

The Republic of Tunisia

FY2021 Ex-Post Evaluation Report of

Japanese ODA Loan Project

“Water-Saving Agriculture Project in Southern Oasis Area”

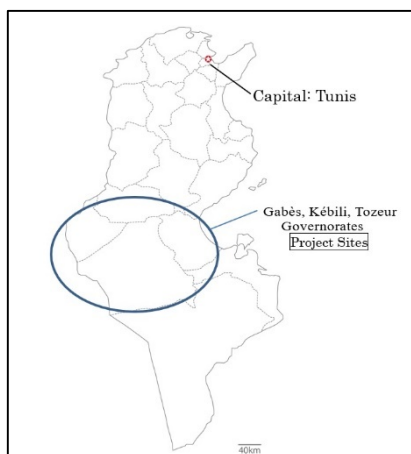
External Evaluator: Kenichi Inazawa, Octavia Japan, Co., Ltd.

## **0. Summary**

This project aimed to save water and secure stable irrigation water by developing terminal irrigation and drainage channel facilities in the oases in South Tunisia (Governorates of Tozeur, Gabes and Kebili), thereby contributing to an increase in agricultural production and environmental protection through the efficient use of water resources. Concerning relevance, this project is “consistent with the development plan” and “consistent with the development needs.” As for coherence, while it is “consistent with Japan’s ODA Policy,” in terms of “internal coherence” and “external coherence,” there was no concrete cooperation or overlap between projects, and thus, it cannot be said that this project had a synergistic effect. Based on the above, relevance and coherence are high. With regard to efficiency, while the outputs of this project increased (from 50 to 59 sites), the project period slightly exceeded the initial plan. Nevertheless, the project cost was lower than the initial plan, therefore, efficiency is high. The actual values of the effectiveness and quantitative effect indicators were around 70% of the target values. It is said that the development of facilities, such as terminal irrigation and drainage channels are contributing to the reduction and prevention of salt damage in the fields within the project areas. Concerning impacts, while production and the unit yield of each crop have not increased significantly, the production of a new crop (olive) has begun as a result of this project; it can be observed that this project has contributed to raising farmers’ awareness of water conservation and environmental conservation. Therefore, effectiveness and impacts are high. Regarding sustainability, although no major concerns exist, there are certain issues relating to the financial aspect and current status of the operation and maintenance system; therefore, sustainability is moderately low.

In light of the above, this project is evaluated to be satisfactory.

## 1. Project Description



Project Location  
(Source: JICA)



Developed Tertiary Channel  
(Hazoua CI in the Tozeur Governorate)

### 1.1 Background

South Tunisia is a dry area with annual rainfall of around 50 to 200 mm. Traditional oasis agriculture is practiced, and groundwater from the Continental Intercalary (CI) and terminal Complex (TC) Aquifer is pumped and used as irrigation water. Before the start of this project, almost 100% of the cultivated land was irrigated, although this is regarded as small-scale agriculture, in the Governorates of Gabes, Kebili and Tozeur, in South Tunisia. However, efficient irrigation agriculture that makes use of limited water resources was not established because of water leakage due to earth irrigation channels. As part of a project implemented previously, “Irrigation Perimeters Improvement Project in Oasis,” (L/A signed in 1996), irrigation water channels and drainage networks were constructed in irrigation areas, which were in need of urgent development, and as a result, the efficiency of irrigation water usage increased in the target areas (oases). On the other hand, to realize more efficient water-saving irrigation agriculture, there was an urgent need to save unrenowable resources through further the development of terminal irrigation and drainage channel facilities as well as expansion of the development area, so as to improve agricultural productivity and conserve water resources by effectively utilizing irrigation water.

### 1.2 Project Outline

The objective of this project is to save water and secure stable irrigation water by developing facilities such as terminal irrigation and drainage channels in the oases in South Tunisia (Governorates of Tozeur, Gabes and Kebili), thereby contributing to an increase in agricultural production and environmental protection through the efficient use of water and soil resources.

|  |  |
|--|--|
| Loan Approved Amount/<br>Disbursed Amount              | 5,260 million yen/4,339 million yen  |
| Exchange of Notes Date/<br>Loan Agreement Signing Date | March 30, 2007/March 30, 2007  |
| Terms and Conditions                                   | Interest Rate 1.5%<br>Repayment Period 25 years<br>(Grace Period 7 years)<br>Conditions for Procurement General Untied   |
| Borrower /<br>Executing Agency                         | The Government of the Republic of Tunisia/<br>Direction Générale du Génie Rural et de l'Exploitation<br>des Eaux, Ministère de L'Agriculture, des Ressources<br>Hydrauliques et de la Pêche (hereinafter referred to as<br>"DG/GREE")  |
| Project Completion                                     | January 2018   |
| Target Area  | South Tunisia<br>(Governorates of Gabes, Kebili and Tozeur)  |
| Main Contractor<br>(Over 1 billion yen)                | None which exceed 1 billion yen  |
| Main Consultants<br>(Over 100 million yen)             | STUDI (Tunisia), SCET Tunisie (Tunisia)  |
| Related Studies (Feasibility<br>Studies, etc.)         | Special Assistance for Project Formation (SAPROF),<br>JICA (March 2007)  |
| Related Projects                                       | [ODA Loan Projects]<br>- "Irrigation Perimeters Improvement Project in Oasis"<br>(L/A signed in 1996)<br>[Other International Organizations, Aid Agencies, etc.]<br>- "Water Sector Investment Project (Financial<br>Assistance)" (World Bank)<br>- "Comprehensive African Agriculture Development<br>Program" (USAID) |

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Kenichi Inazawa, Octavia Japan, Co., Ltd.

### 2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

|                              |  |
|------------------------------|--|
| Duration of the Study:       | November 2021–February 2023  |
| Duration of the Field Study: | No international travel was involved, and surveys were conducted remotely with a field survey assistant. |

### 2.3 Constraints during the Evaluation Study

#### (Remote Field Survey Utilizing a Field Survey Assistant)

Due to COVID-19, the external evaluator did not travel internationally for this study. With the local survey assistant, the external evaluator conducted the site visits remotely, collecting information/data and conducting interviews with the individuals concerned. The external evaluator analyzed the information collated so as to conduct evaluation analyses and make appropriate judgments.

#### (Evaluation Based on the Actual Situation Across the Visited Sites)

This project encompasses many sites (oases)—the total number of sites is 59, therefore, due to time constraints, not all sites could be visited during this study. Nineteen sites in total were visited: Faycel, Metouia, Mzira, Ouethref, Salem and Sboui in the Gabes Governorate (six sites), Ben Zitoun 1 and 2, Douz, El Golaa, Graad, Jemna, Ibnes and Zarcine in the Kebili Governorate (seven sites), Beni Ali, Draa Sud, Gherd गया, Hazoua 1, Ibn Chabbat 2 and Hazoua CI in the Tozeur Governorate (six sites). The effectiveness, impacts and sustainability of the project were analyzed by means of interviews, conducted during site visits with personnel at the Regional Agricultural Development Offices (Commissariats Régionaux au Développement Agricole, hereinafter referred to as “CRDA”), the Agricultural Development Associations (Groupements de Développement Agricole, hereinafter referred to as “GDA”)<sup>1</sup> and with farmers who were beneficiaries, as well as through site inspections.<sup>2</sup>

## 3. Results of the Evaluation (Overall Rating: B<sup>3</sup>)

### 3.1 Relevance/Coherence (Rating: ③<sup>4</sup>)

#### 3.1.1 Relevance (Rating: ③)

##### 3.1.1.1 Consistency with the Development Plan of Tunisia

Before the start of this project, the government of Tunisia formulated the *10<sup>th</sup> Economic*

<sup>1</sup> The institutional and organizational aspects of the CRDA and the GDA will be explained in 3.4.2 Institutional/Organizational Aspect.

<sup>2</sup> In addition to the CRDA in each Governorate (two to five people in each Governorate), a total of 20 staff of the GDAs and farmers under the GDA ( a total of 103 farmers, all male) were interviewed. Interviews with farmers were mainly group interviews. (As of the time of the ex-post evaluation, there were 16,983 beneficiaries in the oasis within the areas covered by this project, of which, 5,241 were in Gabes, 2,018 in Tozeur and 9,724 in Kebili. In the southern region’s oases, men are engaged in agriculture traditionally. The average age of farmers is around 60 years old).

<sup>3</sup> A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

<sup>4</sup> ④: Very High, ③: High, ②: Moderately Low, ①: Low

*Development Plan* (2002–2006). Regarding the agricultural sector, this plan stipulated the goal of improving national food self-sufficiency, while conserving the environment and increasing the yield of agricultural products through the development and maintenance of available land and water resources. In addition, the government formulated the *Water Resource Strategy (Eau 21)* to promote water resource conservation, aiming to reduce the total amount of irrigation water by saving water and reducing the amount of water required per unit area and by expanding the irrigation areas using the saved water. The same policy was carried over to the succeeding *11<sup>th</sup> Economic Development Plan* (2007–2011).

