ISSN 1021 – 268X

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IPTRID network magazine
Issue 24, February 2006. Published twice yearly.

International Programme for Technology and Research in Irrigation and Drainage (IPTRID)

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Submission of material
GRID invites short written contributions, principally for the Diary and Forum sections. They may include photographs or drawings, which must be of high quality and suitable for reproduction at reduced size. Contributions should be sent to International Programme for Technology and Research in Irrigation and Drainage (IPTRID), Land and Water Development Division, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, 00100 Rome, Italy

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Editorial panel
Carlos Garcés-Restrepo, Giulia Bonanno di Linguaglossa, Edith Mahabir and IPTRID Secretariat

Publishers
Published by the Food and Agriculture Organization of the United Nations.

ISSN 1021-268X

Sponsors of GRID
Department of International Development, UK

Food and Agriculture Organization of the United Nations, Italy

Ministry for Foreign Affairs, France

Ministry of Agriculture, Fisheries and Food, Spain

IPTRID Secretariat, Italy

Date for submission of material for Issue 25 is June 2006.

Young farmers working old treadle irrigation system (noria) in a rice field. *(FAO/19683/G. BIZZARRI)*

Aim and scope

GRID is published to assist communication between researchers and professionals in the spheres of irrigation and drainage. It informs readers about IPTRID activities, and about research and development in irrigation and drainage with a view to stimulating international debate on these issues.

GRID is produced for professionals working or having an interest in irrigation and drainage projects in developing countries. It covers all relevant disciplines including engineering, agriculture and the social sciences.

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A welcome from the Programme Manager

Dear Reader,

On GRID

You have in your hands our first issue of GRID for 2006 and, as we had promised, we will try to publish our flag magazine twice a year from now on. While we had initially decided that our issues would contain 16 pages the overwhelming contributions received have required that once again we increase the number of pages, this time up to 28. We are grateful for this support and want to encourage our readers, particularly those in the developing world, to send us their contributions and share with us their experiences, problems and solutions.

In this issue we have our second Interview, a feature that we want to make permanent. On this occasion, our distinguished guest is our Chair of the IPTRID Consultative Group, Mr Peter Lee. Through an event that took place after the selection of our interviewee he became the President of the International Commission of Irrigation and Drainage (ICID) and, thus, by pure coincidence our two interviews so far ended up featuring the outgoing and incoming Head of ICID, one of our Central Partners.

Our work

We had a successful 2005 and we hope you have had the opportunity to read our corresponding Annual Report which has been put out recently. During our governance meetings held in Beijing in September 2005, our main organ agreed to slightly re-orient our mission based on the manifested desire of our stakeholders. I think it is proper that we reproduce our new mission here as it will be our guiding path for the near future and beyond:

> *"To improve the uptake of research, exchange of technology and management innovations by means of capacity development in the irrigation and drainage systems and sectors of developing countries to reduce poverty, enhance food security and improve livelihoods, while conserving the environment".*

With an ever changing world and still besieged by poverty and hunger, IPTRID seeks to find its niche as a facilitator in providing the link between research and development. We want to assure that already existing research results, technology and management innovations will reach the farmers' field to ease his burden and improve his livelihood. Irrigation and Drainage (I&D), as a unit, holds the key for a productive and sustainable agriculture in many areas of the world where, often, water scarcity adds another constraining element. Thus, the application of selective elements of Irrigation and Drainage research and technology that fits particular needs will go a long way in pursuing our goals.

We will continue our work within the framework of an Integrated Water Resources Management (IWRM) approach. However, with Agriculture as the main user of the water resource and the increasing competition with other sectors, our Irrigation and Drainage focus is as valid today as it was decades ago. Investments in I&D are again on the rise and the proper application, utilization and disposal of water for agriculture needs to be kept at the forefront. We will pursue our donors and work with our partners and governments to continue to show and assure them of the great relevance and need for our Programme.

Carlos Garcés-Restrepo
IPTRID Programme Manager

Interview with Mr Peter Lee

The idea of interviewing in every issue of GRID a person that is well versed with the subject of IPTRID's field of work, whether familiar or not with the Programme itself, is meant to add a new and interesting element for our readers. In this issue, however, our interviewee is not only a renowned water professional but also closely associated with the Programme in his capacity as Chair of our Consultative Group. In this position since 2000 hardly anyone else would be in a better position to address the questions that GRID has formulated. Mr Peter Lee, also the Director of Mott MacDonald in India and the President of the International Commission on Irrigation and Drainage, provides a candid view of IPTRID and its future.

What do you see as IPTRID's niche?

There was a very good debate on this at the Consultative Group meeting in Montpellier in 2003, when it was made very clear that IPTRID's particular niche was in facilitating the uptake of research and transfer of technology in irrigation, for the benefit of developing countries. After that meeting, this became referred to as IPTRID's central focus in seeking to develop the capacity of developing countries to sustain an increase in the productivity of irrigated agriculture.

What is your vision of IPTRID in the near and long-term future?

IPTRID is unusual in that it draws on the strengths of a network to deliver its objectives. The capabilities of the network partners gives it enormous potential strength but we have

continually to remind ourselves of the need to mobilize the full potential of the network. My vision is of a network organization that will be seen as a model of what can be achieved by collaborative working, with greater ownership being taken by developing countries. At some time in the near future, we should consider moving the Secretariat of IPTRID to a developing country, again mobilizing the capabilities of the network already existing in those countries.

The recent Consultative Group meeting held in Beijing recommended a shift away from capacity development into a more research and technology oriented Programme. What is the rationale behind this?

As I have already indicated, the Consultative Group has always held that research and technology have always been the central focus of IPTRID, and these are the attributes that differentiate it from the many other organizations that undertake capacity development. The Triennial External Evaluation presented to the Beijing Meeting of the Consultative Group found that in order to attract more funding, IPTRID had placed much more emphasis on capacity development, and the "T" and "R" words in the programme's title were no longer central to its identity, in spite of what was said in the mission statement. The Evaluation confirmed that there was now a broad agreement that the emphasis on capacity development had undermined IPTRID's identity without adding much by way of additional financial support. The Consultative Group accepted this and came to the view that capacity development was a means by which IPTRID might improve the uptake of research and exchange of technology, but not an end in itself. If this is seen as a change then that is fair enough, but in my view it is reaffirmation of what was always IPTRID's role, brought up to date to reflect the importance of the dissemination of knowledge and bridging the gaps by means of technology, in the broadest sense, not just hardware.

Given the recent changes in IPTRID's mission, do you have a message for the Programme's potential donors?

I think the appeal of IPTRID to donors should be that it is network that adds value by acting as a bridge between developing countries and donors, in creating projects that are worthy of funding, and helping in the management of the process. Moreover, IPTRID is a network of organizations that can provide this service and therefore, it can draw on the best capabilities available. In practice, IPTRID has developed the reputation of being an "honest broker" between the aspirations of developing countries and the objectives and organizational constraints of donors, and this reputation is increasing as IPTRID strengthens its links with the

developing world. This is not an easy role as those constraints are constantly changing, and the Triennial External Evaluation spoke of a mismatch of perceptions, expectations and needs of donors, network partners and developing countries, and emphasised the need for IPTRID to be close to the needs of developing countries. This in itself should make IPTRID more useful to donors, than merely echoing what the donors themselves already perceive.

There seems to be a proliferation of 'special' programmes like IPTRID. What makes IPTRID different?

See first question above.

What are the incentives for institutions/organizations to join the IPTRID Partnership Network?

I believe there are advantages for development and research organizations in both the developed and developing world. As the readers of Grid must be aware, there are several organizations which have been active in providing services to the IPTRID network. In the past, this was often associated with funding from the particular partner's government. Now the situation is becoming more flexible, with much of the funding being untied. The advantage to those service providers in being part of the network is that IPTRID is facilitator not a competitor, and dedicated to matching developing countries needs to donor priorities and network partner capabilities and resources. The capabilities of ICID as an IPTRID Central Partner, in supporting links to developing countries and to potential partners and donors is particularly important.

As President of ICID, what kind of relationship do you foresee and what support can you offer to IPTRID?

As the new President of ICID, I hope that I can help strengthen the role of ICID as a Central Partner of IPTRID. Already, the Commission is taking steps to rationalize its interface with IPTRID and it has been agreed that IPTRID will be a member of ICID's Permanent Committee on Technical Activities. I have no doubt that ICID and IPTRID can help each other, particularly as the ICID membership provides a point of contact for IPTRID in many developing countries, and IPTRID's interaction with ICID National Committees can help those committees in establishing themselves. IPTRID's networking with the nascent ICID National Committees in Mali, Bukino Faso and Niger was a recent example of this.

In conclusion, I would acknowledge that IPTRID faces big challenges and, in particular, it must strengthen its Secretariat, for which we need more support from the donors. However, the new Programme Manager, Carlos Garces, has already made tremendous progress and earned the wide support of those connected with IPTRID. ■

Visit IPTRID web site at:
www.fao.org/landandwater/iptrid/index.html

Changing deserts into agricultural lands

Background

During the past century, various Peruvian Governments were concerned about the water deficit existing in many valleys in the Coastal Region of the country. Indeed the water deficit was, and is, the single most important factor hampering overall development. In general, most of the rivers coming down from the western side of the Andean Ranges carry enough surface water only from January to March. The rest of the year, from April to December, there is a water shortage, to serve agriculture, industry, manufacture and domestic uses.

Some 450 kilometres north of Lima along the Costal Region of Peru the Santa River, which marks the border between the Ancash and La Libertad Regions, discharges into the Pacific Ocean. The Santa River is one of the few perennial rivers discharging from the mountains. Upstream, one intake structure diverts part of the river flow northwards into La Libertad Region. The diverted flow is used by the Chavimochic project covering several valleys. These valleys, narrow upstream and wider downstream, all have a seasonal river which command land for irrigation although at times it floods.

Current view of the new lands in the Chavimochic project.

The Chavimochic Multi-purpose Project

Specifically regarding the Chavimochic project, the acronym is formed by the first letters of the names of the valleys where the water is used, namely, Chao, Viru, Moche and Chicama, all of which are located on the right hand side of the Santa River. There were thousands of hectares between successive valleys lying idle due to lack of water. These lands are the so called inter-valleys and are at a higher topographical elevation than the valley itself, therefore difficult, if not impossible, to irrigate by gravity from their respective seasonal rivers. These lands were true deserts, mostly eolic sands or soils with no structure and with very high infiltration rates and high temperatures during the summer. Indeed, a challenge for development, along with an eagerness to expand the agricultural frontier. Photo shows the current view of the new lands.

