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Mazahreh N., Shatanawi M., Ghezawi S.

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JORDAN EXPERIENCES IN WATER SAVING AND PARTICIPATORY IRRIGATION MANAGEMENT

N. MAZAHREH [*], M. SHATANAWI [**] AND S. GHEZAWI [***]
[*] NCARTT, Ministry of Agriculture, Amman, Jordan
[**] Faculty of Agriculture, University of Amman, Jordan
[***] Jordan Valley Farmers Association, Jordan

SUMMARY: The irrigated area in Jordan accupies only 76,000 hectars out of the total area of the country of about 88,778 km^2. Irrigation in Jordan is practiced into two regions; the first is public irrigation projects in the Jordan Rift Valley of 33,000 ha (28,000 ha in the Jordan Valley and 5,000 ha in the Southern Ghors).The irrigated area is the highland and the deserts can be approximated at 43,000 ha; mostly owned and managed by the private sector. Irrigation in the Jordan Valley is taking considerable effort from the Government to manage it properly, but attempts by the government and donor agencies to improve irrigation efficiencies are not encouraging. The individuals initiations taken by many farmers in water saving technology are amazing and beyond the imagination of other stakeholders. There are some pilot saving projects by the government and many donating agencies like USAID, the French Agricultural mission, GTZ and others but no significant indicators of success have been established. The irrigation management system needs to be improved due to the water scarcity situation and the fact that agriculture is the largest consumer; any saving would be significant. One approach would be the gradual withdrawal of public agencies from management giving the farmers the chance in participation through WUA and PIM. At the present there are no such organizations but cooperation among small farmers is limited to areas nearby springs or side wadies. The farmers manage irrigation themselves as they divide water among themselves using the traditional way of the allocation.

Key words: Jordan Water Resources, Participatory Irrigation Management, Irrigation Management, Jordan Valley, water saving, irrigation efficiency.

INTRODUCTION

Jordan is about 88,778 km^2 in area, located between the latitudes of 29.0 and 33.5 degrees north, and the longitudes of 35.0 to 39.5 degrees east. It lies within the semi-arid climatic zone and has a typical Mediterranean short, rainy winter and a long, dry summer. Annual precipitation varies with location and topography, but ranges from 50 mm in the desert to 600 mm in the northwest highlands. Jordan can be divided into four agro-ecological zones: the Jordan Valley, the Highlands, the Steppe and the Badia (Arid) region (3). Jordan valley is used for intensive cultivation under irrigated farming system. This area is used mainly for the production of vegetables and citrus. Indigenous salinity, as well as the concerns from soil salinization, are among factors contributing to the degradation processes in this region.

The total irrigated area in Jordan is estimated to be about 76,000 ha; 33,000 ha in the Jordan valley and Southern Ghor, and 43,000 ha in the Highlands and desert. Water resources consist primarily of surface, ground water sources and waste water. Surface water resources in Jordan vary considerably from year to year. The long-term average surface flow is estimated at 690 MCM. Groundwater resources amount to 54% of the water resources in Jordan. In a water-short country like Jordan, wastewater is an important component of its water resources. Generally, fully treated wastewater is suitable for unrestricted use in agriculture and for aquifer recharge, About 80 MCM/year of wastewater is treated (secondary treatment) and discharged into various water courses or used directly for irrigation, mostly in Jordan Valley. Approximately 70% of the urban population is provided with sewerage services. However, there is work going on to look into growing crops which can cope with both higher concentrations of salinity and drought. So, irrigation efficiency is crucial to save water while preserving the livelihood of small farmers.

The use of sprinklers in irrigation is decreasing and being replaced by drip irrigation which is more efficient. Drip and surface irrigation in the Jordan Valley along with sprinkler systems in the south mainly seem to be used. This could continue or change with the use of recycled waster water resources. Fertilizers through irrigation (fertigation) have also been very successful; this program was started about five years ago.

WATER SITUATION IN JORDAN

Jordan is considered as one of the most water scarce countries of the world. The renewable water resources are in the order 920 to 960 MCM and the per capita share of water has reached about 165m^3 per year for all sectors. The water sector in Jordan has been thoroughly analysed over the past 10 to 15 years by the Jordanian authorities and many expert, only to find that there is no easy solution available for the fact that water resources for private, industrial and agricultural consumption are limited at present and will continue to be restrained in future.

Below are some general features may characterise the seriousness of the situation:

- Relatively high population growth rate of 2.84%;
- Continued depletion of valuable aquifers beyond the point natural replenishment;
- Imbalance between supply and demand is constantly increasing;
- Unaccounted-for-water (UFW) is about 50% of production;
- Tariffs do not reflect real cost of production and distribution;
- Highly centralised structures and bureaucratic systems;
- Up to the year 1999, virtually no role of private sector in operations & maintenance of water systems or wastewater disposal systems.

The consequences of such a situation are obvious. There are likely to be:

- Intermittent supply in summer with widening gap between supply and demand;
- Unequal distribution by region / urban districts and different type of end-users;
- Adverse multiplier effects to other sectors of the economy;
- Loss of confidence and credibility in the Water Authority by other local authorities and the international donor community;
- Growing difficulties to justify subsidies in the water sector and to find sufficient funds to finance the increasing deficits of the water authorities.