At the time of the ex-post evaluation, the government of Tunisia, through its *Five-Year National Development Plan* (2016–2020),<sup>5</sup> regarded the following as priorities: agricultural development in rural areas, income improvement for farmers and fishermen, the strengthening of the food security system, an improvement in productivity and competitiveness to attract new investments, and pursuing the sustainability of natural resources in the face of climate change. The plan indicates the importance of securing and conserving water resources and saving water not only for the purposes of rural development and agricultural policies, but also for mitigating the effects of climate change as far as possible.

Based on the above, emphasis was placed on the strengthening of the food security system, agricultural development in rural areas, securing and conserving water resources, saving water, etc. in Tunisia before the start of this project, as well as at the time of the ex-post evaluation. Therefore, the project relevance is confirmed with regard to policies and measures.

### 3.1.1.2 Consistency with the Development Needs of Tunisia

South Tunisia is a dry area with annual rainfall of around 50 to 200 mm. Traditional oasis agriculture is practiced, and groundwater from the Continental Intercalary Aquifer (CI) and terminal Complex (TC) is pumped and used as irrigation water. Water is supplied to farmland through the shallow wells from the Complex Terminal Aquifer, located at a depth of 60m–500m and through the deep wells from the Continental Intercalary Aquifer, located at a depth of 1,000 to 2,000m or more. Before the start of this project, in the Governorates of Gabes, Kébili and Tozeur in the southern region, almost 100% of the cultivated land was irrigated, albeit on a small scale. However, efficient irrigation agriculture that makes use of limited water resources was not established due to earth terminal irrigation canals. In the “Irrigation Perimeters Improvement Project in Oasis” (L/A signed in 1996), which was implemented prior to this project, the irrigation water channel and drainage networks were installed in 88 oases, where they were needed most

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<sup>5</sup> As of the time of the ex-post evaluation, due to the political circumstances in Tunisia, the next national development plan and other related plans are in the process of being formulated. The central government has begun drafting the new five-year plan, based on the content of the *Five-Year National Development Plan* (2016-2020), however, this may not be announced for some time.

urgently. As a result, the efficiency of irrigation water utilization has increased in the target areas (oases). On the other hand, in order to realize more efficient, water-saving, irrigated agriculture, an urgent need was recognized to save water through further expansion of the development area and the development of terminal irrigation and drainage channel facilities, i.e., to improve agricultural productivity and conserve water resources by effectively utilizing irrigation water.

At the time of the ex-post evaluation, the executing agency of this project, the DG/GREE, indicates that there is a need to renovate and modernize irrigation facilities, such as main and branch irrigation pipes, intake facilities and sluice valves in various parts of the country. The reason for this is that irrigation water pipes are getting old, not only in the southern region but also in other regions, and inefficient water use must be resolved. Apart from JICA projects, the DG/GREE is implementing the development and renovation of irrigated agricultural facilities through co-financing with the EBRD. This irrigation facility renovation project began in March 2021; around the target areas of this project, it covers a total of 2,300 ha in the Tozeur, Kebili, Gabes and Gafsa Governorates. In addition, projects aimed at the correct management of water demand and agricultural productivity are being considered in the Tozeur, Kebili, Kairouan and Sidi Bouzid Governorates. It is expected that these will establish an efficient irrigation system and improve agricultural productivity.

Based on the above, efforts to improve, renovate and modernize irrigation facilities have been implemented and are being considered throughout Tunisia, including the southern region, before the start of this project, as well as at the time of the ex-post evaluation. Therefore, this project is consistent with the development needs.

### 3.1.2 Coherence (Rating: ②)

#### 3.1.2.1 Consistency with Japan's ODA Policy

Before the start of this project, the *Country Assistance Plan for Tunisia* (October 2002), formulated by the Ministry of Foreign Affairs, listed the following important sectors and themes: (1) raising the level of industry, (2) developing and managing water resources and (3) the environment. Concerning the aforementioned developing and managing water resources (2), it was stated as follows: "Japan will utilize its experience and technical capabilities to support not only the development of water sources but also comprehensive water resource management, including water supply and demand management and surface water/groundwater management. In particular, consideration will be given from the perspective of promoting underdeveloped regions and poor areas." In addition, the *Medium-Term Strategy for Overseas Economic Cooperation Operations* (April 2005), formulated by JICA, considered "a foundation for sustainable growth", "global issues", "poverty reduction," etc. as priority areas.

This project is in line with the priority sectors and the assistance policy with regard to the issue identified in the *Country Assistance Plan for Tunisia* (i.e., (2) developing and managing water

resources). In addition, this project aimed to develop and manage scarce water resources, which was a development issue, while tackling a priority area of establishing “a foundation for sustainable growth,” stipulated in the *Medium-Term Strategy for Overseas Economic Cooperation Operations*. Therefore, the project is in line with Japan’s ODA policy.

### 3.1.2.2 Internal Coherence

Before this project began, JICA extended an ODA loan for the “Irrigation Perimeters Improvement Project in Oasis” (the L/A was signed in 1996, and the project was completed in 2005). During the project preparation, around 150 sites were to be included, however, the estimated project budget was excessive, and the original budget eventually deemed as insufficient. For this reason, sites were selected in the order of relative priority of rehabilitation of terminal soil channels for irrigation and drainage maintenance; around 88 sites from four Governorates of Tozeur, Gabes, Kebili and Gafsa were concerned. As a successive project to the aforementioned project, 50 sites were selected for this project from the three Governorates of Gabes, Kebili and Tozeur, where the need and urgency for the development of terminal irrigation and drainage channels were recognized (however, this was later changed to 59 sites, as described in the section 3.2.1 Project Outputs under Efficiency). It can be said that these two projects were mutually complementary from the viewpoint of establishing a stable supply of irrigation water and the conservation of groundwater sources across the entire southern region. However, they were implemented at different times, and thus, it cannot be stated that direct cooperation and synergistic effects were created.

### 3.1.2.3 External Coherence

Before the start of this project, the World Bank provided support for irrigation and water supply through its “Water Sector Investment Project,” and USAID assisted the agricultural sector through its “Comprehensive African Agriculture Development Program” in Tunisia. At the time of the ex-post evaluation, several donors (the World Bank, the Reconstruction Credit Institute (KfW), the African Development Bank (AfDB) and the European Bank for Reconstruction and Development (EBRD)) are providing support in similar sectors nationwide.

For example, the government of Tunisia is developing and renovating irrigation agriculture facilities across a total area of 23,000 ha mainly in the north of the country by co-financing<sup>6</sup> with the World Bank. In addition, the Tunisian government is implementing the “Integrated Water Resource Management Project,” which aims to conserve the environment in Mornag in Ben Arous Governorate, by co-financing<sup>7</sup> with KfW. However, these projects do not collaborate or overlap

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<sup>6</sup> The budget scale equates to 410 million Tunisian dinars from the Tunisian government and a loan of US\$ 140 million from the World Bank.

<sup>7</sup> The budget is 45.5 million Tunisian dinars.

with this project, and it cannot be maintained that synergy has been created.

In relation to the international framework, this project is considered to be in line with one of the Sustainable Development Goals (SDGs), “2.End hunger, achieve food security and improved nutrition and promote sustainable agriculture,” in a sense that it aimed to increase food production and improve farmers’ incomes, thereby contributing to the strengthening of food security.

<Summary of Relevance and Coherence>

This project is “consistent with the development plan” and “consistent with the development needs.” Regarding coherence, it is “consistent with Japan’s ODA policy.” On the other hand, while “internal coherence” and “external coherence” are in a mutually complementary relationship, there is no specific cooperation or overlap between the projects, thus, it cannot be claimed that synergistic effects have been created. Therefore, its relevance and coherence are high.

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

This project renovated and developed the irrigation and drainage facilities in the Gabes, Kebili and Tozeur Governorates. Table 1 shows the plan and the actual outputs of this project. In addition, a list of project areas is shown at the end of this report.

Table 1: Planned and Actual Outputs of This Project

| Plan (at the time of the appraisal: 2007)  | Actual (at the time of the ex-post evaluation: 2021–2022)   |
|--|---|
| 1) Civil Engineering Work, Procured Equipment, etc.<br>Development of the terminal irrigation and drainage channels, etc. (50 oasis sites), procurement of vehicles, etc.  | 1) Civil Engineering Work, Procured Equipment, etc.<br>Development of the terminal irrigation and drainage channels, etc. (59 oasis sites, a total irrigated area of 8,645 ha <sup>8</sup> ), procured vehicles: <u>6</u> |
| 2) Consulting Services<br>New detailed design of irrigation and drainage works, review of the existing detailed design, tendering assistance, construction supervision (progress management, report preparation, etc.) | 2) Consulting Services<br>→ <u>Implemented almost as planned.</u>   |

Source: JICA’s documents (at the time of the appraisal), Project Completion Report, answers to the questionnaire and interviews (at the time of the ex-post evaluation).

The differences between the plan and actual outputs, shown in Table 1, are explained below.

