

April 1988

PROJECT IDENTIFICATION DOCUMENT

IMPROVED WATER RESOURCES MANAGEMENT PROJECT FOR
TUNISIA

ABBREVIATIONS

| | |
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| ATT | Agricultural Technology Transfer Project |
| CRGR | Centre de Recherche du Génie Rural |
| CTRD | Central Tunisia Rural Development Project |
| DERV | Department of Research, Extension, and Education |
| DGPDIA | General Directorate for Planning, Development and Agricultural Investments |
| INAT | Tunisian National Institute for Agriculture |
| INRAT | National Agricultural Research Institut of Tunisia |
| IWRM | Improved Water Resources Management Project |
| OMV | Office de Mise en Valeur |
| PID | Project Identification Document |
| PIT | Project Implementation Team |
| PP | Project Paper |
| MOA | Ministry of Agriculture |
| PPI | Public irrigation perimeters |
| USAID | United States Agency for International Development |
| WUA | Water User Association |

TABLE OF CONTENTS

| | Page |
|---|------|
| Introduction | 1 |
| Project Summary | 2 |
| I. Relation to Country Strategy | 2 |
| A. The Tunisian Strategy for Agricultural Sector Reform | 2 |
| B. Relation to USAID Strategy | 2 |
| C. Other Donors | 3 |
| II. Project Description | 4 |
| A. Perceived Problem | 4 |
| B. Project Goal and Purpose | 5 |
| C. Expected Achievements and Accomplishments | 6 |
| 1. Criteria for Technology Selection | 6 |
| 2. Develop Extension Materials and Training Programs | 6 |
| 3. Create a Tunisian Irrigation Association | 7 |
| 4. Design and Conduct a Farm Enterprise Data Collection and Monitoring System | 7 |
| 5. Establish a Monitoring System for Irrigation Cropping Systems | 8 |
| 6. Analyze Marketing Structure for Perishable Commodities | 8 |
| D. Project Outline | 9 |
| 1. Counterpart Agencies | 9 |
| 2. Technical Assistance | 9 |
| a. Agricultural Engineer/Team Leader | 9 |
| b. Irrigation Engineer | 9 |
| c. Agricultural Economists | 10 |
| d. Agricultural Marketing Economists | 10 |
| e. Irrigation Agronomists | 10 |
| f. Extension Specialists/Social Scientists | 10 |
| 3. Team Mandate | 10 |
| 4. Training and Extension | 10 |
| a. Basic Technical Training | 10 |
| b. Training Materials | 11 |
| c. Extension Activities | 12 |
| 5. Project Monitoring | 12 |
| 6. Commodities | 12 |

d

| | Page |
|--|------|
| 7. Applied Studies | 13 |
| a. Irrigation and Crop Yields | 13 |
| b. Market Prices and Marketing Requirements | 13 |
| c. Private Sector Development | 14 |
| d. Mass Media/Approaches to Extension | 14 |
| e. Support to Water User Associations | 14 |
| III. Factors Affecting Project Selection and Further Development | 15 |
| A. Social Considerations | 15 |
| B. Economic Considerations | 15 |
| 1. Rates of Adoption | 15 |
| 2. Increases in Yield and Water Availability | 15 |
| 3. Cost-Benefit Analysis | 16 |
| 4. Farm Level Decision-making and Investment Strategies | 16 |
| C. Relevant Experience with Similar Projects | 16 |
| D. AID Support Requirement(s) and Capability | 17 |
| E. Estimated Costs and Methods of Financing | 18 |
| F. Design Strategy | 19 |
| 1. PP Design | 19 |
| 2. Supporting Visual Materials | 19 |
| 3. Project Design and Authorization Schedule | 20 |
| G. Recommended Environmental Threshold Decision | 20 |
| H. Design Issues | 20 |
| 1. Contracting Modalities | 20 |
| a. Contractor Responsibilities | 20 |
| b. Contractor Selection | 21 |
| 2. Institutional Capability of the Implementing Agency | 21 |
| 3. Waivers | 21 |
| 4. Policy Determinations | 21 |
| Bibliography | 22 |
| ANNEX A | 24 |

4

IMPROVED WATER RESOURCES MANAGEMENT PROJECT

INTRODUCTION AND SUMMARY

Introduction

Irrigation has contributed substantially to the growth of the agricultural sector in Tunisia. Although irrigated land represents less than 5% of the total cropped, it accounts for roughly 25% of the country's agricultural GDP. By the end of the VIth Plan in 1986, 245,000 ha. of the 250,000 total irrigation potential were equipped for irrigation. This provision of an irrigation infrastructure will reach its full potential early in the VIIth Plan, when issues of maintenance and operation efficiency are certain to be of primary concern.

There is considerable scope for improving the physical and economic efficiency of irrigation and increasing irrigation intensity. Costs for newly developed water are high, and land resources far exceed irrigation water resources. Attempts to improve the irrigation system, such as through the World Bank Irrigation Management Improvement Project, tend to focus on improving the internal efficiency of local government units, the Offices de Mise en Valeur (OMVs); increasing the cost effectiveness and expansion of irrigated areas; and promoting water user associations (WUAs). These efforts lack a strategy and coordinated effort for identifying and transferring physically and environmentally appropriate and economically and institutionally sustainable farm level irrigation technology packages and O&M procedures for on farm systems.

As a result, USAID is committed to supporting a program which, through the use of both public and private sector resources, promotes and extends appropriate farm level irrigation technologies throughout Tunisia. Given the high cost of water, its relative scarcity, and the need for pumping from wells or surface sources, pressurized irrigation technologies are likely to be employed. The random introduction of new technologies is already active in the country. The Improved Water Resources Management Project (IWRM) is expected to shorten the period between the introduction of untried and untested technology packages and the selection and transfer of proven packages. USAID believes that shortening the period will both reduce the real cost of introducing the technologies themselves and increase the returns from the existing irrigation water supply infrastructure.