The Chavimochic multipurpose project's ultimate aim is to bring 70 000 hectares of desert lands (inter-valleys) under irrigation and to improve the irrigation of more than 74 000 hectares of old lands located in the valleys. The water from the Santa River was diverted northwards by a main canal of about 83.4 kilometres. In addition, it will generate 68 MW of electricity though 3 hydropower stations; and will supply 1 000 litres/sec of potable water to the City of Trujillo. Preliminary field work for the Chavimochic project started in 1960, the construction of the hydraulic infrastructure started in 1986 and was completed in 1990. It was only in 1994 that the process of territorial occupation really started.

The Project is applying conventional technologies to conquer the deserts between the inter-valleys and introducing innovations and creating synergies leading to the production of high economic-return crops. All this makes Chavimochic a most outstanding project. The Project is already meeting the challenge of water professionals regarding water use efficiency, high return crops, expansion of the agricultural frontier, integral and biological pest control, organic fertilization, employment generating enterprises, and farmers paying the right water tariffs.

Land development

The inter-valley areas were public lands belonging to the country. The area was sold by the government through a sui generis international bidding process. This land selling process started with the basic concept of land property – land titles – and fully adhered to and respected the Peruvian judicial establishment. The land transfer to the private sector was carried out in lots of varying sizes, from 50 to more than 1 000 hectares. The single most important factor determining the winners was the commitment to invest the most in land development and in the shortest possible time. In addition, the winners were those paying higher prices and within the shortest possible time. These commitments were fully supported by a financial guarantee, so that the Government could repossess the land in case of failure to fulfil the agreed conditions.

Once the winners of the bidding process took possession of the land, they fenced it with trees, stakes or shrubs. Then, a rough land grading was carried out, simultaneously building the irrigation water intake to allow the diversion of water from the Main Canal built by the Government of Peru (GOP). At the same time, the owners installed the head units (measuring, filtration, fertigation, chemigation) for the localized irrigation systems along with the desilting basin for the final evacuation of suspended solids removed from the irrigation water and the main piping system for the distribution of water. Farmers in the inter-valley areas use different types of fully automatic localised irrigation system (drippers, tapes, etc.) with end-of-line self-flushers to allow continuous removal of fine sediments. Sand, screen and ring filters are also used by many owners in Chavimochic to capture and remove suspended solids in the incoming water.

Organic matter was abundantly applied, up to 100 metric tonnes per hectare, in order to improve the physical and chemical characteristics of the soil. Soil moisture retention was therefore increased as well as plant nutrient availability. It must be stressed that fertigation and chemigation is a common practice in the development of these desert lands.

Map of Chavimochic.

Crops and water availability

The main crops in these lands are white asparagus, red pepper or paprika, avocado, artichoke, bonete pepper, onions, beans and many others, including sugar cane. One important asset that the region counts on is the absence of low temperatures, indeed the average yearly temperature is 19.1°C. Farming is therefore allowed throughout the year. In addition, water availability is ensured at all times from the main canal which runs northwards at a topographical position of some 50 metres above the lands providing position-hydraulic permanent head. There is no need for pumping, the water is already pressurized.

Water tariffs

Farmers pay about US$0.025 per cubic metre for the water service. Water delivery is measured by flow metres, similar to those used for domestic purposes. The desert lands were sold with the understanding that the Government ensures the yearly allocation of 10 000 cubic metres per hectare. The Water User Association (WUA) receives a detailed listing of the amount of water used by each farmer. The WUA collects the payments for the water service and farmers have two months to pay. Afterwards, the WUA delivers to the Board of the Multipurpose Chavimochic Project the share of the total tariff corresponding to: (i) payback of the investment; and (ii) the cost of the operation and maintenance of the hydraulic infrastructure, taking into consideration the volume of water used.

Rate of land transfer and exports

So far, close to 27 000 hectares have been sold through the international

competitive process. Another 5 100 hectares have gone through direct sales and 1 000 hectares went to the San Jose farmers community, bringing the total land assignment process to a net area of 32 990 hectares. According to the Representative of Owners of the new lands, currently there are more than 15 000 hectares under production, and they expect to export about US$180 million in 2005. The potential is clearly spectacular, with an opportunity for the creation of jobs for more than 30 000 families in direct employment, and to export about US$1 400 million in the immediate future.

Consequent to the above, from 1995 to 2005 so far 11 export companies have been involved in the Project. The total value of exports of agricultural production has reached more than US$600 million; increasing from US$18.8 million in 1995 to US$151.1 million in 2004. The projected export for 2005 stands now at US$180 million. Farmers continue in the search for new international market openings, with emphasis on European and other markets. The Peruvian market is small for this type of produce and still shows low interest. The produce is however highly regarded in foreign lands for its high quality.

Further development of the Region

In the meantime development continues. Livestock for milk production and sheep fore meat is spreading quite fast. Poultry production has increased tremendously. Even the famous Peruvian horses are bred in some farms. The availability of crop residues has made all these activities possible, including the exploitation of compost and organic manure, generating a close circle for sustainable crop and animal production.

This type of agro-industrial exporting and competitive development within the current world globalization is attracting many others and is spreading to other irrigation projects in the Costal and in the Sierra (Mountainous) Regions of the country. Even small farmers with 3 hectares or less are searching for some form of associations in order to apply the Chavimochic development model.

Some individual examples may be cited from the old lands in the valleys of Chao and Viru. Associated farmers, with little or no Government assistance are using shallow groundwater with equipment for drip irrigation. In addition, they also have purchased small gasoline internal combustion engines to drive pumps. Currently, the Government is investing in the electrification infrastructure to promote the adoption of pressurized irrigation systems, such as the ones in the new lands of Chavimochic.

Simultaneously, the areas of the old lands, are trying to use irrigation water more efficiently and to improve irrigation distribution and scheduling. In other words, farmers are encouraged to request the amount of water that the crop really needs, therefore paying for service corresponding to the right volume of water, and at the same time, ensuring that water will be delivered on time and for the time required according to the flow. Chavimochic is using the software IRRIGATION DISTRIBUTION SYSTEM (IDIS) developed within the framework of a Letter of Agreement between the Food and Agriculture Organization of the United Nations (FAO) and Chavimochic in the 1990s. The software is proving very valuable for the purpose.

The future

The Government investment in Chavimochic has been very high in the construction of hydraulic works. These have made possible the availability of water to the desert lands and at the same time, agricultural entrepreneurs are positively meeting the challenge, with their own investments, with high technological packages and with an overall focus on the environment and a high sense of responsibility.

Both, the Government and the agricultural entrepreneurs have a pending agenda. In order to ensure the sustainability of the Chavimochic project both partners must seriously consider the need to build additional major infrastructure in view of occasional and long term changes, such as the effects of global warming and diminishing flows of the Santa River. For its part the Government must undertake the responsibility: (i) to ensure the basin stabilization, adapting to expected conditions as a result of global climatic changes, and (ii) to carry the Chavimochic to its completion since it is currently in its second stage. Farmers must pledge to participate in the maintenance of the project and creatively adapt themselves to the upcoming climatic conditions, phytosanitary environment, and to take full advantage of the international agricultural marketing opportunities, among others. The Chavimochic project is the dream come true for many agricultural specialists and other professionals who envision a better future for mankind. ■

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Major findings of gender study in the Multiple use scheme (MUS) in the hills of Nepal

Introduction

Numerous rivulets and springs provide promising opportunities for the development of small irrigation and water supply schemes in Nepal. Many such schemes were built under users' initiatives and the users are benefiting from them for multiple purposes. Moreover, these small schemes are easily accessible to the poor and marginal households. Building on this trend, a few multiple use schemes were launched with the support from Nepal Smallholder Irrigation Market Initiative (SIMI), International Development Enterprises (IDE), and other donors. Multiple use water supply schemes provide water both for the household use and irrigation. All of these schemes are community-managed with substantial community participation. Assessment of the impact on gender of Multiple Use Water Systems (MUS) in the hills of Nepal is important. Therefore, this study assesses the gender dimension of MUS and presents preliminary findings.

Methods/Techniques of Data Collection

Focus group discussions (FGD) have been used for collection of primary information from six groups in three hill districts: Syangja, Palpa and Surkhet. The FGD were conducted by using a checklist prepared for the purpose. The participants were executive committee members and male and female users. To assess the impact on women and men, comparison of the "before" and "after" situation was also undertaken.

Multiple Use Schemes

The interventions in different locations have followed basically three strategies.

1. Intervention with completely new irrigation and drinking water schemes as per the technical design based on the need of the users in these locations.
2. Intervention in existing drinking water schemes (Sorek and Pelakot in Syangja; Chhiskhola in Palpa).
3. Intervention on one scheme (an underground tank) that is being used both for irrigation and drinking water (Dibindada in Palpa).

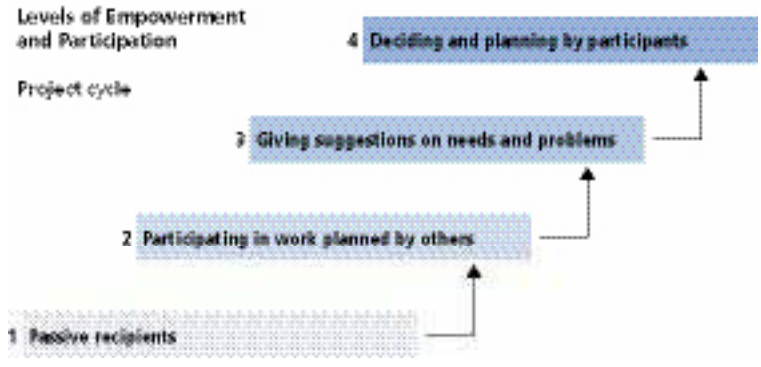
Irrigation schemes are completely new in each of the sites. But existing or abandoned drinking water schemes have been rehabilitated or combined as MUS. The technology used by the project includes one Thai Jar of 3 000 litres for drinking water. The overflow from this jar is collected in an underground tank of 10 000 litres for irrigation and distributed through offtakes at farmers field.