<sup>8</sup> Total irrigated area at the time of the ex-post evaluation. The data is actual figures cited from Project Completion Report.



## 1) Civil Engineering Work, Procured Equipment, etc.

The plan at the time of the appraisal was to develop 50 sites, which became 59 sites in reality. This is because the urgency and necessity of six sites in the Gabes and Tozeur Governorates were considered<sup>9</sup> when the initial plan was reviewed at the time of the detailed design after the start of this project, therefore, they were selected as additional sites (50 + 6 = 56 sites). Subsequently, the CRDA of the Kebili Governorate submitted a request to the DG/GREE to include three sites<sup>10</sup> within the Governorate as project sites as they were in urgent need of support. In view of this, the DG/GREE submitted a request to JICA. Based on this request, the construction supervision consultant of this project investigated and examined the feasibility of the three sites. As it was judged that there should be no issue in starting construction work, the number of project sites increased from the initial plan (50 + 6 + 3 = 59 sites). At the project sites, the development of terminal irrigation channels (including the concrete lining), the installation and replacement of drainage pipes, the removal of sediment from the drainage channels, the development of drainage pumping stations,<sup>11</sup> etc. were carried out. In addition, a total of six vehicles were deployed: one at the DG/GREE headquarters, two at the CRDA in the Tozeur Governorate, two at the CRDA in the Kebili Governorate and one at the CRDA in the Gabes Governorate.

## 2) Consulting Services

Consulting Services were implemented almost as planned. As discussed above, while project sites were added, the initial terms of reference (TOR) included the new detailed design for irrigation and drainage works and a review of the existing detailed design, thus, it can be maintained that the task was performed as planned. (In other words, as the TOR were set with a view that the number of sites might increase or decrease after the start of the project, no major additional work occurred).

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<sup>9</sup> Six sites: Zerkine young, Zrig old and Zarat 1 in the Gabés Governorate and Hazoua CI, Ettâamir and Oudia 1-2 in Tozeur Governorate.

<sup>10</sup> Three sites: Bchelli, Zaafrane and Dhomrana.

<sup>11</sup> Drainage pumping stations were only developed across seven sites where the situation was particularly urgent.



Source: Special Assistance for Project Formation (SAPROF) Report

Figure 1: Locations of Project Sites

### 3.2.2 Project Inputs

#### 3.2.2.1 Project Cost

The total project cost planned at the time of the appraisal was 7,030 million yen (of which the ODA loan was 5,260 million yen); the actual total cost was 6,065 million yen (of which the ODA loan was 4,339 million yen), which was lower than planned (approximately 86% of the plan). When the average exchange rate during the project implementation was applied, the actual project cost was 5,206 million yen (approximately 74% of the plan).<sup>12</sup> As a matter of fact, other than

<sup>12</sup> This is the case when applying the average exchange rate during the project implementation (1 Tunisian dinar = 53.55 yen), while the exchange rate at the time of appraisal was 87.9 yen. According to the DG/GREE, “Although the number of target sites increased after the start of the project, the impact of the exchange rate was sufficient to cover the

exchange rate fluctuations, no particular factors affecting the increase or decrease in the project cost were observed during the implementation of this project. Since it is realistic to make a judgment after calculating the actual amount without considering the exchange rate fluctuations, it can be concluded that the total actual amount is 6,065 million yen (approximately 86% of the plan) by applying the exchange rate at the time of the appraisal (1 Tunisian dinar = 87.9 yen).

#### 3.2.2.2 Project Period

At the time of the appraisal, the project was planned to run from March 2007 to December 2016, a duration of nine years and 10 months (118 months).<sup>13</sup> However, the actual duration was from March 2007 to April 2019, a period of 12 years and two months (146 months) which was approximately 124% of the initial plan. The main reasons for the delay were as follows, a) while the selection of a construction supervision consultant was carried out around the time of the start of the project, the procurement and contract procedures required more time; b) the Jasmine Revolution (Arab Spring)<sup>14</sup> occurred in 2010–2011 after the consultant had begun the work, therefore, the detailed design (site confirmation/investigation), security/safety assurance, on-site adjustments, etc. required additional time, delaying the start of the construction period; and c) the tendering procedure for the contractors required time (e.g., bids were made by contractors who did not meet the qualifications and the procedure had to be repeated), and in particular, the start date of the construction work was significantly delayed as regards the terminal irrigation and drainage channel facilities of the Tozeur Governorate site (Fatnassa) (as the contractor was finally appointed at the 4th re-bidding stage).

It is appropriate to consider the period of turmoil relating to the Jasmine Revolution as an external factor in this ex-post evaluation. The period of one year and one month (13 months), from December 2010 (at the time of the outbreak of riots and large-scale anti-government demonstrations) to December 2011 (at the time of the establishment of the coalition government and the election of the new president), will be considered as a delay in the project progress due to external factors.<sup>15</sup> Specifically, it can be said to have been directly affected by the timing of the bidding and procurement, thus, the decision of excluding this period is considered to be realistic and accurate. Therefore, while the actual period was approximately 124% of the plan, as previously mentioned, it was considered desirable to exclude the aforementioned period (13

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construction cost (additional cost). There was a time when the Tunisian dinar was fluctuated sharply (depending on the timing of the construction). As a result, the total project cost was held down due to the influence of exchange rates.”

<sup>13</sup> At the time of the appraisal, the completion of this project was defined as “at the time of completion of construction and renovation of the terminal and drainage channel facilities, etc., and the time when they are put into service”

<sup>14</sup> High unemployment rates, soaring prices and the resultant public dissatisfaction led to demonstrations and rioting. Anti-government protests spread nationwide, and President Ben-Ali subsequently went into exile in Saudi Arabia.

<sup>15</sup> The reasons for recognizing this as an external factor include “it was not an event that occurs continuously or frequently in the project area” and “it was not assumed as a risk at the time of the appraisal.” (Source: JICA Ex-Post Evaluation Reference 2021).

months) and calculate the actual period as 133 months (= 146 - 13 months). The actual period was determined to be 133 months compared to the planned 118 months, or approximately 113% of the delay compared to the plan, the project period slightly exceeded the plan.

### 3.2.3 Results of Calculations for Internal Rates of Return (Reference only)

#### Economic Internal Rate of Return (EIRR), Financial Internal Rate of Return (FIRR)

The EIRR was calculated to be 10.6% at the time of the appraisal, considering the increase in yields of agricultural products as a “benefit,” the project cost and the operation and maintenance expenses as “costs” and a project life of 25 years. The FIRR was calculated to be 0.6%, considering the revenue from services as a “benefit,” the project cost and the operation and maintenance expenses as “costs” and a project life of 25 years. In this evaluation study, at the time of the ex-post evaluation, recalculation was attempted using the same conditions at the time of the appraisal, however, accurate numbers could not be calculated. This is because a) it was difficult to confirm the basis for the EIRR and FIRR calculations relating to the number of project sites planned at the time of the appraisal (50 sites), and b) as it was difficult to confirm the calculation basis used when the number of project sites changed (the initial plan of 50 sites was changed to 59 sites) during the project implementation, the actual values for the “yields of agricultural product” (EIRR) and the “revenue from services” (FIRR) could not be calculated. However, there is a high possibility that the rates would not fall below the figures calculated at the time of the appraisal (EIRR: 10.6%, FIRR: 0.6%), considering that the actual project cost, which accounts for a large proportion of the “cost,” is held down by fluctuations in exchange rates, etc. and assuming that with the increase in the number of project sites the generated benefits have not decreased.

#### <Summary of Efficiency>

As discussed above, while the outputs of this project increased (from 50 to 59 sites), the project period slightly exceeded the initial plan, and the project cost was lower than the initial cost. Therefore, efficiency of the project is high.



Photo 1: Developed Drainage Channel  
(Tabaga in Kebili Governorate)



Photo 2: Procured Vehicle  
(CRDA in the Tozeur Governorate)

### 3.3 Effectiveness and Impacts<sup>16</sup> (Rating: ③)

#### 3.3.1 Effectiveness

##### 3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

In this project, by developing terminal irrigation, drainage channels, etc., conserving water and securing stable irrigation water were expected as project effects. While taking into account the fact that the number of oasis sites increased from 50 in the original plan at the time of the appraisal to 59 after the change, as previously mentioned, Table 2 shows the quantitative effect indicators (baseline, target, actual values). (Four indicators were set at the time of the appraisal: “irrigation area,” “cropping intensity,” “irrigation interval” and “irrigation water-carrying efficiency.” The target year was set to 2018 (two years after project completion). As the actual completion year was 2019, the data two years on from that date, i.e., the actual data from 2021 were collected. An analysis of each indicator will follow the table.)