The respective government authorities have of course been active to address the above problems and alleviate the situation, but have not always been successful in their attempts, mainly due to the lack of adequate financial and human resources as well as higher priorities given to other sector policies. There has also been a tendency to concentrate investments on the development of new water sources (supply side management) and neglecting demand side management and water saving strategies.

The Government of Jordan took up the challenge to increase efficiency and improve operations management through introduction of commercial management and the transfer of the management responsibility to private sector companies, wherever appropriate.

The Operations Management Support (OMS) Project is supporting the Ministry of Water & Irrigation and the Water Authority of Jordan (WAJ) in:

- Overall change management process and restructuring of the water sector;
- Engagement of private operators;
- Introduction of Micro-PSP (Private Sector Participation) options in smaller governorates;
- Necessary re-engineering of business processes & workflows;
- Introduction of advanced information management on the basis of Geographic Information System (GIS);
- Training of staff in managerial and vocational skills.

PARTICIPATORY IRRIGATION MANAGEMENT (PIM)

According to the World Bank(2002), Participatory Irrigation Management (PIM) refers to the involvement of irrigation users in all aspects of irrigation management, and at all levels. PIM is a process for improving productivity and sustainability of irrigation systems .Participation refers to a continuum of involvement in management decisions. One meaning of "PIM" may be that the irrigation users have total control and responsibility over the operations and maintenance of part or all of the irrigation system. Another meaning of PIM may be that a farmer council plays an advisory role, with real power remaining in the hands of the irrigation agency. Various levels of participation are outlined below.

i. Information sharing
- Translation into local languages and dissemination of written material using various media;
- Informational presentations and public meetings.

ii. Consultations
- Meetings
- Field visits and interviews

iii. Joint Assessments
- Participatory assessments and evaluations
- Beneficiary assessments

iv. Shared decision-making
- Meetings to resolve conflicts, seek agreements, engender ownership
- Participatory planning
- Workshops and seminars to determine positions, priorities, roles
- Public reviews of draft documents

v. Collaboration
- Formation of joint agency/stakeholder committees/task forces
- Joint work with user groups, NGOs, or other stakeholder groups
- Stakeholder groups given principal responsibility for implementation

vi. Empowerment
- Capacity building of stakeholder organizations
- Hand-over and self-management by stakeholders
- Support for new, spontaneous initiatives by stakeholders

Continuum of Involvement in Management Decisions

The continuum can be divide into four types from more to less government involvement (world Bank,2002)

Type 1: Government does everything

In this case, the irrigation agency (like in Malaysia) provides for the operation and maintenance of the main and secondary canals, while government sponsored farmers' organizations are responsible for providing water to individual farms. Farmers have no responsibility, and make no management decisions, about the water upstream from their outlets.

Type 2: State dominates; users help

The conventional management division in large irrigation systems is that the state takes responsibility for operation and maintenance of the headwork's such as a dam or river diversion, and the main, secondary, and larger tertiary canals, while farmers are responsible for managing water distribution and maintenance along the lowest level canals. Typically, this entails farmer groups of

between 10 and 50 farm families who are expected to work out sharing arrangements on their own.

Type 3: Users dominate; state facilitates

In some countries, associations of water users enter into contractual agreements with state water agencies for the provision of specific water services. For example, the National Water Commission in Mexico manages the headwork's and main canals, while legally recognized water user associations employ their own technical staff for the management of the secondary and tertiary levels of the canal networks. Farmers pay their associations for the water, and a small portion of that fee is passed on to the National Water Commission for their services.

Type 4: Farmers do everything

In some countries like the Hill regions of Nepal, most of the irrigated area is in the hands of local communities who have constructed their own canal systems, generally tapping small stream flows. Similar examples of local, farmer-managed systems can be found in nearly every country where irrigation is important, and the rules and customs of such systems provides a valuable pool of local knowledge that can be tapped in developing new irrigated areas.

Users' Organizations Different than PIM

Management approaches in irrigation (Brown,1994) generally fall into three categories: (1) public sector management, (2) private sector management, and (3) users' organizations. This last type can be termed "userism," and the process of transferring management to users can be termed "userization" The concept of "userism" is quite different from "privatization" in that we are talking about transferring management not to a third party "owner" who would purchase the irrigation system from the government and then hire out irrigation services to farmers. Rather, the PIM concept is more akin to an employee owned business that gives equal shares. Countries can be ranked according to their level of "userization" in the irrigation sector. While the ranking is rough, the trends are real.

At the upper end of the "userization" graph we find the United States, France, and Japan. Irrigation users have largely replaced the state in managing the irrigation sector although the government retains regulatory functions. At the lower end of the scale, where the state continues to dominate most aspects of irrigation and down to the tertiary or even quaternary levels, for example Morocco, India, Pakistan, etc.