Major findings

Both men and women in the communities were positive about MUS as clean drinking water and irrigation facilities were available to grow vegetables through the pipe system.

Both men and women were consulted on problems and need identification and selection of the schemes. The SIMI irrigation technician consulted male and female members while doing the design and layout activities. Males and females were involved during construction. But it was found that most of the males participated in planning and decision making while women by large were involved in implementation. The discussions in different MUS groups reflected the division of labour between males and females. Mostly males participated in breaking stones and making walls while females were involved in carrying the sand and stone. All the six groups carry out the operation and maintenance work regularly once a month. Females clean the intake and water tank. Repair and

PROJECT CYCLE DIAGRAM



maintenance like plumbing etc. were taught to male members only.

Active participation is a prerequisite for empowerment and promoting a real sense of ownership. Therefore, in order to assess the quality of participation of men and women in the programmes and organization, the participants were asked in which level the female members fit: a) passive recipients; b) participating in work planned by others; c) giving suggestions on needs and problems; and d) deciding and planning by participants. Most of the female members said that they participated as passive recipients and in work planned by others. Some women participated in giving suggestions on need and problems. Very few women were actively involved in the decision-making process.

Women in the communities were positive about water availability, because it considerably reduced the time needed for fetching water. With the introduction of MUS, they have saved two to three hours of time depending upon the size of the family and the distance to the water source.

Due to the availability of water for irrigation, farm activities have increased and women have time for vegetable farming which also generates some cash. However, they are so busy with the farm activities apart from household activities that they have less free time than before.

The income level of communities has increased with the introduction of MUS. The women, however, have less access to cash and have no control over their own earnings. The case is not the same for female-headed households. The following graph shows income of the households.

Both men and women have received training on various dimensions of growing vegetables. Some women reported that their self-confidence has increased through training.

It is found that the mobility of the women has increased, as they have to attend meetings from time to time in the absence of male members and have to go to market to sell vegetables.

The households' vegetable consumption has increased and this would certainly contribute to the improvement of their health.

Conclusion

Women's participation in MUS groups has increased but the number of women in decision-making roles in the MUS groups is very low. Although women have benefited, a greater effort is needed to achieve a better gender balance through increased women representation in decision making. This would have a positive effect on institutional development at the local level. ■

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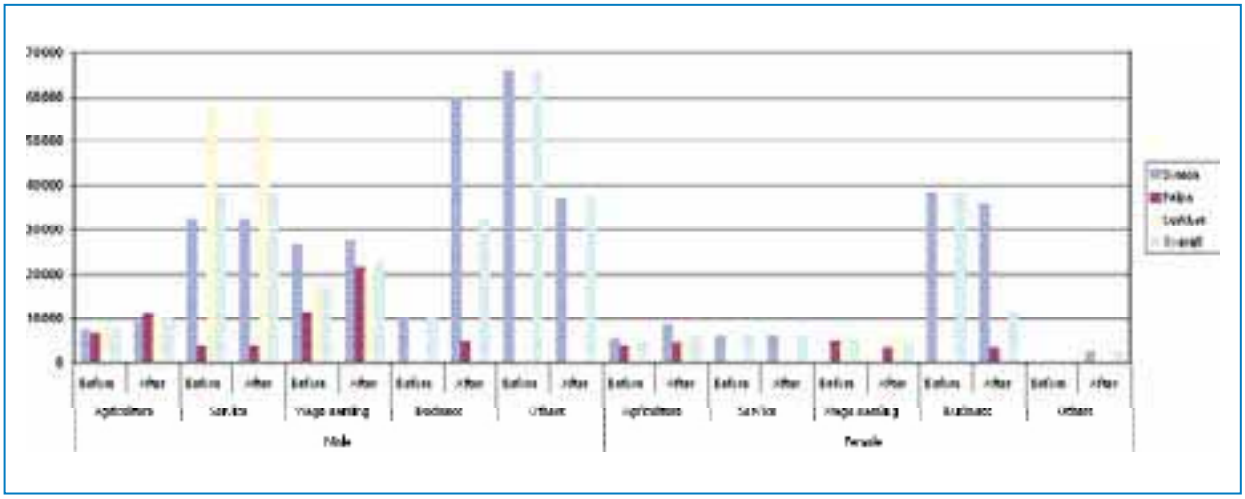
Case of one woman participant

Chuya Aryal lives in Senapuk Pelakot VDC 9, Syangja District. She is a mother of two daughters and two sons. She lives in a joint family with 12 family members. Her husband has a small shop in Galyang Market. She is educated up to fifth class. She was happy to have drinking water and irrigation facility supported by SIMI. Previously, she had to spend two to three hours just to fetch water in a day for domestic purposes and livestock. Now the saved time is utilized productively. As a member of a MUS group, she received training in raising vegetables and started to grow them. Previously they used to buy vegetable for consumption, now fresh vegetables are always available. She herself goes to market to sell vegetables. She received Rs 5 000/- by selling cucumbers in one season and Rs 8 000/- in another season. The income supports purchasing stationery and meals for her two daughters and sons for school. When asked who has access to the cash and who controls the income, she says, "I have to give the cash earned from vegetables either to my husband or my father-in-law. Sometimes my family will consult me to spend the money but I have no control over income.



Structure of income before and after introduction of MUS (NRs).

Source: Field survey 2005 (1 USD = 70 NR)

Treadle pump dissemination and adoption in west africa: performance, problems and prospects

Introduction

In West Africa, as in many other parts of the continent, erratic rainfall events, within and between years, has created uncertainty for rainfed agricultural producers and emphasized the need for irrigation. The traditional means of lifting water using rope and bucket is inadequate to meet the level of efficiency required. In response to this, the international NGO Enterprise Works (EW) introduced the treadle pump (TP) in the sub-region. The TP is a low-lift, high capacity, human powered water lifting pump which is designed to irrigate one hectare of farm land. The cost is low relative to motorized pumps and is intended to be accessible to farmers of all income classes constituting over 60 percent of the rural population in the sub-region.

Treadle pump usage in Lome, Togo.

Pump Manufacturing, Promotion and Marketing in West Africa: Strategies

Enterprise Works' involvement in the promotion of TPs in West Africa (WA) began during the early 1990s. In Senegal and Mali, dissemination began in 1995 and towards the end of 1996 about 1 900 and 600 pumps respectively had been produced in these countries. Other countries where EW has activities are Ghana, Niger, Guinea-Bissau, Benin, Côte-d'Ivoire, and Burkina Faso. The EW pumps are based on the Bangladesh model but modified for pressure delivery. Manufacturing of TP was essentially in the control of local trained manufacturers with functional workshops. EW gives the initial start-up support such as training, ensures quality control, and provides advertising skills, marketing strategy and after-sales care to enhance customer satisfaction and sustainability.

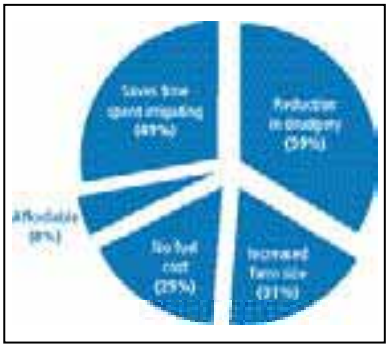
EW's promotion and marketing strategy is similar to private businesses, whereby radio, television, and public on-site/market demonstrations are used for dissemination of the products. Farmer-assisted sales are also adopted whereby an early adopter is encouraged to promote the technology among his or her neighbors in return for a sales commission from the manufacturer. EW encourages beneficiaries to purchase the pumps at fully unsubsidized prices directly from local manufacturers/sales agents without the intervention of the project. This marketing strategy has proved effective as is evident by the increase in the number of economic participants (defined as manufacturers, sales agents and farmers).

Number of Economic Participants of treadle pump in West Africa

Country	2002	2003	2004
Benin	4 383	5 043	4 486
Burkina Faso	4 371	6 850	9 074
Ghana	2	931	1 701
Mali	7 849	8 909	5 139
Niger	3 435	2 309	2 259
Senegal	2 629	1 972	1 479

Source: EW (2004)

Factors that have influenced the adoption of this technology, as revealed by a recent survey conducted by IWMI in Ghana, includes drudgery reduction (59 percent), reduction of time used for irrigation (49 percent), increased farm size (31 percent), no fuel requirement (29 percent) and affordability (8 percent), as seen in Figure. Factors given by non-adopters are: non affordability (58 percent), use of TP is labor intensive (31 percent), lack of suitability for cultivating large farm sizes (19 percent), lack of awareness (15 percent) and unreliability of their source of water (4 percent).



Treadle pump adoption drivers.

Impacts of Adoption

Currently, thousands of treadle pumps are being used by smallholders in West Africa. The number of sold pumps in the sub-region reached

some of 8 469 with an annual income of US$349 per pump and a total economic benefit of US$20.9 million.

Several studies have documented the substantial increase in farm sizes due to adoption. Campbell and Lyman (2000) reported an increase of between 130 percent to over 200 percent. In Senegal farm sizes increased by 40 percent and irrigation time reduced from almost 12 person-hours per day to about 4 person hours per day. (Perry, 1997). However, in Ghana, about a 34 percent decrease in the total number of hours used in irrigation after adoption was reported (Kamara et al, 2004). In Niger a 23 percent decrease of labor time for adults (men and women) and 25 percent and 29 percent for male and female youths respectively, was reported (Naugle, 2000). In all, TPs had a significant positive impact on improving the efficiency of labor use.

EW's assessment reported that incomes of small-scale farmers have doubled due to labour savings, expansion of farm sizes and economies of scale (Enterprise Works, 2004). At a cost of between US$50 to US$100 per unit, the TP helps farmers to increase annual income derived from vegetable production. Increased farm sizes under irrigation and greater yields have made it possible for Senegalese market gardeners to generate annual net income gains of US$850, a return of 750 percent on the original investment of US$100 in the TP. A recent survey conducted by ANPIP (Agence Nigerienne de Promotion de l'Irrigation Privee) in Niger shows that with the use of TPs, the area under vegetable cultivation has more than doubled and annual net income of smallholder farmers has increased by a factor of 2.5 from US$232 to US$594. Generally, there has been an increase in farm incomes with farmers using the TP earning between US$230 and US$780 in increased annual net income (Enterprise Works, 2004).