These improvements will, in turn, lead to greater and more cost effective irrigated agricultural production, increased rural employment and improved balance of payments through both import substitution and increased exports. IWRM will also stimulate and

take advantage of public and private sector cooperation and initiatives, especially in the areas of irrigation equipment manufacture and supply and in produce marketing.

Project Summary

The Improved Water Resources Management Project (IWRM) is designed to improve irrigation performance at the farm level of both the public and private perimeters throughout Tunisia. The five year, \$5 million project will promote and extend the use of physically, environmentally, and economically appropriate farm level technologies in the northern, central, and southern regions of Tunisia. An essential component of IWRM will be the identification and implementation of management systems for the new technologies. To reach those objectives, the project will 1) carry out technical training for farm level irrigation system designers and managers; 2) develop special extension materials covering the selection, application, management, and O&M of the various irrigation techniques; and 3) disseminate these materials to OMV extension personnel, irrigation equipment vendors, and WLA representatives. IWRM will be implemented through such existing institutions as the DCOMVIP and DERV of the Ministry of Agriculture.

I. RELATION TO COUNTRY STRATEGY

A. The Tunisian Strategy for Agricultural Sector Reform

IWRM is expected to complement and support the objectives of the medium-term agricultural sector adjustment program currently being undertaken by the Government of Tunisia. Within the agricultural sector, these objectives include 1) promoting more efficient cropping patterns and input utilization patterns in irrigated areas and 2) encouraging efficient export and import substitution activities. As the agricultural sector adjustment program unfolds, it has been observed that some of the needs relevant to establishing appropriate policies include: 1) the improvement of basic data collection, especially for the calculation of production elasticities; 2) the broadening of the cross-section of production techniques analyzed; 3) the analysis of alternative resource allocation patterns in irrigated perimeters; and 4) the need to expand the knowledge of the structure and operation of markets. All of these needs are addressed by the proposed Improved Water Resources Management Project.

B. Relation to USAID/Tunis' Overall and Agricultural Sector Strategies

In order to achieve the overall Mission goal of assisting in the creation of conditions to permit the renewal of respectable rates of growth in the near future, USAID/Tunis has identified agricultural

sector optimization as one of four major strategic themes. The overall Mission strategy targets the irrigation sector as one where policy changes and judicious use of technical assistance to improve water management and utilization will lead to significant increases in productivity over the medium term.

The government has already made substantial investments in irrigation infrastructure which presently are operating at much less than optimal efficiency. Our agricultural sector strategy statement indicated, therefore, that efforts to reform current operational policies and encourage greater private participation in the ownership and management of the existing perimeters would result in measurable and prompt returns. The introduction of new irrigation technologies leading to greater efficiency and intensity in the application of water concurrent with greater farmer involvement in the management of these systems should lead to lower O&M costs. The target is clearly supportive of the Mission objective of decreasing dependence on government budgetary measures in all sectors.

The IWRM Project specifically addresses two elements of the GOT's structural adjustment program identified in the Mission's Agricultural Sector Strategy Statement: (a) strengthening basic services to farmers, while privatizing those government services which are commercially-viable and greatly improving cost recovery in the others; and (b) building up the sector performance monitoring and policy analysis capabilities of the Ministry of Agriculture in order to fulfill the Mission's strategy goal of increased economic growth.

Through an extensive program of irrigation technology assessment and transfer, IWRM will raise agricultural productivity without increasing the burden on the public sector budget. The program will need to be supported by a well-trained cadre of extension agents and the involvement of and investments from both the public and private sector. Baseline and monitoring information required to fully implement the project will contribute to the Ministry of Agriculture's national agricultural data base used for policy analysis and will be gathered by the government staff who will be provided with the requisite training. The marketing and distribution of both technologies and increased production will be thoroughly assessed to ensure that systems are in place that are responsive to grower's requirements.

C. Other Donors

The only other major donor activity in the irrigation sector is the World Bank's \$22 million Management Improvement Project loan. IMIP supports nationwide improvements of the operation and maintenance of about 105,000 ha of existing irrigation systems as well as policy

and institutional reforms to increase the efficiency and self-financing of the Irrigation Development Offices.

II. PROJECT DESCRIPTION

A. Perceived Problem

As much as 75-80% of Tunisia's water resources have already been developed. Among other uses, this development has created a potential to irrigate about 250,000 ha. Costs for the development and utilization of irrigation are high, with the average cost of water delivered at the farm gate ranging from \$0.04 to over \$0.12 per cubic meter (Annex A). The cost of newly developed water tends toward the higher side of these amounts, and land resources far exceed irrigation water resources. Despite these limitations, there is considerable scope for improving the physical and economic efficiency of irrigation, thereby expanding the irrigated area and increasing irrigation intensity. However, inadequate attention is being given to improving the physical and economic efficiency of irrigation water utilization at the farm level. This is especially true of the private sector which has developed about 60% of the existing irrigation capacity already created in Tunisia.

Total irrigation water costs up to the farm level are mainly dependent on four factors: 1) the capital cost of the irrigation systems; 2) the volume of water distributed by the irrigation systems; 3) the pumping costs; and 4) the operating efficiency of the system managers (the OMVs in the case of public irrigation perimeters:PPIs).

It is estimated that water charges in PPIs only cover between 14 and 37% of total capital plus O&M costs and between 17 and 71% of O&M costs. Current GOT policy calls for the recovery of 100% of O&M costs within PPIs consistent with farmers' ability to pay. In an effort to achieve this goal, farmers will be expected to pay more for their water and to reduce public management costs by taking greater responsibility for system O&M through active WUAs. In addition, the OMVs are expected to become more efficient and cost effective and increase irrigation intensities (which now average about 66% on PPIs and 86% on private perimeters), in order to lower O&M costs per meter of water delivered.