The strategies that countries have taken in implementing PIM policies may be characterized according to three basic approaches: (1) the rapid "big-bang" approach of Mexico where water users are strongly pressured to establish an organization to replace the government, (2) the "bottom-up" slow approach of the Philippines with a strong focus on organizing and consensus building, and (3) a hybrid approach which adopts a moderate pace, such as that adopted by Turkey.

A good rule of thumb is that a participatory dimension is important to all management functions. Perhaps there are exceptions to this general rule, but within the field of irrigation management, it is difficult to imagine any. This does not mean that a farmer's council has to be consulted before any decision is taken. If the water availability is so small that only 40% of the demand can be met along a given canal, do farmers need to be asked if they want the water? However, the farmers who receive only 40% of their demand do need to know about overall water availability so they can plan their response, and perhaps suggest better ways of utilizing their reduced share.

Creating an Enabling Environment: Interest and Willingness of Stakeholders

For participation to work, the government, the incumbent power broker and major "stakeholder" in most national irrigation sectors, must be willing and interested. At least three sections of the government must be willing and interested to support PIM: Political leadership, Administrative leadership, Irrigation agency leadership.

A second, and some would argue more powerful stakeholder must also be brought into any discussions of PIM policies at the earliest stage. The membership of farmer stakeholders overlaps with governmental stakeholders in the form of political leaders who represent farming constituencies. These political forces who can speak on behalf of both government and farmers, can be particularly important in both designing and promoting PIM reforms.

Strengthening interest and commitment

Expressions of interest in PIM on the part of these entities can be strengthened by facilitating participation in workshops where international experiences are shared. Specific study tours to "model" countries and schemes can be arranged. The World Bank had arranged such study tours to Spain, Mexico, and recently to Argentina and Chile(WB,2002). Teams of political and administrative leaders have participated in these visits. The first such visit to Mexico by Turkish senior policy-makers was followed by study tours of several contingents of government officials from the Public Works Department. These visits and the shared experiences clearly contributed to the speedy implementation of the PIM program in Turkey. In Egypt, a tour of the USAID-assisted Irrigation Improvement Project was organized for legislators by the Ministry of Water Resources. The tour contributed to a much better understanding of, and subsequent policy support for, shared financing and management of the irrigation system by the government and water users.

Implementation Strategy

The opportunities for participation are different in each phase of the project cycle. Much of the emphasis on PIM has focused on participation in O&M, and particularly in the recovery of O&M service fees on behalf of the irrigation agency. While this aspect of participation is of great practical importance, there are many ways other aspects of irrigation management where participation can be incorporated. These include: (1) participation in irrigation project identification, planning, and design; (2) participation in system layout and construction; and (3) participation in project monitoring and evaluation.

In short, any aspect of irrigation management can have a participatory dimension. We have discussed why participation is important. In this section we will consider how to achieve it: how to implement participatory irrigation management. There is no recipe for this; indeed, the process of formulating a strategy that fits the specific features of any given country is the first -- and ongoing -- step.

Participatory Irrigation Management (PIM) refers to the involvement of irrigation users in all aspects and all levels of irrigation management. "All aspects" includes the initial planning and design of new irrigation projects or improvements, as well as the construction, supervision, and financing, decision rules, operation, maintenance, monitoring, and evaluation of the system.

This could be complemented by highlighting other cases where management reforms have resulted in improvements. Universities and centers of higher learning can help organize public discussion events. The media can help in reporting the outcome of these events and highlight key issues in the debate. NGOs can assist in seminars with water users. In Egypt, a professionally-made video film was made available to television stations that attracted large rural audiences in a pilot project area.

What are the problems of irrigation

In a national seminar on PIM in India held in 1994(Bruns and Helmill,1996), the participants identified the following problems, or issues, with irrigation management. While one can debate whether some of these are "problems" or "symptoms" of problems, they are certainly issues familiar to all of us:

- Inadequate water availability at the lowest outlets;
- Poor condition/maintenance of the system;
- Lack of measuring devices and control structures;
- Inadequate allocation for O&M;
- Inequitable distribution of water;
- Lack of incentives for saving water.

In particular countries and particular irrigation systems, some problems may be more critical than others. There are always additional problems or issues that could be added.

Rationale for Participation

Why participation? Another question might also be asked: "Why should the government be involved in irrigation?" Clearly, there are investments that only the government can make, or where the government has a definite advantage visa a visa farmers, even very well organized associations of farmers. Construction of dams and barrages, for example, or large canals, would be extremely difficult for farmers to handle. Governments provide us with available institutional resources -- departments, agencies, trained staff, etc -- which can be used to get things done. Why re-invent the wheel and ask farmers to organize their own arrangements for building as dam?

Comparative Advantage

Farmers have some *comparative advantages* as well. They have direct incentives to manage irrigation water in a productive and sustainable manner; they offer an on-the-ground presence that even the most dedicated off-site agency staff cannot equal, and they have an intimate knowledge about their fellow irrigators. The logic of the PIM approach is that both governments and farmers have separate comparative advantages. At the moment, governments are trying to do much more than they can do well. What are the advantages that management by farmers -- by the users -- can offer?