Challenges, Prospects and Suggestions for Sustainability

EW activities in the promotion of the technology in many WA countries have ended and it has become difficult to sustain the success achieved in some of these. Some of the problems highlighted in a recent survey in Ghana include the following: drop in sales of treadle pumps at the end of the EW project, farmers' lack of skill for minor pump repairs, lack of proper maintenance after purchase and low level of awareness in some districts.

Treadle pump sales have prospects as shown by the increased sales records while EW was active. In addition, the material for the manufacture of the pump is available locally. Farmers have expressed willingness to adopt; but want provision for maintenance. To ensure the sustainability of the success achieved, there is a need for improved after sales service and a coordinating agency with longer term programme as is the case with Aprotec in East Africa. ■

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IDE modified river pump, Zambia.

Soil water conservation and rain water harvesting technologies in the semi-arid zone of sub-Saharan Africa

Introduction

In sub-Saharan Africa (SSA), especially in the Sudano-Sahelian zone, the current level of dependency on irrigated land is very low and rainfed agriculture plays the central role in sustaining rural livelihoods and meeting food requirements. The challenge in this region is to optimize crop production per drop of rain. The arid and semi-arid zones (SARZ) of SSA (Map 1) cover about 41 percent of SSA and are characterized by low, erratic rainfall (300-600 mm per annum), and infertile soils which are crust-prone. In this zone, most of the land area is under rainfed agriculture and only two percent is irrigated. Much of the population in the semi-arid zone is still facing chronic under-nutrition and food insecurity due to high seasonal and yearly variability in food supplies, often as a result of the aforementioned factors as well as man-made catastrophes. In the semi-arid zone (especially the rural savanna zone), poverty and food insecurity are interlinked and widespread in rural areas and have a strong bias with regard to the natural resource endowment (water, good soils and vegetation). Land and water degradation, overgrazing, slash and burn practices, have led to food shortages and to significant environmental degradation. According to most experts, a sound and comprehensive approach based on the conservation of water and soil fertility for balanced and sustained agricultural production system is a basis for improved food security in the sub-region.

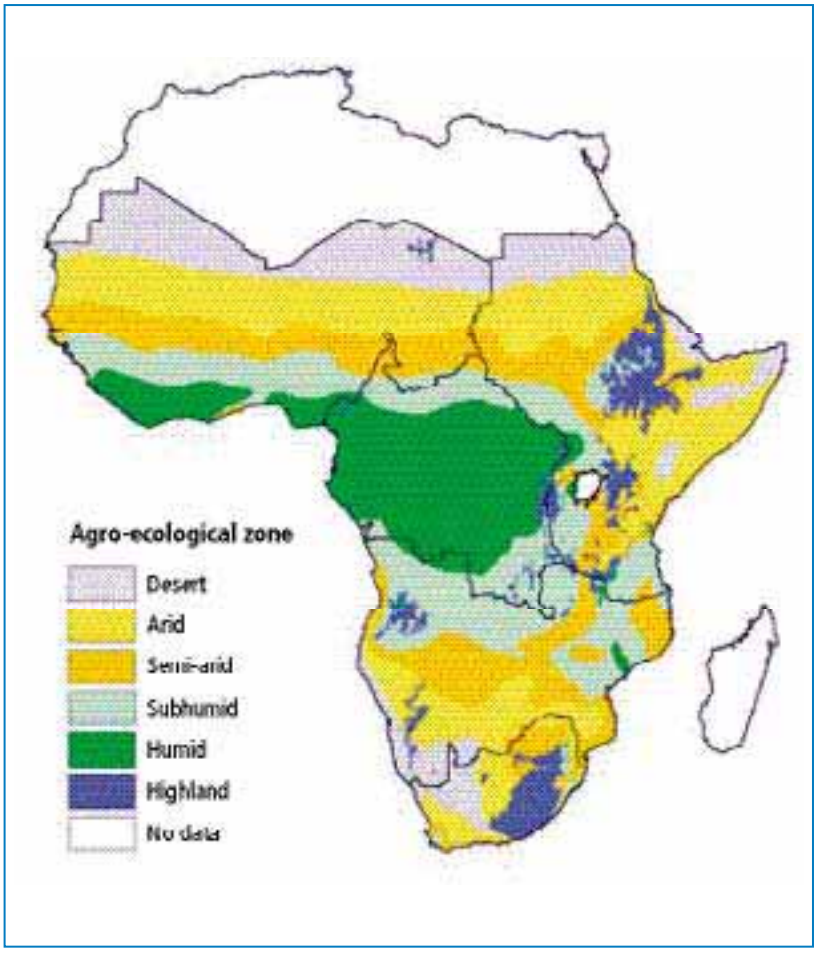
Communal stone rows laying.

Field level Technologies

Research on better use of runoff through a system of tillage has been reported to rejuvenate soil surface structures. Indigenous and adapted technologies of rain water harvesting (RWH) and soil water conservation (SWC) have been shown to offer potentials for reducing runoff and soil loss, rehabilitating degraded lands and improving available soil moisture and nutrients. In an attempt to evaluate the impact of these technologies on poverty alleviation and improvement in livelihoods, a workshop on Water Conservation Technologies for Sustainable Dryland Agriculture in SSA organized by IWMI and FAO was conducted in 2003 with the aim of documenting these technologies, ascertain their geographical spread in Sub-Saharan Africa and identify the adoption drivers/constraints.

In the semi-arid zone of West Africa, two of these technologies, stone-rows (Photo) and *Zaï/tassa* pits have been reported to be the most widespread in the region. An on-farm experiment on RWH, stone rows, was conducted at Kirsi village, northwest of Burkina Faso. Results from the experiment showed that as stone row spacing decreases, soil moisture content (top and sub-soil) increased as did grain and biomass yields.

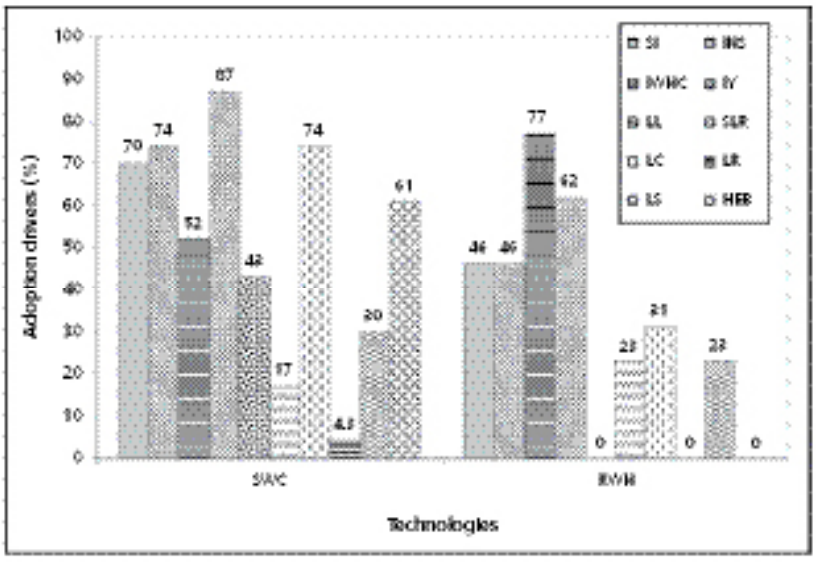
At Saria (Burkina Faso), results from a single or combined soil water conservation measures (SWC) showed that grain yields from treatments with compost + Urea are higher than with solely Urea and the control. Economic analysis conducted on selected treatments such as stone rows or grass strips with or without compost or urea, and combinations showed that the treatment with stone rows +compost (SRC) has higher economic benefit compared to other treatments.



Agro-ecological zones of SSA.

Results from reviewing several documented SWC technologies by experts during the Workshop showed that 75 percent of these technologies have been verified, disseminated and adopted, 10.7 percent tested and verified, and 14.3 percent have not been adopted at all. Regarding documented RWH technologies, results showed that 61.9 percent has been verified, disseminated and adopted while 14.3 percent have been tested and verified.

Adoption drivers for SWC and RWH are summarized in Figure as being soil improvement (SI), improved nutrient status (INS), improved water holding capacity (IWHC), increased yield (IY), low labour (LL) costs, secure land rights (SLR), low capital costs (LC), low risks (LR), low skill acquisition (LSA), and high ecological benefits (HEB). Highest adoption drivers for RWH technologies, are IWHC>IY >SI & INS. Similarly, the highest adoption drivers for SWC technologies are HY>INS&LC>SI.



Adoption drivers for selected technologies.

Conclusion

Under erratic and apparently dwindling rainfall conditions in the semi arid zone of SSA, major contributions to crop production improvement can be anticipated from improved and up-scaled SWC and RWH conservation measures. It is only by fostering and improving these technologies in a sustainable way that the risk of drought, crop failure and ecological refugees could be minimized. Technology adoption by farmers is crucial to increasing agricultural productivity hence meeting food and nutrition is a great challenge in Africa. ■

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Water Users' Associations in northern Uzbekistan: opportunities or constraints for development?

The paper presents partial results from an on-going research being carried out in Northern Uzbekistan within the framework of the ZEF/ UNESCO project, titled "Economic and Ecological Restructuring of Land and Water Use in the Khorezm Region (Uzbekistan): A Pilot Project in Development Research" and funded by the German Ministry for Education and Research (BMBF) and UNESCO.

Typical irrigation field in Khorezm (Forkutsa, 2002).

Project background

The objectives of the parent project are: 1) to develop concepts for landscape restructuring in Khorezm, an intensively used agricultural region in the Aral Sea basin; 2) To develop proposals for both legal-administrative and ecological restructuring measures using sustainable natural resource management concepts; and 3) to promote and encourage scientific collaboration between Germany and Uzbekistan in the field of development research.

The expected output of the project is improved management of water and land use in the Khorezm region and more generally in the Aral Sea Basin, through an ecosystem approach, resulting in increased efficiency in the (sustainable) use of resources, with a socio-economic and institutional-administrative focus. The location is explained by the little attention that has been paid to this area although the province plays an important role in the water budget of the Amudarya river delta. The area is also typical of the agricultural systems in Uzbekistan, which are mainly based on irrigated cotton production.