Table 2: Quantitative Effect Indicators of This Project (Baseline, Target, Actual values)

| Indicator                            | Baseline value<br>(2007 Actual value)  | Target value<br>(2018: Two Years After<br>Completion)  | Actual value<br>(2021: Two Years After<br>Completion)  |
|--------------------------------------|--|--|--|
| 1) Irrigation Area (ha)<br>*Note 1   | 9,265<br>(*66 oases were targeted)<br><br>Reference value: 7,427<br>(*Sum of 50 oases)<br>Reference value: 8,646<br>(*Sum of 59 oases) | 9,265<br>(*66 oases were targeted)<br><br>Reference value: 7,427<br>(*Sum of 50 oases)<br>Reference value: 8,646<br>(*Sum of 59 oases) | 8,645<br>(*Actual is 59 oases<br>Breakdown: 3,124<br>(Gabes), 2,872 (Kebili),<br>2,649 (Tozeur)) |
| 2) Cropping Intensity (%)<br>*Note 2 | 140  | 160  | 141 (Gabes)<br>150 (Kebili)  |

<sup>16</sup> When providing the sub-rating, Effectiveness and Impacts are to be considered together.

|   |      |      |  |
|---|------|------|--|
|   |      |      | 140 (Tozeur)                                     |
| 3) Irrigation Interval (days) *Note 3               | 6–60 | 6–35 | 19–22 (Gabes)<br>15–35 (Kebili)<br>5–14 (Tozeur) |
| 4) Irrigation Water-Carrying Efficiency (%) *Note 4 | 46   | 68   | 70 (Gabes)<br>80 (Kebili)<br>68 or more (Tozeur) |

Source: JICA's documents (baseline and target values), Project Completion Report, answers to the questionnaire and interviews (actual values).

Note 1: This indicates the total area in which terminal irrigation and drainage channels were developed. The actual value is the sum of the 59 oases.

Note 2: This indicates the farmland utilization rate. It is calculated by dividing the area planted with crops by the total farmland area. If the figure is more than 100%, this means that cropping is carried out more than once per year. The actual value is the average in each Governorate.

Note 3: This indicates the number of days between irrigations (water supply interval). Intermittent irrigation is a method of alternately irrigating and drying the field for several days during crop growth. Oxygen is supplied to the roots by drying the soil surface, which has the effect of adjusting the amount of fertilizer absorbed. The actual value is the average for the 59 oases.

Note 4: This shows to what extent (percentage) the irrigation water reaches the field. It is calculated by dividing the planned water intake by the actual amount of water reaching the field. The actual value is the average across the 59 oases.

## 1) Irrigation Area

According to JICA's document, the 9,265 ha, which was both the baseline value and the target value set at the time of the appraisal, was "the total area of 66 sites that were selected as candidates at the project appraisal stage." Similarly, JICA's document stipulated the plan: "In this project, drainage and irrigation works will be carried out at 50 sites selected from 66 candidate oasis sites. Through the consulting services, the detailed design will be reviewed for oases from the 66 sites." Therefore, while the baseline and target values (9,265 ha) were for the sum of the 66 sites, as shown in Table 3, the accurate target value was 7,427 ha for the 50 sites.<sup>17</sup> In any case, the target value and the actual value are compared based on the fact that the number of target oasis sites increased to 59 sites. The comparison of the target value (8,646 ha) and the actual value (8,645 ha) for the 59 sites shows that the result was as planned.

## 2) Cropping Intensity

The actual value has not reached the target. According to those involved in the project, such as the DG/GREE and CRDA, the target was not reached because in 2021, (1) some oases<sup>18</sup> did not proceed with planting, as there were a certain number of farmers who went through land inheritance procedures; (2) operation costs such as fertilizer, seedlings and labor costs increased, and some farmers could not plant; and (3) cropping did not progress due to significant changes in

<sup>17</sup> At the time of the appraisal, 50 sites had not yet been selected but were planned to be decided at the time of detailed design. It is thus presumed that there was no choice but to list the value for the 66 sites (9,265 ha).

<sup>18</sup> Remada, Fatnassa and Beni Ali in the Tozeur Governorate.

climate and temperature.<sup>19</sup> These factors are not highly correlated with this project (development of terminal irrigation and drainage channel facilities, etc.), so they are considered factors that cannot be controlled within the scope of the project. Under the condition that the irrigation facilities have been developed and renovated through this project and the conditions for cropping have been met, and as long as these factors do not occur, it is inferred that cropping proceeds smoothly and the cropping intensity is high.

### 3) Irrigation Interval

The irrigation interval indicates the water supply interval. At the time of the appraisal, the irrigatable amount was insufficient for the optimum amount of water required for each crop. Through this project, it was necessary to increase the irrigation water-carrying efficiency, to spread irrigation water to areas where irrigation water had been difficult to reach, and to meet the water demand necessary for crops taking into account the shortened water supply intervals (baseline value: six to 60 days, target value: six to 35 days). Regarding the actual values, the CRDA in each Governorate commented, “Taking the 15–35 days interval as an example, it shows that irrigation can be done in 15 days at the shortest and in 35 days even in the worst case (at the longest)” and “The shorter interval of the irrigation shows that water is distributed efficiently.” The “longest supply interval” which took up to 60 days before the start of the project, has decreased. This can be considered as an effect of this project. However, the “shortest supply interval” has increased in some cases: the baseline value of six days vs. the actual value of 19 days in the Gabes Governorate; and the baseline value of six days vs. the actual value of 15 days in the Kebili Governorate. The target was not achieved in the Gabes Governorate; the reason was that while most of the oases reached the target value, at two oases (Bechima 1 and Bechima 2) under this Governorate, the shortest supply interval became longer due to the decrease in the water resource flow rate and the depletion of aquifers (available water sources are decreasing). The situation in the Kebili Governorate is similar; the illegal drilling of wells by certain farmers around farmlands has resulted in further withdrawal of water from the Complex Terminal Aquifer, exacerbating the reduction of water sources.<sup>20</sup> Based on the above, it can be said that the irrigation interval is greatly affected by the water resources around farmlands and the usage of wells.<sup>21</sup>

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<sup>19</sup> According to the DG/GREE, the actual value of the previous year (2020) was higher than that of 2021.

<sup>20</sup> As a result, it is highly likely that the amount of water intake from wells that have been in use since before the start of this project has decreased.

<sup>21</sup> Prior to the start of this project, it was already confirmed that there were concerns regarding the amount of water in the deep wells, even in the oasis, where the irrigation interval was short. It was also pointed out that the amount of irrigation water might decrease in the future and the irrigation interval could increase. Although those involved in the project explained this situation to the farmers (beneficiaries), this may not have been sufficient. For this reason, it might have been necessary to conduct awareness-raising activities and provide explanations regarding the use of limited water resources and the aims of the project.

#### 4) Irrigation Water-Carrying Efficiency

The target value has been exceeded, which can be regarded as the effect of the development and renovation of terminal irrigation and drainage channels, etc. as part of this project.

##### 3.3.1.2 Qualitative Effects (Other Effects)

###### (Reduction and Prevention of Salt Damage Through the Development of Terminal Irrigation and Drainage Channels)

As discussed above, water within the project areas is taken from the shallow wells or deep wells of the Complex Terminal Aquifer, located at a depth of 60m–500m, and the Continental Intercalary Aquifer, located at a depth of more than 1,000m to 2,000m and more; water is distributed to farmlands through irrigation channels. The salinity of the two fossil aquifers varies with depth, with the former being approximately 5g/liter and the latter being approximately 2.5g/liter.<sup>22</sup> Since there is a risk of salt absorption in fields and crops, it is desirable to take water from deeper aquifers. Therefore, in order to prevent salt from remaining on the surface layer of the soil, it is important to improve the drainage channel and properly treat the wastewater at the outlet. As mentioned earlier, the implementation of this project has increased irrigation water-carrying efficiency. Stable water distribution is realized through the irrigation water channels, and the water intake from deep aquifers (aquifers with low salinity) is increasing. According to interviews with the CRDA in each Governorate, comments such as the following were received: “The retention of water has improved, and the growth of palm trees near irrigation channels and fields has improved” (CRDA in Tozeur Governorate); “After completion, salt damage has decreased. Especially in the Ghannouch oasis and the El Hamma oasis, a network of drainage channels was constructed nearby, and after the construction, the salt damage that had been observed until then disappeared. It is thought that it is the effect of this project”; “In addition to the development of terminal channels, cleaning the existing drainage facilities and removing sediments are keeping the salt damage to a minimum” (CRDA in Kebili Governorate). Based on the above, it can be inferred that this project has a high possibility of contributing to the reduction and prevention of salt damage to the fields and crops around the target areas.

##### 3.3.2 Impacts

###### 3.3.2.1 Intended Impacts

###### (Contribution to Improving Agricultural Productivity Through Efficient Use of Water and Soil Resources)

This project was expected to improve agricultural productivity in the target areas by saving water and securing the stable supply of irrigation water. Table 3 shows the quantitative effect

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<sup>22</sup> (Reference information)The salinity standard is recommended to be below 2.0g/liter nationally and 2.5g/liter for the southern region.



indicators (baseline and target values) of the production volume of major crops and the yield of major crops per unit area, and Table 4 shows the actual values.