Improved design, construction, and O&M

When farmers are directly involved in the design process, whether for new systems or rehabilitation of old ones, they will provide useful design input and they will come away with an understanding of the design logic of the system they will be managing. During construction, farmer input has the functions of quality control (ensuring design standards are met), cost savings (through guarding against needless spending, and substituting some costs with farmers' own labour), and construction knowledge. Knowing how the system is constructed will help in repairs later on. The advantage of farmer inputs into O&M, either as direct managers or as the overseers of technical managers, has been discussed.

Lower costs to government

Cost savings to the government irrigation agency is often the driving force behind irrigation policy reforms. Government run systems are chronically short of maintenance funds leading to deteriorating systems and more difficult operation. Management transfer of major levels of the system to users offers government agencies an escape from this vicious cycle. While some critics see this as merely passing the costs on to farmers, the picture is not usually so bleak. Evidence from Mexico and Turkey suggest that farmers can manage better and more cheaply than their government predecessors. Thus, both farmers and government can benefit from these cost savings; farmers can enjoy better service, and cost savings; the government incurs less management cost and can then afford to improve service in the main system.

Social capital

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Organizing Process

Assuming that agency staff will be used for the organizing, and assuming that their professional training has been in irrigation engineering, they would need to be re-tooled as organizers. First of all they would need a thorough understanding of the rationale for PIM, so that they can present a clear

message both to the farmers and to their own colleagues within the irrigation agency. Secondly, they will need training in communication skills (including listening skills) for effective interaction with the users. Thirdly, they will need training in social analysis, including an understanding of social stratification (by caste, ethnicity, or class), kinship, patron-client relations, labour relations, religious factors, political affiliation, land tenure (tenants, share-croppers, owners), etc. And fourthly, they would need training in methods for gathering information from farmers (e.g., participatory rural appraisal) and in methods for organizing farmers.

THE PIM IN JORDAN

The irrigation management process in Jordan is still preoccupied with numerous problems such as bureaucrat precedent, lower irrigation efficiency and the big rise is in cost of the operation and the maintenance. The farmers are preoccupied with the loss of their times in the review of the widespread Jordan Valley offices as to the Jordan valley Authority (JVA) is preoccupied with the increase of the farmers aggressions on irrigation's establishments. While the cost of irrigation water that gained by JVA according a price slices from the farmers was less than the operation and the maintenance pumping cost, the average price reaches 13 fils/m^3 (corresponding to 1.84 cents/m^3). The government did not interfere in irrigation management in the high land and the areas of the south and the desert.

Situation of the water user associations in Jordan

It is clear in the previous statements that water scarcity and situation in Jordan needs to improve irrigation management system in agriculture sector which is considered the largest water consumer in the country. The government straightened some of weirs and irrigation's projects in the Jordan Valley. In previous period, the problem of high water losses and high operation and maintenance cost had been increased and widely appeared, having negative effects on the government and the farmers in the same time and imposing logic reasons for reviewing the consideration in the government performance.

This situation enhanced the idea toward the withdrawal graduating in the government role in irrigation management. The idea is to give the farmers a chance for participation in irrigation management throughout private organizations and water user associations.

There are no such associations in the current time in Jordan, but there are cooperation between small farmers in the distributed far area nearby springs in deferent locations in Jordan. The farmer managed irrigation by themselves and they divided the water in a traditional clannishness way by which every farmer has to irrigate in a given time and to expand his irrigated field according his water allocation. This way of irrigation management was successful and works well but irrigation canal and systems did not work efficiently.

The problems related to the activation of the Water User Associations are summarized in the following:

- The government interference and its consumption for the water resources in the dense agricultures for example Jordan Valley and restricts of irrigation management to Jordan valley Authority(JVA) which has the task of organization of a water employment and mono polices irrigation in the agricultural regions;
- The Ministry of the waters and irrigation deprived of the care for the presently found shapes of water users organizations in this connection;
- Domination of clannish nature of the imitation sometime in the presently found shapes of water users organization, and poor awareness about the importance and benefits of these associations formation;
- The spread of un enlightenment and poor consciousness between farmers in general, and poor awareness on experiments of the other countries in this issue;
- The weakness of water users financial power to initiate and maintenance of irrigation projects.

PILOT WATER SAVING PROJECTS IN JORDAN

TO2 Pilot project (Development area n°2 project)

In 1998, the JVA has suggested to concentrate the proposed studies of possible network and ‘’on farm’’ management improvements in a pilot area. in the TO2 Adassyeh area (131 farm units - 400 ha). Some studies on the feasibility of an ‘’on demand’’ distribution of irrigation water have identified the principal prerequisites for an eventual ‘’on demand‘’ operation (comprehensive shift to 6 l/s, comprehensive extension of pressurized ‘’on farm’’ systems, some improvements of the pumping station).

In the year 2000, after a rapid appraisal of the situation of the pilot area farms and of the actual management of the JVA and ‘’on farm’’ networks, a joint project between France and Jordan obtained from JVA the decision to shift all flow limiters to 6 lps in the northern branch of TO2 network (70 farms on 200 ha). In this area, MREA has supported the farmers to adapt their irrigation systems to the new conditions and has experimented the following proposals to improve the management of the irrigation network.