Irrigation of Uzbekistan

The Republic of Uzbekistan, like other Central Asian countries, depends on irrigation for productive agriculture. Uzbekistan is a landlocked country, with a total area of 447 400 km². The cultivated land under irrigation is estimated at 4.24 million hectares, of which 87 percent is under annual crops and 13 percent under permanent crops. In the Khorezm region irrigated land amounts to 262 000 hectares. In Uzbekistan irrigation was introduced many centuries ago. In the past, in the majority of cases, the governance of irrigation was under the responsibility of the communities; by people selected from the society based on public esteem. In the Soviet times, the governance of water resources was done under strong state regulation. Only recently, after Uzbek independence in 1990, the introduction of farmer-oriented management has become possible.

Water User Associations as a research topic

The objectives of the research presented herein was: i) to determine the factors that influence success or failure of the emerging local water management organizations (WUA); and ii) to investigate the role that pilot WUAs can play.

The establishment of water user associations (WUA) is the most important and an integral step of the reforms under the irrigation management transfer programme currently underway in the country.

The research focus lies on informal institutions and their impact on the

functioning of semi-private water management organizations, the so-called water user associations. These are non-profit, non-governmental organizations, where the members are the farmers themselves. The principle of the administration of the WUA is based on free elections. However, during the period of transition, from government to private, the farmers elect the chairman of their WUA taking into consideration the recommendations of water specialists.

The Khorezm region is a pioneer in the complex formation of the new form of water governance. Two types of WUA exist: administrative-territorial and hydrographic. The first water users associations were organized in 1999 on the basis of the liquidated and unprofitable shirkats (collective farms). The organizational setup of water user associations on the basis of abrogated shirkats is referred to as an "administrative-territorial" form of WUA. On the other hand, the hydrographic WUA is the unification of farmers considering the location of irrigated area and the aryks (canals); users obtain water from the same canal.

However, the association principle of water users is not alien to the Uzbek people. Back in history, in the Khans' time, there were such positions as aryk (canal), aksakal (white beard), mirob (engineer) and tuganchi (construction and O&M) performing certain specific functions within the systems. All these positions were based on public elections.

Research Methodology

The study takes place within large irrigation systems inhabited by family farms. Four established WUAs in Khorezm and four pilot projects in two other regions: Syr Darya and Fergana Valley, were selected. The average irrigated area of the WUAs in Khorezm was 2400 hectares, and the average number of members there was 143 irrigators. WUAs of both types in Khorezm have been selected for the investigation. This allows collecting different opinions and perceptions regarding the functioning of WUAs, and what advantages or disadvantages different establishment principles brought.

The research approach was based on modern social methods, atypical and new for Uzbekistan, which directs the water users to problem solving through their own strength and participation. Farmers describe the problems, present them and solutions emerge from the discussions. The training also targets elements of democracy, very important and significant especially during the period of transition to the market system. The seminars and training also help to recognize and train social leaders – mobilizers able to explain the role and function of WUA. Generally, these people can be formal and informal leaders who most clearly understand current processes of reforms and show interest in further development.

The expected outputs were guided and concentrated on three topics that are essential in the functioning of a WUA in Uzbekistan. These were issues of leadership, conflict resolution and mechanisms and user fee payments.

Findings and conclusions

With regard to leadership, the importance of the Chairman is clear. The role is essential for the overall execution and guidance of the work to be done, in the water rotation related activities and for conflict resolution. Users also see the water master in a leading position, especially and as could be expected, as it concerns water rotation.

In relation to conflict resolution, respondents also perceive the WUA Chairman as an important conflict mediator. That was confirmed by respondents in all three Uzbek regions. The water masters are also involved with conflict resolution and play a major role. Less contribution to the conflict mediation, in respondents' opinion, comes from the WUA Council and general meetings.

The respondents perceive shortage of irrigation water as well as [non] cleaning of the canal as the main cause of conflicts between users. Volume of water delivery, state of the irrigation system and terms and conditions of water supply can be the main topics of disputes between the WUA administration and the management board of irrigation systems. Non-compliance of water delivery contracts and irrigation schedule are the main reasons of conflicts between farmers and WUA according to interviewees' opinion. Finally, water users noticed that non-payment of user fees is also a potential conflict issue.

Regarding conflict resolution mechanisms the respondents prefer the so-called peaceful conflict resolution method, meaning that they prefer to talk to the offender, and forgive the violation. If not successful, only then will respondents report about the case to the Chairman.

The third issue, fee payment, is characterized by financial obstacles of WUA members. The first hindrance of non-payments by farmers is the current credit systems. A new "target" credits replaced the *transh* system (agricultural inputs such as seeds, fuel and fertilizers provided by the government) starting from 2005. However, according to experts the new credit has not been popular because farmers have to pay high interest rate. Neither credit system

transh nor target really consider user fees; users are equally dissatisfied.

The next obstacle for fee payment is characterized by untimely payments of cotton mills to farmers. Farmers in both WUAs, in Khorezm, as well as in pilot projects, in Fergana and Syr Darya, suffer from it. Arbitrariness of use of money from farmers' bank accounts by local officials is the third kind of obstacles that hampers the payment of water users. Officials have access to agricultural enterprises; using their power they give a directive to transfer money from farmers' accounts to other on-going strategic projects without the farmers' knowledge.

Based on the summary of findings above, a few recommendations at different levels can be made. Irrigation management at levels such as national, provincial, district, and local should collaborate more with each other: vertically (between subordinated levels) and horizontally (between different interrelated organizations).

At the local level, more real power should be given to the WUA Chairmen. The influence on decision-making authority of WUAs by local officials should be reduced. At the national level, since the major irrigation network is under state control, the state should invest in the construction and maintenance of the system. The role of the state should be revised or lightened.

Finally, at the WUA level it is advisable to increase members' participation in everyday activities. Without the right to determine its production programme or free sale markets for their agricultural products the adaptation of farmers to WUAs is not possible. ■

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Monitoring perspectives of treated wastewater in irrigation

Growing volumes of both industrial and municipal wastewater are being discharged into surface waters, and the need for wastewater treatment and water quality monitoring are ever more emphasized to protect the environment and human health. Optimizing municipal systems and requirements to safeguard the environment and quality for reuse are aspects of concern for planners and decision-makers in water resources. A comprehensive monitoring programme is required to ensure that a proper treatment of wastewater is achieved and environmental degradation is prevented. Furthermore, monitoring and evaluation are essential requirements of any project that uses treated wastewater, and constitute a continual and integral part of operation and management.

The approaches to monitoring of irrigation systems are more extensive than for systems that discharge into streams as it incorporates reuse criteria. The objective of an irrigation site monitoring programme is to provide for early detection of problems in order to make adjustments to the operation of a treatment plant in avoiding ground or surface water pollution, as well as health-related issues. Aspects of monitoring are designed to protect public health and the environment and, ideally, these activities are planned at four points in the irrigation site monitoring system: 1) the treatment plant effluent; 2) storage; 3) irrigation system; and 4) any runoff areas such as soil, the vegetation and groundwater. Compliance with regulations and required control facilities and documentation such as sampling, analysis and comparability of data should all be incorporated in an integrated management plan.

Irrigation System and Ambient (Final Discharge) Monitoring

Integrated quality monitoring of treated effluent reuse for irrigation concerns the impact of treated wastewater constituents on the soil, groundwater, crops and eventual pathways to animals and humans consuming crops irrigated by treated wastewater. Quality control of the integrated system is aimed at ensuring that wastewater supplied meets the sanitary, agronomic and environmental quality requirements for the selected crops. The agricultural plan, including crop selection and rotation, and seeding patterns do have a role in defining monitoring and evaluation plans. Product monitoring at the farm or market is also important in verification in the effectiveness of health-based targets set by the WHO. Products should be tested for E. coli or thermo tolerant coliforms and other pathogens such as Ascaris ova or rotaviruses. Metals such as arsenic, cadmium, nickel, etc., and other potential chemicals should be in compliance with CODEX Alimentarius standards and limits set for health safety.

Furthermore, monitoring and evaluation also relate to environmental aspects of wastewater use in agriculture such as salinization of the surface soils, contamination of groundwater supply and surface drainage flows that discharge into the river. Parameters

monitored include effluent flow and chemistry, shallow and deep groundwater level and chemistry, surface water chemistry, distribution of salts in the soil profile, soil heavy metal content and crop yield. Ideally, monitoring program should also include drainage and fertilizer requirements and the soil-plant system, as well as maintenance of technological database to determine environmental impacts of the effluent application.

The following are some general chemical quality parameters as related to irrigation, which might be regularly or periodically monitored by farmers or, for the farmers through official authorities (FAO 2003):

- Salt load or ECw = Electrical conductivity expressed in units of dS/m referenced at 25°C. It is one of the most commonly measured parameters, particularly in arid and semi-arid regions, to estimate the total amount of soluble salts in water. Salinity is probably the most important single parameter, which determines cropping pattern and management of fields irrigated with wastewater.
- Cations and anions such as Ca, Mg, Na, CO3, HCO3, SO4, Cl. Some of these ions may be monitored at the beginning and then periodically.
- Some other ions such as Boron (B) must be monitored regularly in cases where detergents containing B are widely used. B in wastewater might be the main limiting factor for its reuse for irrigation.
- Sodium Adsorption Ratio is the most widely used index to measure physico-chemical changes in the soil:

SAR = NA/[(Ca+Mg)/2]1/2

where ionic concentrations are expressed in meq/l.

Heavy metals and trace elements (Al, As, Ba, Cd, Cr, Cu, Fe, Pb, Li, Mn, Hg, Ni, Se) are to be determined at least once before initial irrigation.

Effective Management at Relevant Levels

In the past, the responsibilities in general monitoring of wastewater quality have been in the hands of government authorities with little involvement from the farmers who are directly at the reuse site. The quality depends on the treatment itself, on maintenance and operation of the treatment system, and on the quality of operational staff at the treatment plant. However, limited training of farmers has been implemented with visual or simple tests, but this could prove to be very useful in assessing wastewater quality prior to irrigation use. Farmers could be provided training on aspects relating to colour of wastewater or extensive algae growth as indicators of chemicals and nutrients in the wastewater, and odour as indicator of insufficient treatment. Farmers' rights to information and access related to water quality and type of treated reclaimed water for which they are provided are important in the entire monitoring and feedback plan.

FAO Activities

The Food and Agriculture Organization (FAO) provides technical assistance to countries in Integrated Water Resources Management (IWRM) and safe use of reclaimed water, in the prevention of environmental pollution for the protection of health and ecosystems, as well as in international data collection and monitoring.