Table 3: Quantitative Effect Indicators of the Production Volume of Major Crops and the Yield of Major Crops per Unit Area (Baseline and Target values)

| Indicator   | Baseline value<br>(2007 Actual value) |            |              | Target value<br>(2018) |            |              |
|---|---------------------------------------|------------|--------------|------------------------|------------|--------------|
|   | Date Palm                             | Feed Crops | Pomegranates | Date Palm              | Feed Crops | Pomegranates |
| 1) Production Volume of Major Crops (ton)<br>*Note      | 63,455                                | 53,764     | 2,394        | 83,817.5               | 74,315     | 3,843        |
| 2) Yield of Major Crops Per Unit Area (ton/ha)<br>*Note | 8.9                                   | 37.9       | 3.8          | 12.1                   | 55.0       | 6.1          |

Source: JICA's documents (baseline and target values).

Note: The values of pomegranates are only from the Gabes Governorate.

Table 4: Quantitative Effect Indicators of the Production Volume of Major Crops and the Yield of Major Crops Per Unit Area (Actual Values of Two Years After Completion)

| Indicator   | Actual value (2021)  |   |                       |                        |
|---|--|---|-----------------------|------------------------|
|   | Date Palm  | Feed Crops  | Pomegranates          | Olives                 |
| 1) Production Volume of Major Crops (ton)<br>*Note      | Total: 65,305<br>(Tozeur: 21,255, Gabes: 20,050, Kebili: 24,000) | Total: 57,340<br>(Tozeur: 6,750, Gabes: 25,590, Kebili: 25,000) | 2,479<br>(Gabes only) | 33,000<br>(Gabes only) |
| 2) Yield of Major Crops Per Unit Area (ton/ha)<br>*Note | Tozeur: 8.0, Gabes: 4.0, Kebili: 9.0                             | Tozeur: 45.0, Gabes: 30.0, Kebili: 36.0                         | 6.7<br>(Gabes only)   | 7.6<br>(Gabes only)    |

Source: Answers to the questionnaire and documents provided by the CRDA in each Governorate (actual values).

Note: Among the crops, the values for pomegranates and olives are only from the Gabes Governorate.

Neither the production volumes of date palm, feed crops and pomegranates nor the yield of these major crops per unit area reached the target values. It can be said there was not much change from the baseline values (2007). The reasons are as follows: 1) in recent years, labor costs, fertilizers and material prices have risen, and some farmers have postponed planting; 2) production in recent years has been affected by phenomena such as rising temperatures, drying and rainfall decrease; and 3) recently, Tunisia and neighboring Algeria have been affected by an outbreak of the Bufaroua, a kind of *Oligonychus Afrasiaticus*,<sup>23</sup> which has particularly affected the growth of date palm.<sup>24</sup> Meanwhile, through the development of terminal irrigation and drainage channels, etc. as a consequence of this project, the water intake from deep aquifers, with relatively low salinity, has progressed, and water is distributed to fields through the developed irrigation

<sup>23</sup> It is also called Ghobar.

<sup>24</sup> This starts to affect growth before the fruit matures. It has the characteristic of surrounding the fruit with a thin net that catches grains of sand carried by the wind, thereby inhibiting growth.

channels. As a result, the water distribution management function has become stable,<sup>25</sup> which contributes to the reduction and prevention of salt damage in the fields, as well as maintaining the quality of agricultural products. The CRDA and GDA in each Governorate were interviewed and commented as follows: “Had this project not been implemented, the salt damage in the fields would have increased and continued, and the yield would have been greatly affected. While it is believed that there are increasing cases of illegally dug wells by farmers, they could only dig from shallow aquifers with relatively high salinity, which may have resulted in crops being planted with high-salinity water, leading to reduced production and lower quality.” The production of date palm, feed crops and pomegranates, and the yield of major crops per unit area have not increased significantly, however, the production of olives has begun in the Gabes Governorate. In addition, the production of vegetables, such as carrots, turnips and onions, is increasing.<sup>26</sup> According to the CRDA in the Gabes Governorate, “Vegetable production was not planned before the start of this project. In recent years, crop production has been diversifying.” This is one example of how the project has stabilized water distribution, diversifying production in the fields.

Based on the above, impacts, in terms of the production of crops and the yield of major crops per unit area, were not as high as expected at the time of the appraisal; cases of a significant increase in farmer income could not be confirmed. Meanwhile, although it is difficult to measure the actual situation quantitatively, it can be said that the developed terminal irrigation and drainage channels contribute to the maintenance of oasis agriculture, providing stable water distribution and soil stability and an improvement in the target areas.



Photo 3: Farmland  
(Beni Ari in the Tozeur Governorate)



Photo 4: Salt Damage Observed in the Area  
Adjacent to the Target Oasis  
(Suburbs of Ibnes in the Kebili  
Governorate, Not Covered by This Project)

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<sup>25</sup> As discussed above, an improvement in the irrigation water carrying efficiency demonstrates the reality.

<sup>26</sup> Of the 3,124 ha of the irrigated area of the oasis covered by this project, 959 ha, or more than 30%, are planted with vegetables at the time of the ex-post evaluation. The vegetable planted area in the entire Gabes Governorate is 7,470 ha, which accounts for approximately 13% of the vegetable production area.

(Raising Awareness of Water Conservation Among Farmers, Contribution to Environmental Conservation)

When interviewing the CRDA in each Governorate regarding the farmers' awareness of water saving, the following comments were received: "Although there was no educational activity on water saving for farmers in this project, we believe that farmers are turning their attention to water resource conservation through the development and improvement of irrigation systems in the target areas. Considering the situation before and after the start of the project, we believe that they appreciate the stable water distribution" and "Farmers are paying more attention to water resource use and environmental issues." The interviews with farmers (beneficiaries)<sup>27</sup> confirmed that the level of satisfaction with this project is generally high. The farmers commented as follows: "The developed terminal channels rarely have leakage, and I think the project is contributing to water conservation" and "I think it is also a means of counteracting the decrease in the amount of water in the aquifers. The developed drainage facilities will lead to the improvement of wastewater treatment, which will result in the reduction of salt damage risk in the fields."

Regarding environmental conservation, the CRDA in each Governorate commented during the interviews: "As this project did not improve the entire irrigation system but only terminal channels in the target area, the impact on water conservation and water resources may be limited. Nevertheless, after the completion of the project, the distribution of irrigation water has become steady, and I think the environmental conservation of the entire region is progressing" (CRDA in the Gabes Governorate); "We think the incidence of localized water retention and water logging (events that cause the saturation of soil pores due to relatively long retention of water<sup>28</sup>) is decreasing due to the improved management of irrigation water. A certain number of farmers must have been inspired by the implementation and management of water-saving projects like this one. I think there is a growing awareness of the use of irrigation water and water resources" (CRDA in the Tozeur Governorate); and "Mosquitoes are decreasing due to reduced water retention. I also think the bad smell has gone" (CRDA in the Kebili Governorate). Based on the above, it is inferred that this project contributes to the promotion of farmers' understanding of water resource utilization and the maintenance of environmental conservation in the region.

### 3.3.2.2 Other Positive and Negative Impacts

#### 1) Impacts on the Natural Environment

This project does not correspond to the characteristics liable to cause adverse environmental impact or sensitive areas susceptible to the impact listed in the *JBIC Guidelines for Confirmation*

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<sup>27</sup> Group interviews were conducted with a total of 103 farmers (36 from the Gabes Governorate, 42 from the Kebili Governorate and 25 from the Tozeur Governorate) at 19 of the oasis sites visited. Most of them were small-scale farmers.

<sup>28</sup> Anoxic phenomena that disturb soil fauna and vegetation.

*of Environmental and Social Considerations* (enacted in April 2002). Consequently, an undesirable environmental impact is judged to be insignificant, therefore, the project is classified as Category B. Concerning environmental permits, according to Tunisian domestic law, it was not mandatory to prepare an environmental impact assessment report.

It was confirmed through the questionnaire and interviews with the DG/GREE and CRDA in each Governorate, as well as site inspections, that there was no particular impact on air pollution, water quality, noise/vibration or the ecosystem during the project implementation and after its completion. In addition, no mitigation measures have been implemented in relation to the natural environment, and no complaints have been received from residents living around the target areas. In principle, water is taken from deep confined groundwater in the project areas, and water pollution had not been confirmed by the time of the ex-post evaluation.<sup>29</sup>

Regarding environmental monitoring, the DG/GREE headquarters is in charge of the environmental aspects of all irrigation projects in the country, and the CRDA in each Governorate is in charge of the practical aspects. However, the CRDA does not have a particular department, and regular environmental monitoring of the developed irrigation facilities has not been carried out by the time of the ex-post evaluation. As discussed above, this is because there has been no negative impact on the environment. In case any problem arises, the CRDA has a system to deal with the issue through consultation and cooperation with the local organizations of the Ministry of the Environment.

## 2) Resettlement and Land Acquisition

Land acquisition and resettlement were not anticipated in this project at the time of planning, and neither did they actually occur.