A) Improved JVA network management

In order to improve the equity of the distribution of the flows and to enable the direct use of JVA pressure for ‘’on farm’’ pressurized irrigation systems, it appears necessary to increase the delivered pressures to improve their distribution and their stability. Many small improvements have been experimented:

Shift all the flow limiters to 6 lps

- more FTA (farm intake) opened at the same time and less FTA to control;
- measure distribution of the opened FTA in the branches;
- almost obligatory shift to pressurized irrigation systems;
- eliminates the previous advantage to surface irrigation systems;
- JVA decision in December 2000 to apply comprehensive shift to 6l/s in North TO2;
- reduction of the flow well accepted by the majority of the farmers due to the pressure increase.

FTA Improvement

- all water-meter and flow-limiter functioning normally;
- window installed to allow the farmer to read the water-meter;
- fittings to install pressure gages (one inside for JVA;
- watermeter and flow-limiter fixed are generally accepted;
- the cost of metering has to be monitored and technical solutions may be need (new models of meter);
- no need to keep the JVA and farmer pressure control, one outside for farmer operation control,...) gages always installed.

Better pumping station management

- links (junctions between branches) installed when possible to increase the pressure uniformity in the network;
- suspension of the use of the main gate valves and the reduction of the number of operating pumps to control the flow;
- use of the ditch-riders to control the illegal openings;
- possibility to stop the pumping before the end if the control of the flow was not sufficient;
- improved rotation schedule using a pressure simulation program;
- new pressure gage to control the delivered pressure after the main gate valve;
- window allowing the control of the general digital water-meter;
- written control of the delivered flow and pressure every hour;
- both installed links are a success for farmers in the branch 4 (sometimes farmers from the branch 5 close the link to improve their pressure);
- when the order exceeding the maximum the operator is still obliged to use the main gate valve but it can be diminished considerably;
- the efficiency of the ditch riders depends upon their understanding of their duty;

- stopping the pumping station earlier when necessary allows less use of the main gate valve;
- new pressure gage very useful to control the delivered pressure;
- very few farmers use it (they do not know how to take advantage of the information (flow calculations, controlled volume for each block;
- written control seems very useful.

Better control of the irrigation orders

- effective fines when illegal openings are discovered in the field by the ditch riders;
- daily control of the water meters and distribution of fines to the farmers that appear receiving extra volumes;
- installation of new individual locks to protect the FTA (water meters and flow limiters) with the keys kept by maintenance team and team leader;
- better efficiency of the ditch riders is a complicated issue;
- the fines based on daily water meter readings request an extra ditch riders work, good control from stage office and good water meter maintenance but seem efficient and well adapted;
- the protection of the FTA through a good quality lock with specific key is necessary to protect flow limiter and water meter.

B) Improved ‘’on farm’’ irrigation

In the pilot area, the farmers were offered a comprehensive technical assistance (project of the network, installation, training for operation, etc.) and part of the necessary irrigation equipment free of charge 20 to 60% depending upon a socio-economic classification based upon the initial rapid appraisal and a participatory analysis. The main proposals were :

Use pipes of adapted diameters

Using the JVA network simulation to estimate the design pressure and to calculate the adapted pipes the irrigation uniformity is improved and the head losses are limited (generally bigger pipes especially in the mainline). A correction of on-farm network requires a technical study (simulation program, hydraulic calculations). Most of the networks are based on the vendors orientations. Could IAS (Irrigation Advisory Service) provide this technical support?

Use the micro-spray/virojet irrigation systems for citrus•

Good success of the virojets was observed even if many farmers (especially the poor ones) continue too more adapted than drippers ‘’open tubes’’ and evidently surface irrigation rely on ‘’open tubes’’ especially because virojet requires high pressure

Use screen filters for micro sprays systems

In order to limit the labour to clean the emitters to assure always the same flow and wetted area) many farmers think they can use virojets without screen filters (they recognize the interest but think it is expensive and that they can solve it with labour).

Improved screen filters

- modified local screen filters with bigger filtration area to extend the operation period;
- experimental local filters with higher filtration area have convinced many farmers (cleaning every ‘ one hour instead of 2 hours).

Training of the farmers on pressurized network operation

- use of the water meter, use of pressure gage, better operation of the irrigation blocks, trees)...
- very few farmers use the water meter to control the received flows
- some farmers understand the use of ‘’on farm’’ pressure gages
- trials of tensiometric scheduling for citrus suggest now practical methods to farmers

Control of the illegal openings

- How to maintain the ditch riders control, how to limit the corruption risks?
- How to use the farmers to support the control by the ditch riders?
- How the fines based on daily water meter readings can be continued and extended?

Possible extension to the vegetables areas

Where the farmers use already pressurized’ on farm’’ irrigation systems with pools and individual

pumps the proposals may be different (better design of the networks, better filtration, cover the basins to control algae's, smaller flow rates but receiving water during longer periods, increased period of direct use of JVA pressure).