If the efforts to improve the cost effectiveness of irrigation water supply systems are to be successful, the irrigation projects of which they are a part must be economically viable. Thus the entire irrigation system which includes both the water application and the supply systems must be considered along with the agricultural production economics. The high cost of water, its relative scarcity

and that most of it must be pumped from wells or surface sources, suggest the use of pressurized irrigation application technologies. Such technologies include various types of gated pipe delivery systems for surface irrigation methods, sprinkle irrigation systems, and localized irrigation systems such as trickle/drip. In addition to being physically and environmentally appropriate, the irrigation technologies must also be economically viable and institutionally sustainable.

Currently some attention in Tunisia is directed toward improving irrigation performance at the farm level through efforts such as: 1) the World Bank's Irrigation Management Improvement Project; 2) extension activities in the OMVs; 3) Centre de Recherche du Génie Rural (CRGR) research and experiments related to irrigation; 4) USAID's Central Tunisia Rural Development Project Small Holder Irrigation Development and Rural Extension and Outreach Sub-Projects; and 5) what appear to be numerous efforts involving irrigation equipment suppliers and their efforts at serving private farmers. However, these efforts aimed at improving irrigation performance in Tunisia lack a strategy. There is no coordinated effort to identify and transfer physically/environmentally appropriate and economically/institutionally sustainable farm level irrigation technology packages and related O&M techniques to the on-farm systems.

B. Project Goal and Purpose

The goal of the Improved Water Resources Management Project is to improve irrigation performance at the farm level on both public and private perimeters throughout Tunisia. Irrigation improvements will lead to higher yields and more cost-effective irrigated agricultural production. IWRM beneficiaries will range from government instituted water user associations, traditional cooperative societies, and Kinship-based corporate groups, which jointly manage the delivery systems as well as private sector equipment and input suppliers and traders who market production.

The purpose of the project is to identify, promote and extend the use of appropriate and sustainable farm level irrigation technologies in the north, central and southern regions of Tunisia. This requires technologies which are: (a) socially, institutionally and managerially viable; (b) appropriate for the environmental setting including water quality and quantity, weather, soils and cropping patterns found in each of the three regions; and (c) which help provide adequate rates of return.

The promotion and extension of the technologies will necessitate 1) carrying out technical training programs for farm level irrigation system designers, managers, and farm economists based on standard texts augmented by Tunisian specific experience; 2) developing

extension level written and video materials covering the selection, application, management and O&M of the various irrigation techniques; and 3) disseminating these materials through special training sessions conducted for OMV Extension personnel, irrigation equipment vendors, WUA representatives, and dynamic farmers.

The Project will take advantage of the considerable experience gained from the use of the various pressurized irrigation water application technology packages already being employed in Tunisia and in the surrounding countries within the region. In order to fulfill its purpose it will include networking activities such as annual meetings and workshops involving both public and private sector professionals and farmers from private as well as public irrigation perimeters. In summary, IWRM will capitalize on local experiences with appropriate farm level irrigation application technologies and utilize both public and private sector resources to adapt and externalize them for use throughout Tunisia.

C. Expected Achievements/Accomplishments

The introduction of new technologies is already actively being promoted by private dealers and some OMVs. As a result, a number of pressurized water application systems have been installed. An important aspect of IWRM will be to take advantage of the experiences gained with these installations by studying their performance. The project is expected to shorten the period between the random introduction of untried/untested technology packages into the Tunisian irrigation environments, and the selection/application and transfer of the proven packages throughout the country.

Shortening the period for the introduction of appropriate new irrigation technologies will both reduce the real cost of introducing the technologies themselves and increase the returns from the existing irrigation water supply infrastructure. The project will encompass rehabilitation efforts and new shallow or deep well developments being undertaken by private initiatives or with World Bank funding.

IWRM is expected to achieve the following:

1. Determine criteria for technology selection

IWRM will determine the physical, environmental, economic and institutional criteria for selecting specific appropriate technology packages to promote and extend in each of the three regions of Tunisia. In addition, management and O&M criteria for properly utilizing these technology sets will be considered when making this determination.

2. Develop extension materials and training programs

To fulfill the Project's purpose of transferring these technology packages to the end users (farmers), various training and extension activities must be carried out. Specific achievements will include 1) developing between 6 and 12 videos covering the fundamental criteria for selecting, installing, operating, managing, and maintaining the pressurized technologies for various crops and regions; 2) short course (6 to 10 weeks) technical training and field trips for 60 to 100 professional engineers, economists, and agriculturists; 3) quarterly one-day workshops for OMV extension personnel.

3. Create a Tunisian Irrigation Association

The pressurized irrigation water application technology packages require special hardware and software inputs which provide the basis for creating an industry group. This group is made up of manufacturers, vendors, designers, researchers, teachers, creditors, installers, managers/advisors, and users/farmers. Many irrigation technology commodity groups have been formed (usually with considerable public sector assistance). For example, in the USA there is the Irrigation Association, and several states, such as California, Florida and Idaho, have their own affiliate associations. England and Australia have similar irrigation associations. One of the important achievements of the proposed project will be to create a Tunisian Irrigation Association to foster the exchange of knowledge and collaboration between the various public and private sector people involved in irrigation. The association is expected to sponsor both technical and commercial meetings in the major centers of irrigated agriculture throughout Tunisia.

4. Design and conduct a farm enterprise data collection and monitoring system

IWRM will develop a farm enterprise data collection and monitoring system to provide feedback on Project performance and information to appropriate channels for agricultural policy analysis and formulation and private sector decisionmaking. In order to have a useful set of farm budget information for developing extension materials for farmers and the irrigation industry in general a system of farm level micro-economic analysis must be set up. This system will be based on small samples, rather than large replicated farm surveys, to be designed by agricultural economists familiar with the agriculture of the region.

The farm level micro-economic analysis must be designed as a monitoring activity that will be carried out during a number of cropping seasons in the appropriate OMVs. The objectives of the

project cannot be achieved with one-time, cross-sectional data. Changing factor and output prices, increased experience with the various irrigation technologies, and changing husbandry technologies, including new varieties, all recommend a continuous updating if the data are to be useful for policy analysis by the government and for decision-making and resource allocation in both the private and public irrigation sectors. The crop budgets in a given region ought to be analyzed using a sensitivity analysis that captures the variation in farm resources and management levels that are normally expected to be found between farmers in any farming community.