FAO has developed a Wastewater Database (http://www.fao.org/landandwater/aglw/waterquality/dboverview.stm) from networks established containing information on wastewater production, treatment, reuse, as well as economic information provided by Member States. FAO provides direct country support through various mechanisms on wastewater treatment and reuse with the main objective of improving efficiency of water use for crop production, through proper treatment of sewage effluent for irrigation. FAO also engages in Farmer Field Schools to train farmers on the safe reuse of treated wastewater for irrigation and farmer monitoring of water quality and has written manuals on the safe reuse of treated wastewater in irrigation.

In summary, with increasing water scarcity and pollution problems, international trans-boundary basin issues and judicious water resources planning and management, inclusive of irrigation development, has become more and more important. Without proper monitoring, knowledge of the real magnitude of the issues cannot be achieved. Various international initiatives are aimed at an integrated framework for new approaches to water, food and the environment and to economic and social activity and development. This all requires positive will at all levels of the political and corporate spectrums, and the involvement of multi-stakeholders in order to meet the desired improvements towards a sustainable future. ■

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Applying an evaluation methodology for social impact in a small-scale irrigation district in Colombia

Introduction

The Government of Colombia has developed about 600 small scale irrigation districts to benefit 24 000 small farming families in an area of about 40 000 hectares. The implementation of this infrastructure is part of a rural development strategy known as The National Programme for Small Irrigation (Programa Nacional de Pequeña Irrigación) which is supported by the World Bank and the Interamerican Bank of Development.

The lack of evaluation methodologies available involving the communities participating in the project does not allow to appreciate the benefits or the damage caused by the new infrastructures through its effects and impacts. In general, the evaluations consider only institutional, technical or economical aspects and do not refer to the users of the districts. An alternative methodology was proposed by Castro and Chaves (1994) to analyze a case study in Colombia: the irrigation district of Albesa in the Department of Cundinamarca.

Methodology

The methodology proposed is made up of the following elements:

1. The analytical reconstruction of the problem including, among others, the following elements: i) identification and characterization of the actors involved; ii) definition of the main problem that gave origin to the project; iii)determination of the descriptors of the problem and, iv) construction of the analytical and operational tree of the problem.
2. Evaluation of the Internal Consistency of the project, including: i) revision of the feasibility studies and design; ii) determination of the development, the general and the specific objectives; and iii) identification of the participating populations and their social coverage.
3. Evaluation of the Management and Efficiency of the project, established by means of: i) analysis of agreement between the supposed reasons of the diagnosis and the descriptors of the problem; and ii) analysis of agreement among the multiple factors and the specific project objectives.

The reconstruction of the problem that gave origin to the project indicated, among others, the following incident factors: low income of the farmers; uprooting and migration of the families from the countryside; very poor marketing; lack of irrigation water; and deficiencies in the productive agro-ecosystems.

Table 1. Project results by objectives and operations *(in Colombian pesos)*

Specific objective	Initial objective	Final objective	Efficacy *	Initial timing	Final timing	Resourses planned	Resources final	Efficiency **
Area	250 ha	253 ha	1.01	18 months	54 months	471 mill.	471 mill.	0.33
Families	181	175	0.96	18 months	54 months	471 mill.	471 mill.	0.33
Works	250 outlets	280	1.12	3 months	5 months	50 mill.	50 mill.	0.67

Operations	Initial objective	Final objective	Efficacy *	Initial timing	Final timing	Resources planned	Resources final	Efficiency **
Studies and design	Report	Report	1.0	8 months	8 months	12.3 mill.	12.3 mill.	1.0
Construction	1 district	1 district	1.0	10 months	40 months	359.2 mill.	359.2 mill.	0.25
Training in operations	1 training course	1 training course	1.0	60 months	120 months	0.5 mill.	0.5 mill.	0.5

** Efficacy = Final objective/Initial objective*
*** Efficiency = Initial timing/Final timing*
1 USD = 2 350 Colombian pesos (2004)

Table 2. Some effects of the project activities

Effects	Indicators	Without project	With project	Type of effect	Incidence factors attributed to project
1. Life quality					
Drinking water, electricity, telephone	% coverage	70	95	Social	Increased income
Environmentalquality	Good, medium, poor	Medium	Medium	Environmental	Problems diversified
2. Generation of additional income					
Beans	N° working days	167	219	Economical	More employment
Onions	N° working days	181	243	Economical	More employment
Peas	N° working days	120	156	Economical	More employment
3. Technological changes					
Production	Type	Traditional dryland	Technologically irrigated	Technological	Project effect
Beans	t/ha	15.0	20.0	Technological	Project effect
Onions	t/ha	13.5	20.0	Technological	Project effect
Peas	t/ha	5.3	8.0	Technological	Project effect

Table 3. Some examples of project impact

Impact	Incidence factors	Indicators	Type of impact	Notes
1. On the users	Wellbeing	100% favourable	Social	Theprojectinducedchanges
	Created rural employment	50 new working days/ha/year		Intensive work needs more employees
2. Agricultural productivity		Intensive agricultural management	Technological	Change from dryland to irrigation
	Yield increase	Yield increases 30%		Environmental risk due to use of agrochemicals
	Intensive use of soil	3 harvests/year		Needed conservation practices
3. Creation of aggregated value		80% efficiency in the operations	Economical	Project produced added value
	More product offer and diversity	5 new products offered		Onion is the most important crop
	Land value increased	Increase over 100%		Land value increase due to water availability
4. Objectives of the Small-scale National Irrigation Programme		Operating in district by users	Institutional	Objectives satisfied
	Farmers remain on land	Migration to towns nil	Social and cultural	Interaction with city instead of migration
	Water deficit reduced	Water volume 100 l/sec	Technical	No dependence on rainfall

The Internal Consistency of the project was determined correlating the reasons of the diagnosis with the development and the specific objectives.

In the Evaluation of the Management and Efficiency, the descriptors of the problem and the reasons for the diagnosis presented a medium size incidence relationship. The supposed reasons of the diagnosis with the major level of agreement were: the iniatives of the leaders to execute the project, the existence of communitary organizations to support the project; the National Programme for Small Irrigation and Integrated Rural Development Project (Proyecto de Desarrollo Rural Integrado) supporting the project. Conversely, the lack of water resources, the low soil productivity and the low income are the critical factors mostly related to the operations of the project.

Evaluation of the Results

The information was gathered in 45 working days. The results are summarizad in the following tables according to the different elements considered in the evaluation exercise; namely, objectives, operations, effects and impact.

Conclusions and Recommendations

The general objective of the project was to evaluate in a participatory way the effects and impacts caused by the construction and work at the Albesa small scale irrigation district. The evaluation was made through the use of the methodology adapted and applied. To evaluate the project, a comparison is established between the situation "without" and "with" the project, hence identifying the effects recognized by indicators previously selected. Additional information was obtained in order to establish which impacts were related with the objectives of the participation of the institution in the National Programme of Land Adequacy.

The results of the project by specific objectives indicate that these were satisfied concerning the area covered, the number of beneficiary families and the engineering works. There was inefficiency on the use of the resources and in timing. The efficacy was high in the operational training objectives, in particular the workshops, but it failed in the training activities planned for organizational matters.

Concerning the operations, the more efficient activities were those related with the initial studies and the design that were satisfied in full. Those less efficient were the timing of the engineering works, including the installation of the outlets, the determination of the families to make the improvements and their financial participation to finalize the water distribution works at farm level.

The most positive and evident effects caused by the project were the generation of new employment, the introduction of technological changes, the changes in the commercial relations and the organizational strenghthening. There were no evident negative effects, if at all.

As a recommendation, it is worth underlining that the participation of the users in all the project phases is fundamental for the farming communities in order to apprise themselves of the irrigation system and of the territory, demonstrating the collective work made to develop it. The institutional view of the land adequacy should incorporate anthropological considerations in order to have a more integrated approach to the irrigated agriculture and be able to define more coherent policies in line with the social reality of the project. ■

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Irrigation in Africa in figures – AQUASTAT Survey 2005

In 1993, FAO launched a programme known as AQUASTAT, its global information system on water and agriculture. It collects, analyses and disseminates information by country and by region, with an emphasis on developing countries and countries in transition. Its aim is to present a comprehensive picture of water resources and irrigation and to provide users interested in global, regional and national analysis with the most accurate, up-to-date, reliable and consistent information on water for agriculture and rural development. At the time of its launch, priority was given to Africa, which initiated the AQUASTAT publication series. The survey continued with the Near East, the countries of the former Soviet Union, South and East Asia and finally Latin America and the Caribbean.

Ten years after the first publication on Africa, it appeared necessary to update the data and to identify the main changes in water use and irrigation that had occurred on the African continent. To obtain the most reliable information, AQUASTAT draws as much as possible on national capacities and expertise. The collection of information by country was organized using a detailed questionnaire, followed by a compilation and critical analysis of the information gathered, also taking into consideration transboundary water issues. The country profiles have then been submitted to national authorities responsible for irrigated agriculture and water for verification and approval, and finally the on-line database was updated.

The publication resulting from this new survey presents the synthesis of the data collected from the 53 African countries. It presents the most recent information available on water availability and its use on the African continent, with an emphasis on agricultural water use and management. It analyses the changes that have occurred in the ten years since the first survey. The publication consists of two parts: the main report and the 53 detailed country profiles of the African continent included in the CD-ROM accompanying the main report.

The main report presents a regional analysis of the standardized sections of the country profiles: (i) geography, climate and population; (ii) economy, agriculture and food security; (iii) water resources and water use; (iv) irrigation and drainage development; (v) water management, policies and legislation related to water use in agriculture; (vi) environment and health; (vii) perspectives for agricultural water management; and (viii) references and additional information.

The main conclusions drawn from this synopsis are: substantial institutional changes have taken place in the region in the last ten years: almost all large international rivers now have basin organizations that group together all or some of the countries included in one basin to manage the shared resources; water management in African countries has now generally a legal framework, mainly based on a water code. Since the previous survey, a lot of drafts have been reviewed, amendments made and adopted and implementation started.