## 3) Gender Equality, Marginalized People, Social Systems and Norms, Human Well-being and Human Rights

This project aimed to secure stable irrigation water in South Tunisia and contribute improving agricultural productivity through the efficient use of water resources. Although cases in which this project had a direct impact on gender, the realization of equality, social system norms and people's well-being were not observed, the improvements in agricultural productivity and stable food supply seem to benefit many farmers and their families (including those who are vulnerable), providing them with more life choices and generating phenomena that lead to their well-being. This project is considered to be playing a role in this regard.

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<sup>29</sup> Withdrawing water from deep aquifers poses very little risk of contamination along the way, and the process of distributing water to fields carries similarly little risk.

### <Summary of Effectiveness and Impacts>

Regarding the achievement rate of effectiveness and quantitative effect indicators, 1) the irrigated area is approximately 100% when the target (8,646 ha) for 59 oases is compared with the actual value (8,645 ha), 2) the cropping intensity is approximately 20%, 3) the irrigation interval is about 60%, and 4) the irrigation water-carrying efficiency is over 100%. The average of these is calculated to be approximately 70%. With regard to qualitative effects, it is said that the development of the terminal irrigation and drainage channel facilities as part of this project has contributed to the reduction and prevention of salt damage. As for the impacts, although the production of each crop and the yield of major crops per unit area have not increased significantly, the interviews have confirmed that the production of a new crop has started, that farmers have raised their awareness of water conservation and that the project has contributed to environmental conservation. Therefore, it can be said that the expected outcome and impacts of the implementation of this project were achieved mostly as planned. There has been almost no negative impact on society (including human rights and gender equality), the environment and the economy in the long term. Therefore, effectiveness and impacts of the project are high.



Photo 5: Farmland  
(Mzira Ghannouch in the Gabes  
Governorate)



Photo 6: Date Palm Damaged by  
*Oligonychus Afrasiaticus*  
(El Oudia 2in the Tozeur Governorate)

### 3.4 Sustainability (Rating:②)

#### 3.4.1 Policy and System

The *Five-Year National Development Plan*, formulated by the Tunisian government, lists the following as priorities: agricultural development in rural areas, income improvement for farmers and fishermen, strengthening of the food security system, improvement in productivity and competitiveness to attract new investments, and pursuing the sustainability of natural resources in the face of climate change. The importance of securing and conserving water resources and saving water is highlighted not only for the purposes of rural development and agricultural

policies but also for mitigating the effects of climate change as far as possible. Under such circumstances, this project contributes to the country's policies related to the agricultural sector and is in line with the policy and direction of the Tunisian government at the time of the ex-post evaluation.

#### 3.4.2 Institutional/Organizational Aspect

The executing agency is the DG/GREE. Concerning the maintenance of irrigation facilities, including the terminal irrigation and drainage channels developed by this project, the CRDA in each Governorate, which is a local organization of the Ministry of Agriculture, has clarified the roles of relatively large-scale maintenance and repairs. In addition, in each Governorate, there are GDAs that are responsible for relatively small-scale daily maintenance and repair work. The CRDA and the GDA carry out maintenance and repairs based on an agreement; they work in cooperation with one another. Although there are certain differences depending on the scale of the organization, the CRDA in each Governorate is responsible for the operation and maintenance of large-scale irrigation and drainage channels, irrigation pump facilities and procured vehicles, while the GDA is responsible for cleaning terminal (tertiary) channels and branch channels, removing sediment, preventive maintenance, minor repairs (e.g., repairing leaks in channels), replacement of parts for irrigation pump facilities, securing parts, etc.

Through the questionnaire and interviews with CRDAs in the Tozeur, Gabes and Kebili Governorates, as well as with the GDAs, it seems that the number of staff responsible for maintaining the terminal irrigation and drainage channel facilities is kept at a minimum. Although some staff of the CRDA in each Governorate have retired in recent years, there has been limited progress in terms of hiring new recruits; the number of staff is on a downward trend.<sup>30</sup> It was confirmed that, in general, there was no shortage of staff at the GDAs. In any case, no incidents have been reported in which a shortage of staff has resulted in a serious lack of maintenance either at the CRDA in each Governorate or at the GDAs. As will be discussed in 3.4.4 Financial Aspect, the CRDA usually makes up for the shortfall in the GDA's maintenance costs, and the CRDA will provide support even if the GDA has limited funds or has difficulty in securing staff; thus, within this system, staff shortages rarely occur.

Based on the above, it is considered that there are no particular problems regarding the institutional/organizational aspect of the operation and maintenance of this project.

#### 3.4.3 Technical Aspect

As for the technical aspect of operation and maintenance, it was confirmed through the questionnaire and interviews that the CRDA in each Governorate has staff with many years of

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<sup>30</sup> This is because recruitment activities in the public service sector have been sluggish due to the worsening financial situation of the central government.

experience and advanced operational skills. On the other hand, high technical skills are not required at the GDAs, as they are mainly engaged in relatively small-scale maintenance and management. If GDAs encounter some technical problems, they ask the CRDA (or a local private company with expertise on payment basis) to assist in dealing with the problem.

The DG/GREE plans and implements training programs every year for CRDA technical staff at 24 regions in Tunisia. In the CRDAs in the Tozeur, Gabes and Kebili Governorates, recent training sessions included "How to Handle Equipment for Irrigation Pumping Facilities" and "Introduction of Solar Power Generation Equipment; the technical staff of the maintenance and management department participated in these training sessions over several days. In addition, the DG/GREE also plans and conducts training for GDA staff (mainly technical directors and financial officers) to strengthen the administrative and financial management of the GDA. The CRDA and the GDA have training programs for newly recruited staff, focusing on the operation and maintenance of irrigation water channels and pump facilities, general affairs and financial management as on-the-job training (OJT).

The CRDA and the GDA formulate maintenance plans every year. It was also confirmed that each department has a maintenance manual for irrigation facilities.

Based on the above, it can be maintained that there are no major problems with the technical level of operation and maintenance.

#### 3.4.4 Financial Aspect

Table 5 shows the operation and maintenance budget of the CRDA<sup>31</sup> in each Governorate. The CRDA in each Governorate commented, "Regarding the operation and maintenance budget for the irrigation facilities managed by the national government, from time to time, the economic and financial situation becomes severe, and the budget allocation may not be sufficient, however, we prioritize the budget allocation and carry out maintenance. There has not been any particular case in which budget shortages have caused insufficient maintenance."

Table 5: Operation and Maintenance Budget of the CRDA

|                                | 2019      | 2020      | 2021      |
|--------------------------------|-----------|-----------|-----------|
| CRDA in the Gabes Governorate  | 1,130,000 | 900,000   | 1,150,000 |
| CRDA in the Tozeur Governorate | 1,650,000 | 2,778,000 | 2,900,000 |
| CRDA in the Kebili Governorate | 2,345,000 | 2,820,000 | 2,777,000 |

Source: CRDAs in the Gabes, Tozeur and Kebili Governorates.

<sup>31</sup> The CRDA's operation and maintenance budget is allocated by the Ministry of Agriculture, Water Resources and Fisheries.

Table 6 shows the operation and maintenance budgets of the GDA in each Governorate. The financial resources consist of association membership fees and irrigation water usage fees that farmers in the project areas pay to the GDA every year. According to the GDA in each Governorate, “The required maintenance work cannot be covered by the collected association fees and revenue from irrigation water fees.<sup>32</sup> Although there is a constant shortage, the CRDA compensates for the shortfall.” As shown in Table 6, while increases and decreases can be observed in each Governorate, they do not show a particular improvement or deterioration trend. In fact, as the CRDA makes up for the chronic shortage, the budget shortage is not greatly affecting the maintenance procedures, such as cleaning and sediment removal from terminal (tertiary) and branch channels, preventive maintenance and small-scale repairs, for which the GDA is responsible. Meanwhile, the CRDA considers the GDA’s shortfall as “accumulated debt.” The GDA requests that the CRDA makes up the shortfall, and the CRDA provides the fund, however, this is based on the assumption that it will require repayment in the future.<sup>33</sup> As a reference, Table 7 shows an example of accumulated debt (the case of the Tozeur Governorate). According to an interview with the CRDA in the Tozeur Governorate, “We do not see any improvement in the amount of accumulated debt to the CRDA. In addition, the utility costs (mainly the electricity charges required for the pump facilities used to pump up groundwater) and the cost of purchasing goods have been on the rise in recent years, which has led to ballooning spending and concerns.” Many GDAs also commented, “Our financial challenge is paying high electricity bills, which make up 60–70% of the GDA’s expenditure.” In particular, in water-saving agriculture where groundwater is pumped and used for irrigation, as in this project, the cost of electricity needed for pumping often becomes a bottleneck in terms of operation and maintenance. If the price of electricity rises, the cost borne by the GDA increases, which also affects the association fees and the irrigation water usage fees paid by farmers. Electricity costs have risen sharply in Tunisia in recent years. As shown in Table 8, at the time of the ex-post evaluation (2022), the unit price of electricity has increased (approximately two to three times higher) since before the start of this project (2007). In addition, the GDA is facing an increase in electricity bill payments due to increased electricity usage as a result of increased water withdrawal from deep wells.<sup>34</sup> At present, there are no major problems regarding the status of operation and maintenance due to the financial support from the CRDA that will continue. Nevertheless, a time

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<sup>32</sup> We were unable to confirm specific information regarding the collection rates or regulations relating to association fees.