Water Users Associations

IOJoV project has been supporting the creation of a local farmers or users association which could be an important partner for the network management, especially now that the management of the network has been improved. However the majority of the farmers still seems to reject the transfer of the management to a farmer's organization.

Use of tensiometric scheduling in citrus farms

The IOJoV trials organized in FU44 will have to be continued for at least one more year before a simple proposal for tensiometric scheduling for citrus orchard on sandy soils can be proposed. The use of tensiometric scheduling for fruit trees appears more complicated than for vegetables.

Key results of impact analysis and performance rating

The measures to develop about 5,900 ha for irrigation (main component) were largely carried out as planned. These measures comprised extending the KAC (King Abdullah Canal) by 14.3 km, erecting four pumping stations, laying a subterranean pressure pipeline network and other infrastructure measures (service roads and drainage system). The construction measures were carried out between 1984 and 1989. The implementation encountered no major problems. Nevertheless, the irrigation perimeter is till today not in operation. This is due to various reasons: Initially, the - 3 - operation of the additional area developed for irrigation was delayed due to the low water level in the King Tallal Dam for lack of rainfall. When the reservoir was sufficiently filled towards winter 1992, the JVA argued that growing winter vegetables alone was not financially viable for the farmers, since the investments they would have to make (drip irrigation system, greenhouses, etc.) were not profitable unless they were used in the summer half-year, too. This was in contradiction to the project design, which envisaged using the irrigation perimeter solely for irrigation in the winter half-year. JVA intended to ensure an all-year-round availability of irrigation water through putting the Karameh Dam into operation. After completion in autumn1997, however, there were problems with the salt content of the water. At the same time, a drought set in that lasted till 2001, which resulted in an overall water shortage in the Jordan Valley. Moreover, only at the end of the nineties the land reallocation required for irrigation operations was carried out: In 1999, 90% of the farmers had agreed to their new farming areas.

The reason why the irrigation perimeter is still not in operation is that although JVA had initiated the necessary overhaul of the irrigation infrastructure at the end of the nineties with World Bank financing the drought has persisted and caused a water shortage for the last four years. Based on the experiences gained over the last 13 years, there are today reasonable doubts whether the additional irrigation area will ever be put into operation. The key component of the project has so far had only marginal impacts on the target group as very little water was provided in the canal during winter and only irregularly tapped, so the project has been unable to make a significant contribution to raising the income of the farmers. For the same reason, possible beneficial environmental impacts, such as the conservation of groundwater reserves, have not materialized.

The improvement of the Water Management Information System (WMIS) for the whole of the Jordan Valley has been implemented in several stages. First, the WMIS was examined in a pilot phase to appraise functionality and acceptance. Based on the findings and recommendations of this pilot phase, the following measures were carried out: replacement or improvement of the computer equipment of the WMIS to forecast seasonal and daily water needs and water supply (Phase A), adjustment of the WMIS applications and suitable software for a better and more user-friendly management (Phase B), expansion of the measuring system, automation of remote control of weirs and installation of dynamic regulation to monitor and control the whole hydraulic system of the KAC (Phase C). All phases were successfully completed and the WMIS is properly operated by JVA. The WMIS makes a major contribution to improving the efficient use of the water resources in the Jordan Valley. Alongside an increase in water supply for irrigation through improved efficiency, this project component has also had beneficial impacts on environmental protection and resource conservation. In the project appraisal, a total of nine conditional ties were imposed on the borrower and/or the

project executing agency. The conditional ties, where relevant, were largely met, though with considerable delay in some cases. The implementation of the required actions had some tangible beneficial impacts, such as the improved marketing of agricultural produce and a substantial rise in the fees for irrigation water (1995), but could not prevent project failure. The project appraisal identified marketing as the most important project risk. The major deficits were identified in marketing organization, market research and agricultural extension services to suit market needs. Several conditionality aimed at remedying these deficits. As production has not been increased due to the project, these risks have never become relevant. The project design (restriction to irrigation in the winter half-year) was also considered to pose an economic risk for the farmers of the target-group. A recommendation was made to JVA to conduct - 4 - relevant water management studies to inquire the possibility of providing water in the summer half-year as well (see above). As the farmers due to the unavailability of water did not invest in the irrigation infrastructure they were supposed to finance, this risk never played a role either. The additional irrigation area developed in the project was never put into operation, nor is this likely in future. The intended increase in farm production by developing irrigation in the Southern Jordan Valley was therefore not achieved and this is not expected in future, either. The complement to the main measure, improving the Water Management Information System, was implemented effectively and thus made a contribution to more efficient and economical resource management and in turn also to improving the conditions of life of the population in the Jordan Valley. This project component accounted, however, for merely 10% of total costs, so that the successful implementation must be seen in a relative light. Therefore, the effectiveness of the project can be assessed as clearly insufficient (partial rating 5). Since the investments in irrigation infrastructure, accounting for 90% of total costs, have been idle for 10 years, the project can no longer attain an adequate financial and economic rate of return. As to its main component, the project must be rated as a complete failure in terms of efficiency. No precise figure can be determined for the economic benefit gained from improving the WMIS. Nonetheless, the costs incurred can be assumed to be reasonable.