5. Establish a monitoring system for irrigation cropping systems

IWRM will also establish a mechanism for monitoring irrigation cropping systems with corresponding subsidy and development programs which have been instituted in some of the regions of the country. For example, in the oasis deep well irrigation development in the South, irrigation date palm and intercropping systems have been developed which may not maximize either returns to water or returns to labor and capital. The considerable variation in farmer strategies for managing their land suggests the need for a careful appraisal of the irrigated farming systems being developed. The project agricultural economists will assess existing data on crop production and practices and collect new data to assess the effects of the irrigation technologies on production.

6. Analyze the marketing structure for perishable commodities

The increased agricultural production resulting from IWRM's activities require that the marketing channels exist and function so that farmers can find outlets in both the domestic and export markets. The GOT has made efforts to improve the marketing infrastructure through the construction of grading, packing, and cold storage facilities at a number of locations around the country. It is not clear, however, if the existing marketing channels can handle a rapid increase in perishable commodities. The agricultural marketing economists will gather and analyze information on internal market structures serving both the domestic and export market and recommend interventions or policy changes needed to ensure an outlet for the increased production derived from the project. It is anticipated that the Agriculture Policy Implementation Project (APIP) analyses will provide substantial information regarding export potential.

D. Project Outline

1. Counterpart Agencies

The proposed project will be implemented through existing institutions within the Ministry of Agriculture (MOA). The only new institutional structure that will be created is an ad hoc Tunisian Irrigation Association made up of public and private participants in the irrigation industry. The MOA will have overall responsibility for project implementation and monitoring. It supervises the activities of the OMVs, which are responsible for irrigated agricultural design and extension activities at the farm level. With assistance from DERV, the OMVs will provide the same services in IWRM areas.

Within the MOA, the DCOMVIP and/or the DERV are the most logical directorates to coordinate and monitor project activities, work with USAID's contractor in carrying out the recruitment of Tunisian consultants for the proposed technical assistance, training and studies, and provide the OMVs with the necessary assistance in managerial and technical matters.

The proposed project will support the establishment of the Tunisian Irrigation Association. The association will stimulate and support network activities within Tunisia and other countries in the Mediterranean region. The activities include field trips, technical sessions, and industrial/commercial fairs. The association is expected to continue after the completion of the project.

2. Technical Assistance and Staffing Requirements

The contractor's project implementation team would be multi-disciplinary in scope with a mixture of five or six long-term and three short-term expatriate and Tunisian professionals (consultants). The implementation team will include:

a. Agricultural Engineer/Team Leader

An expatriate agricultural engineer with broad experience in project management and in irrigation system technologies within the USA and the Mediteranean region.

b. Irrigation Engineer

An expatriate irrigation engineer familiar with farm level irrigation system design and operation within the region. The irrigation engineer will work closely with CRGR and the OMVs in carrying out on-farm irrigation technology testing and demonstrations.

c. Agricultural Economists

An expatriate agricultural economist trained at the Ph.D. level with a background in farm management in irrigated agriculture and production economics. In addition, a cadre of Tunisian M.Sc. level agricultural economists will be recruited to monitor and analyze farm enterprises across the country. They are likely to be stationed within those OMVs which have an irrigated agricultural sector.

d. Agricultural Marketing Economists

An expatriate short-term and a Tunisian long-term agricultural marketing economist with backgrounds in annual and perennial crop marketing structures and in market analysis.

e. Irrigation Agronomists

An expatriate short-term and a Tunisian long-term irrigation agronomist familiar with annual and perennial cropping systems in both irrigated and rainfed agriculture.

f. Extension Specialists/Social Scientists

One or more expatriate short-term and a Tunisian long-term extension specialist/social scientist familiar with modern mass media approaches for training and extension, and familiar with the social and institutional structure within Tunisia and their implications in knowledge transfer.

3. Team Mandate

The Project Implementation Team (PIT) will work with the OMVs, TIA, CRGR, INAT and the private sector irrigation industry, in identifying promising irrigation technology packages which are already being tried in Tunisia. The PIT, in collaboration with CRGR, would then carry out multi-disciplinary diagnosis of these promising technology packages to categorize them in terms of their physical/environmental appropriateness as well as their economic/institutional sustainability. The most promising packages would be selected for adaptation and transfer within and across the three climatic regions. The PIT would also extend their search for appropriate farm level irrigation technologies to other areas in the Mediterranean region such as Cyprus, Jordan, Spain, Italy, and France.

4. Training and Extension

a. Basic Technical Training, Equipment Testing and Extension

IWRM seeks to assimilate rapidly the existing body of knowledge on irrigation technologies in order to determine which might be best

tested and demonstrated in project sites. By the end of the first year of the project, IWRM will have analyzed technology systems in particular economic, social, and environmental contexts and extended materials to users. Based on secondary data and carefully focused assessments of farmer practices and constraints, the PIT ought to be able to make some conclusive statements about which systems are most appropriate and how they might be best introduced and integrated into ongoing practices.

Concurrently, the PIT will design and conduct short (2 to 4 weeks) training courses for the professional engineering, economic and agronomic staff of OMVs, DGPDIA, DGR, CRGR, INRAT and some individuals from the irrigation industry within the private sector. These courses will supplement the existing skills of the professional with the needed basic background knowledge associated with the new irrigation application technologies. Existing programs at the International Irrigation Center in Rabat and in the USA may be utilized, supported by special courses (based on existing materials) designed for delivery in Tunisia.

The agricultural economist(s) should be trained up to the degree of Ingenieur Principal (M.S.), focusing on farm management and production economics. They will also require supplementary training in irrigated agriculture: basic plant water relationships, the effects of water quality on yields; the concepts of crop transpiration, percolation, drainage and runoff, and effective rainfall; and irrigation water requirements by type of crop and by soil environment. In addition, they should have a basic understanding of the mechanics of both ground and surface water delivery.

