, improvement of agricultural incomes can be expected. In addition,



it is very attractive because it will make it possible to supply the products to new markets.

#### (2) Organizing Farmers

Judging from the situation of the irrigation association of the lower irrigation area which is outside of the site covered by the yen loan project, the farmers are highly reliant on the government, and the farmers in the irrigation association seem to have no intention of managing the water on their own. Therefore, provision of the running costs, offices, means of transportation, etc. are necessary for the organization activities of the farmers. These cost burdens may hinder the farmers from organizing and getting them to participate in organization activities. It is necessary to study how to effectively link the change in the attitude of the farmers who are users and the water management and irrigation water fee systems of the government.

#### (3) Long Life of Irrigation Facilities

The irrigation facilities in the upper irrigation area are around 10 years old, but the quality of construction has been ensured and the facilities are in a relatively good condition with no impediment to their functions. It is thought that not only the maintenance costs but also the irrigation water fee burden can be reduced by maintaining the functions of the facilities for a long time. As for financial support in the long term, it will be effective for the long life of the facilities, such as the canals, to transfer diagnostic and maintenance techniques.

### **4.3 Lessons Learned**

None

### Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1. Project Outputs		
Construction of irrigation facilities	18,901ha	As planned
Main canals	17.3km	As planned
Secondary canals	33.7km	As planned
Installation of water management system		As planned
Irrigation network	654km	703km
Drainage network	700km	676km
Farm roads	205km	193km
Land development	18,901ha	As planned
Drainage outside the area	75km	As planned
Milk collection facilities	21 places	Cancelled
2. Project Period	June 1996 – December 1999 (42 months)	June 1996 – September 2002 (75 months)
3. Project Cost		
Amount paid in Foreign currency	5,656 million yen	94 million yen
Amount paid in Local currency	12,408 million yen	16,996 million yen
Total	18,064 million yen	17,090.27 million yen
Japanese ODA loan portion	13,548 million yen	13,426 million yen
Exchange rate	1 dirham=11.0 yen	1 dirham=11.0 yen