During the last ten years, the area equipped for irrigation (which includes areas equipped for full/partially controlled irrigation, equipped lowlands and spate irrigated areas) has increased from 12.2 to 13.4 million hectares, which is an increase of 1.2 million hectares, or almost 10 percent. This is equivalent to an annual rate of increase of 0.88 percent (1992–2000 weighted year index). The area under one or another form of agricultural water management, which includes the above area equipped for irrigation plus the non-equipped cultivated lowlands (wetlands, inland valley bottoms, flood recession areas), has increased from 14.3 to 15.4 million hectares, or less than 8 percent. The slower growth of the latter is due to the fact that in addition to equipping new areas for irrigation part of the previously non-equipped cultivated lowlands have since then been equipped.

Pressurized irrigation covers 2.7 million hectares, which is 20 percent of the area equipped for irrigation and almost 22 percent of the full/partially controlled irrigation area (17 percent sprinkler irrigation and 5 percent localized irrigation). The area under sprinkler irrigation has doubled since the last survey and the increase took place almost entirely in Southern Africa, while localized irrigation sees a growth both in North and Southern

Africa. These regions are dry but also contain most of the countries that are in a more advanced stage of development.

The country profiles present more detailed qualitative and quantitative information at national level and are illustrated by national maps. Whereas the main report is available in both English and French, the country profile is available only in the official language of FAO in the country.

This work will be published as FAO Water Report 29.

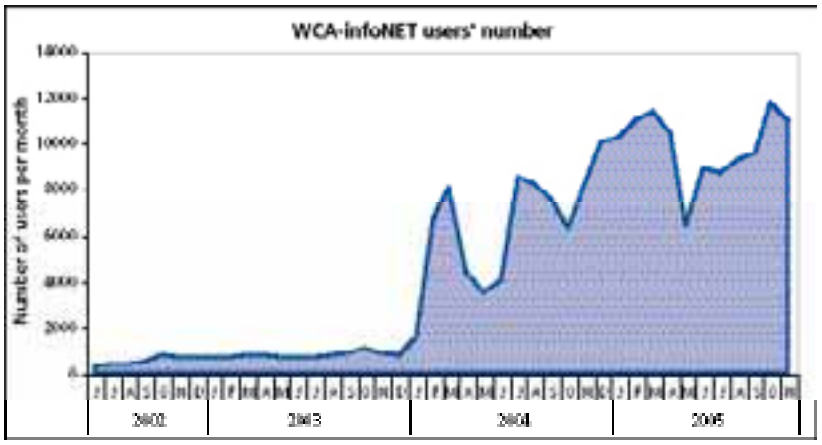
For further details, consult the AQUASTAT website: **http://www.fao.org/ag/aquastat** (**e-mail: aquastat@fao.org**) or contact: **karen.frenken@fao.org** or **virigine.gillet@fao.org**

WCA infoNET – moving forward

WCA-infoNET, the IPTRID Interactive Internet-based Information System, was recently re-launched given the interest shown by the majority of its stakeholders and the remarkable success of its original idea which was pointed out by the evaluation of its current situation.

The system was upgraded with enhanced features and more stability to keep up with the continuous development of the Community Directory System platform that constitutes the fundamental structure of WCA-infoNET. The backbone of the system (its semantic topic tree) was also simplified and reoriented to make it easy-to-use to bring more subscribers and to preserve its current loyal users.

In terms of content enhancement, the management of WCA-infoNET has made a special effort to add region-selected information through the recruitment of consultants from within the regions for data inputting and through the linkage with regional/national water institutes while centrally coordinating activities. So far, content related to the Near East and South Asia regions has been enhanced with an iteration plan to move to other regions.



The system is currently fully functioning, has more than 2 500 knowledge objects stored on it most of which are held on its server. It now counts 21 editors, 2 researchers and one consultant for regular inputting of information. However, it is only through the continuous and active support of all its stakeholders, both individuals and institutions, that the system can, in a sustainable manner, continue running and its threshold value of 8 000 to 10 000 KOs estimated at its inception can become a realistic goal.

For more information, please contact **Maher.Salman@fao.org**
WCA-infoNET can be accessed as usual by its URL:
http://www.wca-infonet.org

Joint database on Capacity Development for Water in Agriculture (CapDevWater)

IPTRID and the Water Resource Development and Management service of FAO have decided to join their common goal and merge their work on learning tool provision for capacity development. The result of the joint effort was the Capacity Development for Water in Agriculture Database (CapDevWater). CapDevWater is a web-based tool that provides information on activities that cover the typically applied instruments used in the process of training the stakeholders involved in irrigated agriculture management. It aims at creating a meeting point for both people in search of capacity development opportunities and those offering these opportunities. The joint database contains relevant information on course/event provider, duration, target group as well as contact information in order to obtain further details. Course/event providers are invited to register so they can add and update their data online. CapDevWater can be found on: **http://www.fao.org/landandwater/cdwa/**

See page 21 for Web page image.

For more information, please contact **Maher.Salman@fao.org**
CapDevWater can be accessed as usual by its URL:
http://www.fao.org/landandwater/cdwa

Water Charging for Irrigated Agriculture FAO Water Report No. 28

This FAO Water Report presents a review of international knowledge and experience in charging for irrigation services, drawing from published literature and six commissioned case studies in five countries. Together, these sources provide a broad spectrum of theory and practice, from less-developed to more-developed countries. The purpose of the report is to make available the results of a Department for International Development (DFID) (United Kingdom) funded project to a wider audience in the hope of stimulating thinking about the practicalities of charging for irrigation water and, to an extent, explode a few popularly held myths about water pricing in agriculture.

Policies of water pricing are affected by, and in turn affect, a large number of other important issues in the irrigated agriculture sector, for example, operation and maintenance; turnover and water user associations; rehabilitation and modernization of systems; increasing competition for available water with other sectors/users; international trade and commodity pricing.

However, there is still a considerable lack of understanding of what impacts can be realistically expected from water pricing policies in practice. In order to focus attention on such a fundamentally important point, it was decided to confine the scope of this document to charging for defined objectives in irrigation, principally, for cost recovery and for limiting demand for water. Associated issues, including the ones set out above, are identified in the text but are generally not dealt with in detail.

To bring about any significant change in water use requires that users be charged volumetrically at prices many times greater than those required to cover costs. These issues present important technical and political challenges that must be recognized. The document underscores these important differences in objective and indicates the type of charging mechanism or other economic tool that may be appropriate to each.

An extensive bibliography is provided to help the reader interested in the broader background to the subject.

Agricultural trade liberalization---Implications for irrigated agriculture

There is extensive debate and literature focused on the likely consequences of future trade liberalization under the Doha Development Agenda (DDA) of the World Trade Organization (WTO). Much of that debate focuses on the potential effects of trade reform on issues of poverty, welfare and national economic growth and development. This position paper aims to provide a brief review of those larger themes before moving on to examine what the consequences of trade reform may be for the irrigated agricultural sector. Preparation of this position paper was prompted by the following types of question:

Will the implementation of balanced, multilateral trade reform under the WTO bring about changes in commodity prices, market access and product dumping on a scale that will significantly alter the current role and status of irrigated agricultural production?

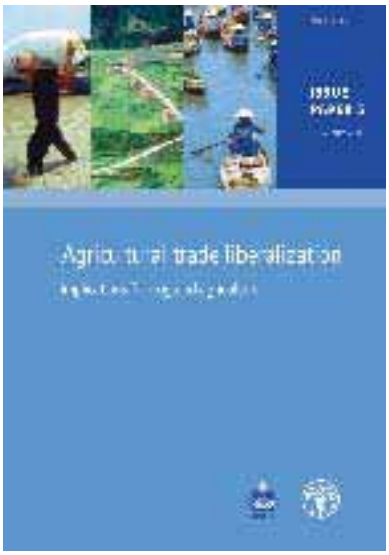
Will anticipated rises in commodity prices increase the viability of new investment in irrigation infrastructure?

Are small-scale irrigation farmers in a position to respond to changes in the global market?

Can such farmers compete with large-scale farms in their own countries and in the North?

What should be the response of agencies charged with the improvement of technical and institutional capacity in the irrigation sector to these and other issues potentially arising from trade reform?

What should be the response of agencies charged with improving the technical and institutional capacity in the irrigation sector to these and other issues potentially arising from trade reform?



The literature review undertaken by the authors has shown that there is no clear position and hardly any specific study about the impact of trade reform on the irrigated sector. The paper presents a balanced account of the different views identified. The paper concludes by identifying a possible role for organizations such as IPTRID to carry out or facilitate research for quantifying the opportunities and threats bearing on the irrigated production systems of individual nations as a consequence of trade liberalization. ■

RECENT IPTRID PUBLICATIONS

Programme Reporting
- Annual Report 2005

Events Publications
- Workshop Proceedings on Design and Implementation of Capacity Development Strategies

Project reports
- Manual - Participatory Rapid Diagnosis and Action planning for irrigated Agricultural Systems (PRDA)
- Brochure about the management of irrigation-induced salt-affected soils.

Many IPTRID publications are available as electronic versions at the IPTRID Web site, www.iptrid.org. To request hard copies of these publications, contact: iptrid@fao.org

Consultation on financing water for agriculture

In March 2003, the World Panel on Financing Water Infrastructure produced the document, "Financing Water for All". The scenario adopted by the Panel considers the need to double annual investment to ensure global water security by 2025. This included all the major water-using sectors, such as households and municipalities, agriculture, industry & commerce, wastewater treatment, environmental uses, flood control and various other functions of water management.

Since the launch of the report considerable activity has been taken by many organizations, for example, a Working Group on Financing Water for Agriculture is being supported by a large number of international organizations, mainly the Water World Council (WWC), the Global Water Partnership (GWP), the World Bank, the International Fund for Agricultural Development, the International Water Management Institute (IWMI) and FAO through both its Water Service (AGLW) and the International Programme for Technology and Research in Irrigation and Drainage (IPTRID). The Group agreed to hold three consultations on this issue in Hyderabad (India), Alexandria (Egypt) and Pretoria (South Africa) leading to a fourth and "integrating" meeting to be held in Mexico within the context of the World Water Forum # 4, in March 2006.

In line with the proposed activities, the First Consultation was held in Hyderabad, India from 3 to 5 October 2005. The members of the group provided support in various ways. IPTRID agreed to fund the attendance of the regional participants, IWMI agreed to host the venue at their facilities, FAO/AGLW was instrumental in the identification of participants via its regional and country offices and contributed two resource persons. Finally, WWC and GWP put together the event's programme and likewise contributed with resource person and the identification of regional participants.