The formation of water user associations is not an activity of IWRM. However, it is assumed that, if the water user associations are in place and are functioning under their charters, a small number of associations might participate in the training programs provided for the extension agents. Training may be provided in elements of on-farm water management and irrigation technologies and in budget enterprise analysis. However, the appropriateness of involving water user associations in the training program outlined requires further consideration.

b. Developing Training Materials

The second stage of IWRM activities will begin during the second full year and involve an expansion in developing training materials for the specific technology packages and providing specific professional training for their extension. This training will build on the basic level. It will include short courses with four to six week field trips. The courses will include specific components directed at each of the three climatic regions and their various appropriate cropping programs.

c. Expansion of Extension Activities

Following two years of close collaboration among public and private agencies in the irrigation industry and IWRM, there will be an expansion in the cooperative effort to extend the appropriate pressurized irrigation water application technologies throughout Tunisia. Information on the appropriate technology packages identified during the first two stages will be codified and organized for use in training public and private professional practitioners and extension agents. Professional practitioners will be trained to plan, select, design, and implement technologies during the second stage while systems are being field tested and training materials are being developed for mass dissemination.

During this stage, technologies will be extended more widely in the country using a combination of mass media, normal extension, and irrigation equipment industry approaches. At the same time the expertise needed to plan, design, and implement the technologies and monitor the outcome from using them will be in place as a result of the training efforts carried out during the first and second stages.

5. Project Monitoring

One of the expected outputs of IWRM will be greater application efficiency, thereby expanding agricultural output of irrigated crops through either increase of area irrigated or greater planting intensities and other per hectare yield increasing effects. Through supply increases, the project is likely to affect product prices and farm incomes. This argues for a regular monitoring of farm budgets. Some parameters of the monitoring effort need to be determined such as mechanisms for distributing the collected farm enterprise data among appropriate government agencies and how this data collection effort and analysis should be coordinated with existing farm level surveys being carried out by various divisions of the Ministry of Agriculture. These matters need to be resolved by the project paper stage so that during project implementation information can be made available to those responsible for agricultural policy analysis and formulation.

6. Commodities

IWRM will provide commodity support for 1) vehicles and vehicle operating expenses for the technical assistance team, 2) microcomputers, related peripherals and software, training and maintenance, 3) equipment and supplies for modern and traditional media presentations, 4) irrigation demonstration systems, and 5) performance testing equipment.

7. Applied Studies

A number of studies have been identified which relate closely to the objectives and activities of the project. These issues ought to be investigated prior to project implementation, and preferably prior to the arrival of the Project Paper design team.

The studies will largely synthesize secondary data, although some field data collection and interviewing may also be required. It is envisioned that some of the information will be gathered by tapping into resources available through the Agricultural Policy Implementation Project (APIP). Contract assistance will be utilized for those remaining items which the Mission staff is unable to address. The Mission currently is discussing these possibilities internally and with the Ministry of Agriculture.

a. Irrigation and Crop Yields

This study will review a variety of documents and data sources, including assessments conducted by the World Bank, to determine the effect of irrigation on crop production in Tunisia. While water has often been cited as a major constraint to increased production, there appears to have been no systematic comparison of yields in irrigated and non-irrigated areas or where different methods of irrigation are employed. The results of this study will have consequences for technology selection and supporting extension activities. It is critical to determine whether current constraints to full cropping intensity can be solved by the introduction of new technologies and are not the result of other factors such as environmental or socio-cultural causes which would require different solutions.

The study should also examine whether cropping packages are sufficiently advanced to take reasonable advantage of improved irrigation technologies. From the available evidence, there appears to be an opportunity to increase both the cropping intensity and irrigated area on the great majority of farms in both the private and public sector irrigation schemes. This point will require specific documentation because the project does not provide for expanded main system irrigation distribution in order to achieve the expected benefits.

b. Market Prices and Marketing Requirements

Given current market prices, it is assumed that farm budgets are attractive enough to entice many small farmers to grow high value vegetable and fruit crops and encourage the use of the relatively high capital cost (\$0.36 - \$1.00/ha.) modern irrigation water application system. Concomitantly, domestic and export markets must be deep enough to support increases in production of 20% to 40% in vegetable and fruit crops.

If the analysis of marketing being carried out by the government or by the universities is not sufficient to provide the information needed to develop policies that will facilitate orderly market development, then an analysis of the marketing structure for perishable commodities grown under irrigated agriculture will be undertaken prior to and as part of the project. One case in point is the rapid expansion in the planting of apples in recent years. It would be instructive to document this rate of expansion and the likely output increases in the next several years in light of current marketing capacity.

c. Private Sector Development

The extent of interest within the private sector irrigation industry (made up of vendors, importers and manufacturers) in participating in this program needs to be investigated. This also will involve documenting locally produced versus imported equipment and projected changes in supply sources. It is necessary to determine whether the expansion of various irrigation technologies is presently or will be constrained by the lack of equipment, spare parts, and/or trained repair people or is as a result of government policies which might need to be addressed.

In the USA promotion of successful agricultural technologies and inputs is usually undertaken by the suppliers themselves. By the end of the project the burden of disseminating new technologies and providing upkeep assistance should have shifted from the extension service back to the private sector itself. The possibility of achieving such an output will be investigated before the project begins. In addition, mechanisms for achieving the required coordination and collaboration between the private sector, the MOA and the OMVs should be identified in advance as these will be crucial to project success.

d. Mass Media Approaches to Extension

Success of the project depends on the extension and adoption of new, appropriate irrigation technologies. Additional research is required to determine the adequacy of current OMV extension services to the irrigation sector and what improvements are needed. The project envisages using TV coverage, videos and other modern media to communicate information about the new technologies. The ability of the communications media to handle these activities should be investigated and documented. Furthermore the costs and potential benefits of modern versus traditional extension techniques should be analysed carefully prior to final project development.

e. Support to Water User Associations

Achievement of the project's goal and purpose will require the adoption by farmers of the proposed new irrigation technologies and

the resulting increase in crop yields. In the Tunisian context not much is known about the role or importance of water user associations (WUA). Further investigation is needed of the WUAs to determine whether project efforts are best directed to them or to individual farmers or to both. Should special training be provided to leaders of WUAs? Should WUAs play a prominent role in project implementation? Will different extension techniques be needed to reach members of WUAs than for solitary farm families? These questions need to be addressed during the design stage.