<sup>33</sup> It was not possible to confirm the terms of the bond issuance or the record of repayment.

<sup>34</sup> Pumping water from deeper locations increases power costs. Specifically, while most of the deep wells are drawn from the Complex Terminal Aquifer, due to illegal drilling of deep wells by certain farmers and the legal drilling by the GDA have lowered the depth by 45 to 90 m (67.5 m on average) depending on the location by the time of the ex-post evaluation (2022) (source: CRDA staff in Kebili Governorate). As a result, the number of pump heads has increased and consequently, pump equipment installed in deep wells consumes more energy (electricity).



may come when financial support from the CRDA can no longer be expected as now due to constraints on the national budget. Therefore, the GDA needs to make forecasts and prepare countermeasures for utility costs, specifically revenue-cost projections, to strengthen and improve its financial aspect.<sup>35</sup>

Table 6: Operation and Maintenance Budget of the GDA

(Unit: Tunisian dinar)

|        |                 | 2019    | 2020    | 2021    |
|--------|-----------------|---------|---------|---------|
| Gabes  | Governorate GDA | 37,000  | 47,885  | 52,814  |
| Tozeur | Governorate GDA | 192,000 | 160,000 | 160,000 |
| Kebili | Governorate GDA | 150,000 | 120,000 | 210,000 |

Source: GDA (total amount) in the Gabes, Tozeur and Kebili Governorates

(Reference) Table 7: Accumulated Debt of the GDA to the CRDA<sup>36</sup>  
(The Case of the Tozeur Governorate: Accumulative Amount of 16 GDAs)

(Unit: Tunisian dinar)

| 2018    | 2019    | 2020    |
|---------|---------|---------|
| 188,439 | 196,655 | 206,677 |

Source: CRDA in the Tozeur Governorate

(Reference) Table 8: Comparisons of the Electricity Charges Before the Start of This Project (2007) and at the Time of the Ex-Post Evaluation (2022) \*Note 1

(Unit: millime/kilowatt hour)\*Note 2

|      | Daytime | Peak Hours | Evening | Nighttime |
|------|---------|------------|---------|-----------|
| 2007 | 77      | 131        | 107     | 61        |
| 2022 | 189     | 329        | 195     | 138       |

Source: Tunisian Company of Electricity and Gas (STEG)

Note 1: Prices before tax (7% VAT should be added)

Note 2: One millime is 0.001 TND (= approximately 0.0421 yen: exchange rate as of April 2022)

Regarding the impact of the spread of COVID-19, the GDA made the following comments: “Due to COVID-19, some farmers in the Kebili Governorate and Tozeur Governorate experienced

<sup>35</sup> According to the GDA in the Tozeur Governorate, one solution is to reduce utility costs through the introduction of solar power generation systems. It has been reported that there are already cases where they have been introduced in a different region of the country. In addition, since 2016, the DG/GREE has been co-financing the “Rural Drinking Water Supply Program Phase 2 (PAEPRII)” with the African Development Bank. This program aims to install 20 potable water pumping stations in 20 governorates of Tunisia, with photovoltaic power plants connected to the medium voltage (MV) power grid; the technical feasibility and economic profitability will be analyzed after 2022. With the aim of reducing the electricity costs of drinking water systems in rural areas, and depending on the results of the survey, the DG/GREE may aim to install solar power generation equipment at pumping stations, thus, the DG/GREE is considering an allocation of budget for this purpose.

<sup>36</sup> As for the accumulated debt before 2018, there were apparently many cases where farmers could not pay their irrigation water usage fees on time due to the continued political instability from 2011 to 2017 after the Jasmine Revolution (Arab Spring). In other words, political instability can be said to be one of the major factors behind the expansion of debt. The cumulative debt amount from 2018 to 2020 is not as large as that before 2018. (Table 8 shows that the annual average increase over the three years is 8,500 TND). This suggests that the impact of political instability before 2017 was greater.

reduced sales volumes of date palm, and their incomes have decreased. As a result, association fees and irrigation water usage fees have not been paid on time in some oases” and “Due to the spread of COVID-19, the cost required for maintenance and the purchase price of spare parts are on an upward trend.” It is not likely that there will be a serious impact on the maintenance work for which the GDA is responsible because, as mentioned above, the CRDA subsidizes the expenditure. Nevertheless, it can be said that the impact of COVID-19 on the financial aspects is not minor.

In light of the above, it can be said that there are certain issues regarding the financial aspect of the operation and maintenance of this project.

#### 3.4.5 Environmental and Social Aspect

It was confirmed through the questionnaire and interviews during site inspections that no environmental or social mitigation measures had been taken by the time of the ex-post evaluation and that no immediate impact is expected. As discussed in 3.3.2.2 Other Positive and Negative Impacts, it is considered that no significant negative impact had occurred by the time of the ex-post evaluation.

#### 3.4.6 Preventative Measures to Risks

At the time of the ex-post evaluation, there were no cases of deregulation of groundwater development or excessive agricultural development by the competitive private sector in South Tunisia. In addition, there have been no impacts relating to the deterioration of security or extreme climate change, and neither have there been any major changes in the policies related to agriculture and water resources. No particular risks, external conditions or events that should be controlled were observed, either at present or in the future.

#### 3.4.7 Status of Operation and Maintenance

There have been no major problems regarding the status of operation and maintenance of the terminal irrigation and drainage channel facilities that have been developed. As mentioned above, the CRDA is responsible for the operation and maintenance of relatively large-scale irrigation channels, all drainage channels and irrigation pump facilities, etc., as well as the maintenance of procured vehicles, while the GDA is responsible for the cleaning and removal of sediment from the terminal (tertiary) channels, preventive maintenance, minor repairs (e.g., the repair of leaks in channels), the replacement of parts for irrigation pumps and the procurement of parts. As a result of site visits, it was observed that the maintenance work (cleaning and sediment removal) of the drainage channels was not always sufficient in some places. The issues observed were as follows: drainage channels are not all sufficiently cleaned, and sediment is not removed; the GDA was unable to keep up with maintenance work, and the CRDA had to intervene and respond; each

CRDA has only one hydro cleaner used for cleaning the irrigation and drainage channels, which delayed the work. In addition, of the six vehicles procured, one vehicle delivered to the Kebili Governorate was out of order. It is expected that the vehicle will be repaired at the CRDA's expense.

Furthermore, according to the CRDA, although there was no major impact at the time of the ex-post evaluation, if the salinity of the groundwater pumped up by the pump increases in the future, there will be an impact (specifically, corrosion) on the pump facilities.

Spare parts are procured and stored by the CRDA in each Governorate. The CRDA purchases parts manufactured by Tunisian companies, and procurement usually takes a minimum of seven days and a maximum of one month. On rare occasions, it may take more than five months to procure equipment with advanced technology.

It has been confirmed that there are cases in which the CRDA intervenes and responds because the GDA cannot keep up with the maintenance, and cases in which the maintenance of the drainage channels (cleaning and sediment removal) by the GDA is insufficient. Therefore, it can be said that there are certain issues regarding the operation and maintenance status of this project.

Based on the above, some minor issues have been observed in the financial aspects including the current status of the operation and maintenance system. They are not expected to be resolved for the time being. Therefore, sustainability of the project effects is moderately low.

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

### **4.1 Conclusion**

This project aimed to save water and secure stable irrigation water by developing terminal irrigation and drainage channel facilities in the oases in South Tunisia (Governorates of Tozeur, Gabes and Kebili), thereby contributing to an increase in agricultural production and environmental protection, through the efficient use of water resources. Concerning relevance, this project is “consistent with the development plan” and “consistent with the development needs.” As for coherence, while it is “consistent with Japan’s ODA Policy,” in terms of “internal coherence” and “external coherence,” there was no concrete cooperation or overlap between projects, and thus, it cannot be said that this project had a synergistic effect. Based on the above, relevance and coherence are high. With regard to efficiency, while the outputs of this project increased (from 50 to 59 sites), the project period slightly exceeded the initial plan. Nevertheless, the project cost was lower than the initial plan, therefore, efficiency is high. The actual values of the effectiveness and quantitative effect indicators were around 70% of the target values. It is said that the development of facilities, such as terminal irrigation and drainage channels are contributing to the reduction and prevention of salt damage in the fields within the project areas. Concerning impacts, while production and the unit yield of each crop have not increased

significantly, the production of a new crop (olive) has begun as a result of this project; it can be observed that this project has contributed to raising farmers' awareness of water conservation and environmental conservation. Therefore, effectiveness and impacts are high. Regarding sustainability, although no major concerns exist, there are certain issues relating to the financial aspect and current status of the operation and maintenance system; therefore, sustainability is moderately low.