In hindsight, the project design was quite well suited to make a contribution to increasing farmers' income. Even if due to the persistent drought and the resultant water shortage the irrigation infrastructure will not be put into operation, the basic developmental relevance of the project approach remains. Since the project was never put into operation, this aspect is attributed subordinate importance only. Despite the successful implementation of the WMIS, the project has made no significant contribution to increasing farm income so that the significance of the project is clearly insufficient (partial rating for relevance/significance: 5). Weighing up the above listed key categories, we attest the project a clearly insufficient degree of developmental effectiveness.

Kafa'h Project (3-5 years duration)

This project will be implemented by the USAD, Jordan Valley Authority, Ministry of Agriculture, National Center for Agricultural Researches and Technology Transfer, (NCARTT) and other public and privet sectors. The Project was started in December 2003 in the Jordan Valley and Amman-Zarqa Basin with the following *objectives:*

- Improvement of water resources management.
- Initiation of a long-term program on water-use efficiency in agriculture.

The expected duration of the project is between 3 and 5 years. The project activities include:

- Advise decision-makers of unassailability of present practices in water/ agriculture sectors. Build constituency and advocacy for agriculture water conservation policy.
- Provide farmers with useful information.
- Demonstrate improved on-farm water management practices to poor, rural communities.
- Establish an active and involved high quality private sector or non-for profit sector extension system in Jordan that utilizes up-to-date research.

Performance goals of the project

Goal 1: Implementation of a special informative campaign targeted to decision-makers regarding present unsustainable practices to create an appropriate environment for positive changes.

Expected results:

- Two policies and implementation regulations that revise regulations promoting unsustainable practices in water resources use.
- Two policies and implementation regulations promote sustainable agricultural use of water resources.
- Selected local journalists and broadcasters have good understanding of complete water situation and how it affects agriculture.
- 60% of the public is knowledgeable of current unsustainable practices in the agricultural sector and can name three policies that would improve these practices.*Goal 2:* Significant spread of new attitudes and behavioural patterns among the Jordan Valley and the Amman-Zarqa farmers.

Expected results :

- At least 80% of farmers in the project area are familiar with on-farm water management techniques.
- At least 30% of farms in the Jordan Valley and Amman-Zarqa basin irrigating with wastewater effluent have adopted cropping pattern.
- At least 50% of farms in the project area have adopted water-efficient irrigation technologies and 60% of farms have improved on farm water management practices.
- The water use of 50% of the farms in the project area has decreased by an average of 10%
- Average productivity in at least 30% of the farms has increased by 5%
- Income of 40% of farmers has increased by an average of 15%
- A mailing list of farmers in Jordan is developed
- At least 5 demonstration sites exhibiting techniques and methods of improved irrigation water management established in the Jordan Valley and the high land.

Goal 3: The private sector and/or the non- for profit sector have established a sustainable, active and involved, producer-level extension and agricultural communication service.

Expected results:

- Extension personnel at public and private institutions trained on the issues covered by this effort and serving farmers.
- At least 2 institutions form a partnership with institution in the US in area of Agricultural extension and research.
- Appropriate educational material in the areas covered by this effort developed for use by extenuation personnel, cooperatives and farmers.
- Appropriate, periodic, short-term, intensive training courses
- Farmers satisfaction with the extent and quality of extension services provided public and private institutions doubles (50%) in relation to on-farm water management, crop selection and marketing channels knowledge.

Goal 4: Improved irrigation management and rainwater harvesting activities initiated in selected poor communities.

Expected results:

- At least 5 revolving funds in 5 rural, poor communities are established on a yearly basis. These funds should relate to water harvesting and improved on-farm water management practices including cropping patterns and must lead to a direct improvement in daily lives of the families benefiting from the funds in the community by providing a additional income source.

THE FUTURE ASPIRATIONS AND NEEDS

There is no doubt that a lot has been learned in the process of transfer and from the experience gained in Jordan, several suggestions can be offered as follows:

- Promotional programs explaining the advantages of participatory irrigation management are essential initial activities for successful transfer programs. This can be done through meetings, workshops, and distribution of pamphlets.
- It is important to raise irrigation tariffs to the level of financial self-sufficiency before the transfer so that Water Users Associations can support adequate operation and maintenance programs.
- Government agencies should provide for ongoing programs of rehabilitation and modernization of infrastructure and support for WUA directors.