III. FACTORS AFFECTING PROJECT SELECTION AND FURTHER DEVELOPMENT

A. Social Considerations

IWRM will operate in irrigated areas in the north, central and southern regions of the country. Yet, the project outputs will reach across these regions and will be available to large and small holders alike, in both public and private irrigated areas. Inclusion of the private sector traders in the training dimensions of the project will insure that information flows to the broad spectrum of those involved in irrigated agriculture. Given the extent of rural electrification, T.V. messages prepared by the project will further increase the audience.

The project is designed to create a capacity in both the public and private sectors which will extend well beyond the end of the project. The outreach and monitoring activities will have been integrated into the operations of the appropriate government and private sector institutions and industries and will be an integral part of their standard operating procedures. The useful life of the educational materials created should extend well beyond project termination.

B. Economic Considerations

1. Rates of Adoption

Economic benefits derived from the project depend upon an increase in the rate of adoption of modern water-efficient irrigation techniques beyond what would have occurred in its absence. Also important is the rate at which the technologies, once adopted, are used to their full potential. These benefits will extend across the private and public irrigation sectors to both small holders and those with more extensive holdings alike.

2. Increases in Yield and Water Availability

The cost savings for pumping water, even at real prices, may be insufficient justification for individual farmers to invest in the

more expensive technologies. The primary sources of benefits will be from yield increases inherent in the application efficiencies of the technologies and from increased water availability to individual farm units. This water can be used to increase the area irrigated or the cropping intensity by intercropping and increasing tree densities.

3. Cost-Benefit Analysis

The cost-benefit analysis for the project will have to include a careful consideration of the existing agricultural economy and of the effect on the economic and financial rate of return of a variety of factors: 1) the rate of change in the adoption of modern irrigation technology as a result of the project; 2) change in rate at which the adopted technology is used to its full potential; 3) savings in agricultural labor associated with the technology; and 4) the impact of the adopted technologies on crop yields and the price changes as a result of the yield increases. In order to capture much of this variability in the cost-benefit analysis a considerable range of sensitivity analyses are thereby required.

4. Farm Level Decision-making and Investment Strategies

The very circumstances which contribute to the variability in the returns from new irrigation technologies strongly argue for the inclusion in the project of a system for analyzing and monitoring farm budgets and for understanding decision-making at the farm level. This should help increase the rate of adoption of appropriate technologies and minimize investment with technologies if circumstances suggest a negative return to the farm family.

Additional sources of benefits from the project will be the contribution of information to agricultural policy formation.

C. Relevant Experience with Similar Projects

AID has wide experience in promoting the development of the systematic transfer and adoption of agricultural technology. Many of these efforts in Tunisia share components and approaches with the Improved Water Resources Management Project. The substantial experience accumulated by USAID/Tunis in technology transfer, research and extension, and private sector development will serve in the implementation of the project. Furthermore, the Mission's portfolio, which emphasizes small farmer development and technology transfer, receives strong support from the GOT.

A number of USAID projects are currently being implemented which will support the activities of IWRM. The Agricultural Technology Transfer Project (ATT) is designed to assist the MOA in developing an agricultural cadre to identify, select, and manage the future

agricultural technology of the country. IWRM will work closely with this project, particularly as ATT has a large participant training component. While not operating specifically in irrigated agriculture, the project seeks to establish a needed information base for small farmers, upon which IWRM can draw. The Private Sector Development and Technology Transfer Project encourages the Tunisian private sector to play a more dynamic role in achieving national economic targets by enhancing the climate for private investment and increasing skills development. It too will support IWRM.

IWRM will contribute to the Agricultural Policy Implementation Project (APIP) by providing supporting information in the following areas of study which are being undertaken by APIP: a) assessing the effects of changes in subsidy levels on the use of agricultural inputs, b) calculation of domestic resource costs and coefficients of effective protection in production and processing of key agricultural crops, c) development of economic models of the rainfed and irrigated farm sub-sectors, d) development of simulation models of agricultural supply responses, and e) competitiveness of Tunisian agricultural commodities.

In addition, three significant projects, which have already terminated, will offer lessons for the implementation of IWRM. The Central Tunisian Area Development (1979-86) was conducted in one of the three regions identified for IWRM. The project was successful in establishing a multi-sectoral, decentralized regional development agency. The CTRD Small Holder Irrigation Development Project (1979-86) is considered to have been one of the more successful in the Mission portfolio. It developed water resources for the benefit of small farmers through the expansion of an irrigated infrastructure and the diffusion of improved on-farm water management and cropping practices. Under the credit activity, more than 1800 ha. of shallow well irrigation were developed, benefitting 900 small households. The CTRD Rural Extension and Outreach Project sought to improve the agricultural extension service in Central Tunisia. Field agents were trained in their technical disciplines and in extension methods. An applied research program, conducted at a training farm focused on vegetable/fruit tree cultivation and water-saving irrigation technologies. Demonstrations drawing upon the research were conducted for farmer groups on a regular basis.

D. AID Support Requirement(s) and Capability

The Mission will have an agricultural development officer as project manager for IWRM. In addition, two staff members have extensive irrigation experience, two others are knowledgeable and actively involved with private sector work and a staff agricultural economist are all available to assist with the project design and to provide guidance during implementation.