In light of the above, this project is evaluated to be satisfactory.

## 4.2 Recommendations

### 4.2.1 Recommendations to the Executing Agency

- At the GDA in each Governorate, there is a constant shortage of funding for maintenance budgets, etc., and there are issues in terms of securing financial resources. Since the CRDA compensates for the shortfall, there have been no major problems regarding cleaning and sediment removal from terminal (tertiary) and branch channels, preventive maintenance, or minor repairs, etc. However, the CRDA regards the shortfall as accumulated debt and contributes on the assumption that GDA will repay the debt in the future. In particular, utility costs (electricity charges) have become a heavy burden for the GDA, thus, it is desirable that the project stakeholders (the DG/GREE and the CRDA in each Governorate) work diligently to secure and improve the GDA's financial resources, with a view to pursuing a sustainable maintenance system. In addition, the DG/GREE is currently conducting a study with a view to reducing the operation and maintenance costs of drinking water systems in rural areas under the program co-financed by another donor (Rural Drinking Water Supply Program, Phase 2); the installation of solar power generation equipment at pumping stations is being considered. It would be desirable to utilize the study results, so as to secure and improve the financial resources of the GDA.

- In some project areas, farmers are illegally drilling wells around their farms, which may be reducing the amount of water from the aquifer, the water source. This can lead to the lowering of aquifer water levels, increased irrigation intervals and salt damage. Therefore, it is desirable for the project stakeholders (the DG/GREE and the CRDA in each Governorate) to enhance awareness-raising activities and provide thorough explanations to farmers regarding the effects of drilling wells and water resource issues.

### 4.2.2 Recommendations to JICA

None.

#### 4.3 Lessons Learned

##### (Importance of Awareness-Raising Activities and Explanations to the Beneficiaries Regarding the Use of Natural Resources and the Project)

As previously discussed, farmers are illegally drilling wells around their farms in some project areas, which may be reducing the amount of water from the aquifer, the water source. Although the impacts on the project areas are not considered significant at the time of the ex-post evaluation, it is considered necessary for the project stakeholders to have carried out awareness-raising activities and provided thorough explanations to the farmers (beneficiaries) on the importance of water resources and water conservation awareness before the start of this project or during the project implementation. When formulating similar projects in the future (projects that deal with irrigation and water resource conservation simultaneously), it is desirable to ensure that awareness-raising activities and explanations are provided regularly regarding the use of limited water sources (natural resources) and the aim of the project on a regular basis (e.g., if the project runs for a long period of time, these awareness-raising activities should be conducted repeatedly before the start of the project, during the implementation of the project, after the completion of the project, etc.).

##### (Necessity of Calculating Costs and Planning Financial Measures for Operation and Maintenance)

In water-saving agriculture in which the groundwater is pumped up and used as irrigation water, such as this project, the cost of electricity used for the pumps tends to become a bottleneck in terms of operation and maintenance. If the price of electricity rises, the burden on the organization responsible for operation and maintenance will increase, and in some cases, farmers cannot pay the association fees and irrigation water usage fees in time. In addition, from a cost-benefit perspective, it is difficult to immediately revise the electricity tariff, as farmers may not plant, and the amount of crops produced may decrease if the cost portion increases due to an increase in electricity prices. For this reason, it is considered meaningful for the project stakeholders to have projections, such as an analysis of the electricity price per cubic meter of irrigation water supplied and the association fee income to be obtained, while taking into consideration, as far as possible, the financial capacity of the farmers at the time of the project formulation. This will make it easier to have an immediate operation and maintenance plan, as well as income-expenditure projections, which will enable financial measures to be taken.

## **5. Non-Score Criteria**

### 5.1 Performance

#### 5.1.1 Objective Perspective

Before the start of this project, when selecting the consultant and contractors, the executing agency and JICA proceeded by mutually confirming progress so as not to cause any delays, based

on a mutual understanding that the detailed design and the construction period should not be affected after the selection; however, delays occurred. In this context, it was confirmed that there were no major flaws in JICA's project supervision system and that there were no particular events that led to the delays or problems regarding communication with the executing agency.

## 5.2 Additionality

None.

(end)

Comparison of the Original and Actual Scope of the Project

| Item                            | Plan   | Actual  |
|---------------------------------|--|---|
| 1. Project Outputs              | <p>1) Civil Engineering Work, Procured Equipment, etc.<br/>Development of the terminal irrigation and drainage channels, etc. (50 oasis sites), procurement of vehicles, etc.</p> <p>2) Consulting Services<br/>New detailed design of irrigation and drainage works, review of the existing detailed design, tendering assistance, construction supervision (progress management, report preparation, etc.)</p> | <p>1) Civil Engineering Work, Procured Equipment, etc.<br/>Development of the terminal irrigation and drainage channels, etc. (59 oasis sites, a total irrigated area of 8,645 ha), <u>procured vehicles: 6</u></p> <p>2) Consulting Services<br/><u>Implemented almost as planned.</u></p> |
| 2. Project Period               | March 2007–February 2016<br>(118 months)   | March 2007–April 2019<br>(149 months <sup>37</sup> )  |
| 3. Project Cost                 |  |   |
| Amount Paid in Foreign Currency | 85 million yen   | 4,065 million yen   |
| Amount Paid in Local Currency   | 6,945 million yen  | 2,000 million yen   |
| Total                           | 7,030 million yen  | 6,065 million yen   |
| ODA Loan Portion                | (5,260 million yen)  | (4,339 million yen)   |
| Exchange Rate                   | 1 Tunisian dinar=87.9yen<br>(Exchange Rate as of December 2006)  | 1 Tunisian dinar =87.9yen<br>(Exchange Rate as of December 2006 <sup>38</sup> )   |
| 4. Final Disbursement           | January 2018   |   |

<sup>37</sup> As discussed above, the period from December 2010 (when riots and large-scale, anti-government demonstrations occurred) to December 2011 (when a coalition government was established, and a new president was elected) was greatly affected by the Jasmine Revolution (Arab Spring). This period of time (13 months) was excluded because the project progress was delayed by external factors.

<sup>38</sup> As discussed above, since it is realistic not to consider the exchange rate fluctuations when determining the project cost in this ex-post evaluation, the exchange rate at the time of the appraisal was used for calculation purposes.

Appendix: List of the Names of the Areas (Oases) Covered by This Project (Numbers in parentheses indicate irrigation area)

(Unit: ha)

| Gabes Governorate              | Kebili Governorate             | Tozeur Governorate             |
|--------------------------------|--------------------------------|--------------------------------|
| Mahjoub (376)                  | Tbaga(45)                      | Nefta: Remada(340)             |
| Bouchemma (156)                | Ibnes (34)                     | Nefta: Fatnassa (294)          |
| Mzira Ghannouch (315)          | Radhouan (20)                  | Nefta: Beni Ali (216)          |
| Metouia (295)                  | Blidet (88)                    | Draa Sud (198)                 |
| Sboui (42)                     | Zarcine (96)                   | Ghardgaya (40)                 |
| Oudhref (292)                  | B.Zitoun 1–2 (236)             | Hazoua 1 (72)                  |
| Ben Ghilouf (227)              | Gueliada (148)                 | Hazoua 2 (47)                  |
| Glib Dokhane (68)              | Faouar 1 (104)                 | Hazoua 3 (240)                 |
| Bechima 1 (318)                | Faouar 2 (150)                 | O.Ghrissi (78)                 |
| Bechima 2 (290)                | Ghidma (96)                    | Ibn Chabat1 (240)              |
| Khebayet (84)                  | Nouil (110)                    | Ibn Chabat2 (286)              |
| Fayçal (264)                   | Klibia (115)                   | Chemsa (90)                    |
| Salem (110)                    | Jemna (120)                    | Ibn Chabat 3–4 (306)           |
| Zerkine jenne (chabab) (137)   | Mtouria (81)                   | Hazoua CI (54)                 |
| Zrigancienne (61)              | Bourzine (94)                  | Ettaamir (50)                  |
| Zarat 1 (89)                   | Sidi Hamed (80)                | Oudia 1–2 (98)                 |
|                                | ElGhoula (76)                  |                                |
|                                | ElGolaa (65)                   |                                |
|                                | Graad (110)                    |                                |
|                                | Bou Hamza (81)                 |                                |
|                                | Sakkouma (81)                  |                                |
|                                | Tarfaya (79)                   |                                |
|                                | Smida (65)                     |                                |
|                                | Douz (302)                     |                                |
|                                | Tarfayet El Ma (53)            |                                |
|                                | Sabria (68)                    |                                |
|                                | Bchelli (129)                  |                                |
|                                | Dhomrana (45)                  |                                |
|                                | Zaafrane (101)                 |                                |
| <b>Total: 16 oases (3,124)</b> | <b>Total: 29 oases (2,872)</b> | <b>Total: 14 oases (2,649)</b> |

Source: Project Completion Report