- The larger modules are, the cheaper are their operations costs per unit area.
- The election of a WUA's first set of directors is a critical action for the future of the association. When the directors are representatives of the membership and have leadership capacity and managerial spirit, the WUA will likely be successful.
- Successful transfer requires an appropriate legal framework. This framework most define clearly the rights to water, forms of organization, the responsibilities of each party, and the manner in which activities should be regulated. Fiscal benefits must also be considered for companies that manage the irrigation and drainage infrastructure.
- A transfer program should be accompanied by training for both WUA directors and their operating staff. The system of training should be ongoing.
- In order to finance programs of support, the government should provide subsidies. It should also foster the participation of users in support programs, and, if possible, the participation of state or county governments. Users' participation will guarantee not only better management of funds but also a major interest in the programs on the part of users.
- Once the process of transfer is carried out, public agencies previously in charge of water management should be restructured. Their new roles should be oriented toward guidance and supervision of the new managing entities and acting as a linkage point between WUAs and the government. To perform this new role, they must have an adequate staff with an appropriate mix of skills. Since investment in constructing new hydraulic structures will be significantly reduced, JVA's role should be oriented to helping to solve problems of operation, use, negotiation, and management of water, and to supervise and support WUAs and the application of the Water Law.

Several issues affect the potential for further improving participation in irrigation management.

1. Agricultural diversification is needed to improve farmer incomes and welfare. If irrigated agriculture is more profitable for farmers then they will be more interested to participate in irrigation management.
2. Clearer water rights and farmer participation in basin water resources management can help prevent problems and facilitate a smoother, more equitable and more efficient process to improve water use efficiency and reallocate water among competing users.
3. The capacity and sustainability of WUAs may be strengthened through joint activities beyond irrigation management, building on local opportunities.
4. More traditional, quasi-voluntary WUA management can work well in small systems, while contracting for specialized irrigation management may be more suitable in multi-village irrigation systems and more commercialised areas.
5. The financial capacity of WUAs should be increased, enabling WUAs to borrow and invest in irrigation development.
6. Accumulated experience provides a basis for re-engineering tasks in irrigation O&M to create better patterns of cooperation between government and farmers, which should include opportunities for WUA to take over a greater role in the management of larger irrigation systems.

CONCLUSIONS

A number of key lessons can be extracted from the experience of participatory programs:

1. Participation improves planning, helping to provide valuable local information, prevent problems and optimise use of local resources.
2. Local cost sharing increases benefits, both by mobilizing additional resources and by increasing accountability to farmers, which then helps improve the quality and appropriateness of construction.
3. Institutional reforms promoted by participatory programs have often helped highlighting the problems and supporting the changes, such as more equitable block-level water distribution.
4. Training programs have helped improving capacity to carry out participatory programs. Training should continue to help orienting the staff taking up new responsibilities. Monitoring information and WUA requests could aid in more efficiently targeting training at sites with priority problems and opportunities.
5. A legal framework has been established for WUA. This framework will be more useful if it allows

WUA to take on more formal legal status according to their own needs.

6. Policies now support participation, with detailed regulations, guidelines and training materials available.
7. There has been a tendency to make participatory approaches excessively complicated. Simpler, more focused approaches to PIM are likely to be more effective.

REFERENCES

Abu-Zlameh R. (1999). *The role of the water user organizations in agricultural sector*. Arab Organization For Agricultural Development. Ministry of Water and Irrigation Annual Report 1998. Morocco, 20-22/7/1999.

World Bank (2002). *A handbook to get the involvement of irrigation users in all aspects of irrigation management, and at all levels.* Environment and Natural Resources Division (EDIEN) &New Products and Outreach Division (EDINP) World Bank Institute (WBI), World Bank, Washington, USA.

Al-Weshah, R. A. (1999). Jordan's Water Resources Technical Perspective. In *Proc. Fourth Gulf Water Conference*, Water Science and Technology Association, Bahrain.

Al-Weshah, R. A. and Shatanawi, M. R. (1996). Rainfall Forecasts and Irrigation Demands: A Case Study from the Jordan Valley. In Proc. *Irrigation Research in the Mediterranean Region*, Amman, Water Resources in the Middle East, IWRA Publication.

Berdegué, J. A. (1997). Organization of Agricultural Extension and Advisory Services for Small Farmers in Selected Latin American Countries. In the *Development Workers*. Course on Technology development and transfer, 7–11 April 1997, Greve, Denmark.

Brown, D. (1994) Strategies of Social Development: Non-governmental Organizations and the Limitations of Freirean Approach. *The New Bulmershe Papers*, University of Reading.

Bruns B. and Helmill L. (1996). *Lessons from experience and issues for the future*. Draft document.

Jordan Valley Authority, (2000). *Irrigated Agriculture in Jordan and on-going irrigation advisory service pilot program with the Jordan Valley Authority.* Amman, Jordan, Funded by USAID.

Ministry of Water and Irrigation of Jordan (2000). *Annual Report 2000*. Amman, Jordan.

Ministry of Water and Irrigation of Jordan (2002). *Annual Report 2002*. Amman, Jordan.

Shatanawi, M. R. (1988). A Formulation of a National Water Policy: Case Study From Jordan. In *Proc. Policies and Regional Instruments for the Sustainable Management of Water Resources in the Mediterranean Region*, Milan, Italy 27-28 March 1988.

Shatanawi, Muhammad, Yasin al-Zu'bi, and Odeh al-Jayoussi (2003). Irrigation Management Dynamics in the Jordan Valley Under Drought Conditions. In *Tools for Drought Mitigation in Mediterranean Regions*. Kluwer Academic Publisher.