E. Estimated Costs and Methods of Financing

IWRM will result in a \$5 million ESF-funded grant to the GOT. The estimated life of project costs are displayed below:

| | | |
|--|--|----------------|
| 1. Long Term: | | |
| 3 expatriates at 200,000/yr for 3 yrs | | 1,800,000 |
| 3 Tunisians at 30,000/yr for 5 yrs | | 450,000 |
| 2. Short Term Consultants: | | |
| expatriates 19 months at 20,000/mo | | 380,000 |
| Tunisians 39 months at 5,000/mo | | 195,000 |
| 3. Irrigation Commodities: | | |
| 20 demonstration systems at 6,000 ea | | 120,000 |
| Performance testing equipment | | 50,000 |
| 4. Training and Field Trips: | | |
| External 60 professionals at 6,000 ea | | 360,000 |
| Internal 200 professionals at 1,000 ea | | 200,000 |
| Internal 400 technicians at 250 ea | | 100,000 |
| 5. Travel and Vehicles: | | |
| Vehicles 6 at 15,000 ea | | 90,000 |
| Service & fuel 600,000 km | | 120,000 |
| International Travel 24 | | 70,000 |
| Per diem expenses 1500 days | | 90,000 |
| Regional travel 24 | | 40,000 |
| 6. Office Expenses: | | |
| Office equipment | | 20,000 |
| Furniture | | 10,000 |
| Communication | | 30,000 |
| Staff assistants, 1 at 15,000/yr for 5 yrs | | 75,000 |
| Secretarial, 2 at 10,000/yr for 5 yrs | | 100,000 |
| Security, 1 for 5 yrs at 5,000/yr | | 25,000 |
| Miscellaneous | | 15,000 |
| 7. Other Expenses: | | |
| Tunisian Irrigation Association | | 30,000 |
| Special conferences & field days | | 30,000 |
| Video equipment & supplies | | 35,000 |
| Freight | | 25,000 |
| Miscellaneous & contingency | | <u>100,000</u> |
| | | 4,560,000 |
| Overhead & GBA, 10% | | <u>440,000</u> |
| TOTAL | | US \$5,000,000 |

F. Design Strategy

The concept and general outline of this proposed project has been well received by MOA administrators and professionals in the irrigated agricultural sector within Tunisia. In fact, there is a general consensus concerning its likelihood of success and timeliness. USAID/Tunis has found considerable enthusiasm for carrying it out.

1. PP Design

Prior to the initiation of the PP design, a broad set of policy and implementation issues ought to be investigated. These issues have been outlined here in the section on applied studies. Some studies will require the participation of short-term expatriate technical assistance, but all ought to include the collaboration of Tunisian professionals.

The PP team should have the following membership:

- a. Irrigation engineer thoroughly familiar with modern, as well as traditional, farm level irrigation technologies. The engineer should not only have a technical/academic understanding but also have extensive field experience with the use of these technologies, and be familiar with the commercial (manufacturer, vendor, advisor, user) aspects of system selection, design, procurement, installation, operation, and management.
- b. Agricultural economist with a background in farm management in irrigated agriculture and production economics and who will have software available for farm budgeting and enterprise analysis.
- c. Organization expert/Social Scientist familiar with the relevant social, cultural and institutional (both private and public) environment, and able to assess training institutions and programs related to project implementation.

2. Supporting Visual Materials

The Concept Paper team (Keller and Weaver 1987) recommended that a video record of the PP team's field activities and investigations be made. The PP team should review the video record and help develop the "story board" script for making a relatively well polished visual report to supplement the project paper. The video will give the decision makers who will be scrutinizing the PP a better basis and understanding for making decisions about it. In addition, it will give a certain unique momentum for projecting the project forward into the entire irrigation community which it is designed to serve.

The Director General of DERV in the MOA has been contacted and will support this effort by providing the PP team with a fully equipped video cameraman. His video group will also produce the final visual report (using the technical advice from the PP team). The cost for this service should be little more than the extra travel, per diem, and supplies needed.

3. Project Design and Authorization Schedule

| <u>DATE</u> | <u>ACTIVITY</u> |
|-----------------|-------------------------------------|
| May 1988 | AID/W project committee reviews PID |
| May 1988 | AID/W approves PID |
| May-Sept. 1988 | Pre-Design Studies |
| Sept.-Oct. 1988 | PP Design |
| Nov. 1988 | Mission reviews PP |
| Dec. 1988 | Mission authorizes PP |
| Feb. 1988 | RFTP published in CBD |

The above schedule represents the mission's best estimate of realistic design requirements. Fielding a PP design team in September depends upon the availability of FY 1988 PD&S funds. Should FY 1988 PD&S funds not be provided by AID/W, the design will slip into FY 1989.

G. Recommended Environmental Threshold Decision

The Mission recommends that a negative environmental threshold decision be made. IWRM will not be building new irrigation infrastructure but rather testing more efficient water delivery technologies on already constructed systems. No significant adverse environmental impact is likely to occur.

H. Design Issues

In addition to the topics and issues identified for analysis in the Applied Studies section the Mission believes that the following design issues should receive indepth treatment in the PP effort:

1. Contracting Modalities

a. Contractor Responsibilities - The mission recommends that a direct-AID contract be established with the supplier of technical assistance and that the contract contain provisions for purchasing

all commodities not already on order at the time the contract is negotiated. In addition, the supplier must demonstrate that it is capable of managing all long-term and short-term technical assistance or will sub-contract this responsibility to a competent agency. The contractor should also be responsible for contracting all local hire required to implement the strengthening component of the project (from drivers to local consultants). Whenever possible, the contractor will substitute qualified Tunisian personnel for expatriate personnel in the provision of short- and long-term technical assistance.

b. Contractor Selection - Given the fact that the contractors implementing this project will require a familiarity with new appropriate irrigation technologies, USAID/Tunis believes that bidding be as open as possible. It is not appropriate to set this project aside for either Title XII or 8(a) contracting.

2. Institutional Capability of the Implementing Agency

The mission feels that the MOA is the most logical candidate to be the Implementing Agency and that the OMVs be responsible for irrigated agricultural design and extension activities at the farm level. However, key questions remain concerning the capacity of the staff of the MOA and the OMVs to support the activities.

It is expected that there are a sufficient number of professional engineers (48), economists (12), and agriculturists (36) to provide the designated 6 to 10 weeks short course in-service technical training. In addition, there are said to be 150 to 200 technicians and extension workers who would be participants in workshops, requiring appropriate user level extension materials. Furthermore, it is assumed that these professionals, technicians, and extension workers are either already employed or there are open vacancies for them within the MOA, OMVs and private sector.

3. Waivers

A Source and Origin Waiver of AID procurement procedures is requested for the purchase of commodities from 899 countries.

4. Policy Determinations

The concept of the project is not in conflict with PD 15 or PD 71. IWRM, through assessments of irrigation technologies, their demonstration, and extension, seeks to improve irrigation performance and thus have a positive effect upon production, employment, and income.

BIBLIOGRAPHY

Bureau de L'Inventaire et des Recherches, Hydrologiques. 1986.
"Annuaire de l'exploitation des nappes profondes."

Cuenca, Richard H. "Projet de l'irrigation des petites
exploitation." Consultant's Report for Small Farm Irrigation
Subproject. Ministere De L'Agriculture, ESAK-ODTC, Ecole Superieure
D'Agriculture du Kef Office de Developpement de la Tunisie Centrale,
1983.

Cusack, T. "TDY Consultant Report." Oregon State University
Extension Project, Nov. 27 - Dec. 14, 1985.

Dahl, Reynold P. "Agricultural Marketing, Transportation and
Storage in Central Tunisia. Technical paper prepared for the Agency
for International Development, U.S. Department of State,
AID/ta-C-1162, 1978.

Gritzinger, D. "Central Tunisia Water Resources and Population
Mapping Study: Summary Report." Institute for Development
Anthropology, Binghamton, NY, August 1987.

Hopkins, N.S. "Local Organizations in Central Tunisia; Water User
Associations and the Autogestion Unit." Institute for Development
Anthropology and Clark University, May 1987.

Keller, J. and T. Weaver. "Irrigation Technology Adjustment Project
for Tunisia: Project Identification Document." Tunis, September
1987.

Larson, B.R. "Final Report on Monitoring and Evaluation for the
Central Tunisian Development Authority: Executive Summary."
Institute for Development Anthropology, Binghamton, NY, June 1987.

Ministere de l'Agriculture, Republique Tunisienne. "Enquête des
perimetres irrigués 1986." Direction de la Planification, des
Statistiques et des Analyses Economiques, Janvier 1987.

Ministère de l'Agriculture, Republique Tunisienne. "Cereales en
irrigue centour des forages destines a l'alimentation en eau?potable
des zones rurales." Ridha Abdallak, November 1986.

Ministère de l'Agriculture. "Annuaire des statistiques agricoles
1985." January 1987

Newberg, Richard; William Furtick; and Jose Alfaro. "Project
Evaluation - Dryland Farming Systems Research Subproject (No.
664-0312.2) and Small Holder Irrigation Development Subproject (No.
664-0132.3) of the Central Tunisia Rural Development Project."
Contract No. PDC-1406-I-13-1138-00, April 1983.

Office de Development Tunisia Centrale. "Supplemental Irrigation, Wheat Trial." Abdelmalek M'Nassri, Sbeitla, Tunisia, 20 July 1987.

Office de Development Tunisia Centrale. "Supplemental Irrigation, Barley Trial." Sbeitla, Tunisia, 1987.

USAID. "Tunisia, Agriculture Sector Assessment 1985." Annex I, January, 1986.

USAID, "Tunisia CDSS Preamble". September 1986.

USAID, "Tunisia Agricultural Sector Strategy Statement". Tunis. December 1986.

Waldstein, A. "Central Tunisia Development Authority - Marketing Activity." Exploratory Consultancy, March 30, 1982.

World Bank. "Staff Appraisal Report, Tunisia Irrigation Improvement Project." Implementation Volume. Vol. 1, Report No. 5396-TUN.

World Bank. "Staff Appraisal Report Tunisia Irrigation Management Improvement Project." Implementation Volume, Vol. II, Report No. 5396-TUN, Annex 13.

World Bank. "Report and Recommendation of the President of the IBRD to the Executive Directors on a Proposed Loan in an Amount Equivalent to US\$150 million to the Republic of Tunisia for an Agricultural Sector Adjustment Loan." Sept 3, 1986, Report No. P-4368-TUN.

World Bank. "Staff Appraisal Report, Southern Irrigation Project, Tunisia." December 19, 1979, Report No. 2681-TUN.

Annex A

Table 1. Estimated O&M and total irrigation water costs per cubic meter of water delivered to farmers.

| Location | Note | Cost in millimes/m | |
|-----------------|------------|--------------------|--------|
| | | O&M | Total |
| Gafsa | PPI(1) | 14 | 29 |
| Gabes | PPI(1) | 32 | 47 |
| Jendouba | PPI(1) | 36 | 66 |
| Kairouan | PPI(1) | 65 | 90 |
| Lakhmes | PPI(1) | 50 | 80 |
| Medjerda | PPI(1) | 39 | 51 |
| Cap Bon | PPI(1) | 49 | 79 |
| Nebhana | PPI(1) | 75 | 105 |
| ODTC | PPI(1) | 67 | 92 |
| Sidi Bouzid | PPI(1) | 85 | 110 |
| Central Tunisia | Potable(2) | -- | 62-182 |
| Central Tunisia | Private(3) | 23 | 57 |
| Central Tunisia | Private(4) | 45 | 130 |
| Central Tunisia | PPI(5) | 23 | 108 |

(1) Taken from World Bank - Irrigation Management Improvement Project, Staff Appraisal Report of May 10, 1985.

(2) From report by Dr. Robert M. Reeser on potential use of excess water for irrigation from domestic (potable) supplies.

(3) TDY Consultant Report NN27-Dec. 14, 1985, by Tom Cusak for 10m deep well pumping 10,000/year.

(4) Same but for 25m deep well.

(5) Same but for a 40m deep well pumping 500,000m/year serving PPI of 100 ha.