Twenty-five regional participants representing 10 countries (India, Pakistan, Nepal, Sri Lanka, China, Viet Nam, Thailand, Malaysia, Laos and Indonesia) were present. Seven participants representing international organizations brought the total attendance to 32 persons. These represented farmers, financing institutions, governments and international bodies. While an effort was made to balance these categories, the financing institutions were less represented while governments – both water related agencies and ministries of water resources and finance – had the upper hand.

The workshop's presentations were divided into three main categories to reflect the financing needs perspectives of a) farmers, b) financial institutions; and c) governments. The presentations and discussions revolved around central questions under each category, as follows:

Farmers: *Access to finance*. Considering investments in agricultural water management, what are the needs for financing and external funding, what mechanisms are available, what are the main constraints and problems faced and what improvements are required?

Finance Institutions: *Availability of Finance*. What mechanisms are available to meet the financing needs for agricultural water management, what are the main constraints and what innovations are introduced?

Governments: Creating the enabling environment. In what direction does government reform have to go to enable a wider spectrum of financial options and better access to finance?

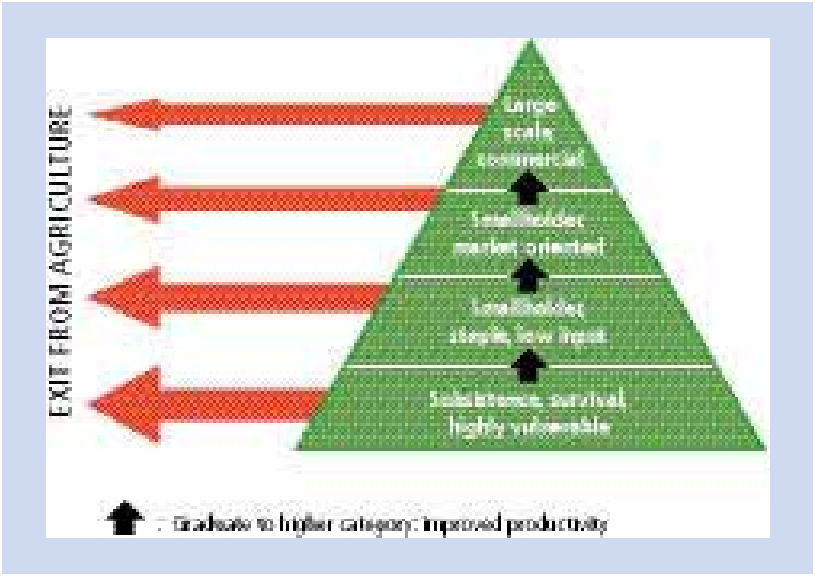
Below some of the relevant issues emerging under each perspective and tied to the particular questions are summarized; while recognizing that these are not an exhaustive list they reflect the group discussions.

In relation to farmers' perspectives, the needs for financing and external funding were identified primarily as: i) capital; ii) recurrent costs; iii) crop insurance; iv) equipment insurance; and v) output insurance. Regarding the financing mechanisms available the following loan types were identified: i) crops, ii) terms, and iii) consumption. Finally, the constraints more frequently mentioned were: i) the lack of collateral as security as normally requested by the financial institution; ii) the economic capacity of the farmers; and iii) the perceived high interest associated with the loans.

With respect to the question on current financing sources available these can be summarized as in amount-descending order: i) government; ii) multilateral organisms; iii) financial institutions; iv) official development agencies; v) community-based institutions, vi) water users and vii) Grant-related. The constraints associated with the financing, as expected, vary with the source, but include, among others, capacity, competition, fiscal deficit, policies and politics, regulatory frameworks and, specifically related to grants, the uncertainties involved. Finally, under this perspective, required innovations mentioned included the need to have a broad range of "products" that would fit different needs; the establishment of incentives associated with financial performance of clients, and the need to strengthen organizations to uplift their borrowing capacities.

In relation to governments' perspectives on the direction that reforms should take to facilitate a better financing environment, there was almost a consensus that a first requirement is the establishment of clear water-related policies that stress and reflect the importance of the water resources and that describe at length the role and functionalities of the various actors/stakeholders. Also, there seemed to be a general agreement on the need for a water-related Apex Body to guide the whole process with cross-sectorial representation directed and linked to the highest governmental level possible. Participants recommended facilitating the creation of Public-Private-Partnerships (PPPs) that can provide greater flexibility on financing options. Likewise, participants manifested the need to encourage a broad range of financial institutions that can cater to the needs of all levels of the users "pyramid" (see figures). However, it was pointed out that there is also a need for a "one stop" institution, to avoid the multiplicity of steps currently faced by users in order to cover their financial needs. Finally, and very much in line with earlier recommendations, it was felt that irrigation performance-based incentives should be established to guide financing request allocations. Many farmer enterprises simply do not (or should not) qualify for financing given their dismal operations. ■

For more information contact Carlos Garces at: carlos.garces@fao.org



Adapting agricultural strategies. Source: Jean-Marc Faures (FAO)

Staff changes and other announcements

STAFF ARRIVALS

Hervé Lévite is a French government-seconded Senior Technical Officer. His appointment will last 2 years and consists mainly in contributing to project identification, formulation and technical implementation as well as the search for their funding. He will also assist the Programme Manager to maintain and strengthen the Programme's relationship with partners and donors, particularly in francophone countries. Before coming to IPTRID, Mr Lévite was responsible for the Water Resources Management mission at the French Ministry of Foreign Affairs (MAE). He also has past experience as an Adviser of the Minister of Agriculture in charge of Water Resources in the Republic of Djibouti, as a Research Project Manager at the International Water Management Institute (IWMI) and at CEMAGREF (France), and as a Technical Assistant of the Hydraulic Director (Niger).

Dominique Durlin is a French Government seconded Technical Officer joined IPTRID for a two-year appointment. He will assist the Programme Manager in the implementation of activities related to the uptake of research and exchange of technologies. He will also contribute to the organization of technical missions, and provide technical support to the on-going projects of IPTRID having a capacity development component. Mr Durlin has over 30 years of experience, including different posts as Adviser to the Minister of Water and Environment in Chad, Manager of the Food Aid Fund programme of the Ministry of Agriculture in Egypt, evaluation expert for the European Union in Senegal, Laos, Rwanda, as well as soil scientist/agronomist in different projects in Bangladesh, Indonesia, Madagascar, Niger, Nepal, Syria, Algeria and Yemen among others.

Federico Patimo joined the IPTRID Programme as Clerk since September 2005. He provides assistance to Staff as required but his main duty is the running of the new IPTRID Database. He manages the transition from the old system to the new and more efficient system which has become an excellent tool of data administration. He maintains and updates the database and despatches daily IPTRID publications upon request or to forthcoming events and/or IPTRID workshops.

STAFF DEPARTURES

Claudia Schubert joined IPTRID in the middle of November as volunteer for two months. She is studying water management at Dresden University of Technology, Germany, which concentrates on engineering and natural sciences. Her field of study is water conservation.

Ms Schubert assisted in completing the web site for the Virtual Centre for Water in Agriculture, supported the institutional mapping and needs assessment studies undertaken by national consultants in Cambodia and Viet Nam under the ESPIM Project, and assisted on issues related to the WCA-InfoNET information system performance and development.

ANNOUNCEMENTS

Mott MacDonald India Director, Mr Peter Lee, has been elected President of the International Commission on Irrigation and Drainage (ICID) at the Commission's 56th International Executive Council meeting held in Beijing in September. Peter was nominated by the British National Committee (ICID,UK) based at the Institution of Civil Engineers (ICE), London. He will serve for a three-year term.

Mr Lee is Managing Director of Mott MacDonald's Indian operations and coordinates the Group's business throughout South Asia. He has over 30 years experience of water resources development issues in Africa, West and South Asia and Europe and has worked for a variety of different national and international institutions, including the World Bank, FAO, UNDP and DFID (UK).

Associated with ICID for over 15 years, he was Chairman of the British National Committee 1992-94 and served on the ICE Water Board during the periods 1989-95 and 1998-99. He was elected a Vice-President of ICID 1997-2000 and has chaired a number of ICID work bodies. He has taken a particular interest in the financial sustainability of irrigation systems and agencies and broadening the membership of ICID national committees. He is Chairman of the International Programme for Technology and Research in Irrigation and Drainage (IPTRID), hosted by FAO in Rome.

He has also served on a number business groups and is currently a member of the British Business Group, Mumbai and the Water Committee of the Confederation of Indian Industry.

IPTRID

The uptake of Research and Exchange of Technology and Innovations in irrigation and drainage for a sustainable agriculture

The International Programme for Technology and Research in Irrigation and Drainage (IPTRID) is a multidonor trust fund managed by the IPTRID Secretariat as a Special Programme of FAO. The Secretariat is located in the Land and Water Development Division of FAO and draws on a worldwide network of leading centres of excellence in the field of irrigation, drainage and water resources management.

IPTRID aims at improving the uptake of research, exchange of technology and mamagement innovations by means of capacity development in the irrigation and drainage systems and sectors of developing countries to reduce poverty, enhance food security and improve livelihoods, while conserving the envrionment. IPTRID acts as a facilitator mobilizing the expertise of a worldwide network of leading institutions in the field of irrigation, drainage and water resources management.

Together with its partners, the IPTRID Secretariat provides advisory services and technical assistance to countries and development agencies, for the formulation and implementation of strategies, programmes and projects. During the last ten years, it has been supported by more than twenty international organizations and government agencies. The present programme is co-financed by the Food and Agriculture Organization of the United Nations (FAO), the United Kingdom, the Netherlands, France and Spain, the World Bank and the International Fund for Agricultural Development (IFAD).

DIARY

7-10 March 2006
International Conference on Agrarian Reform and Rural Development: New challenges and options for revitalizing rural communities. Porto Alegre, Brazil
Contact: ICARRD Secretariat
ICARRD-Secretariat@fao.org
http://www.icarrd.org/icarrd_partners.html

4-8 April 2006
International Symposium on Water and Land Management for Sustainable Irrigated Agriculture. Adana, Turkey
Contact: Dr. Attila Yazar, Cukurova University, Irrigation and Agricultural Structures Department, 01130 Adana, Turkey.
Tel.: 0090-322-3386516
Fax: 0090-322-3386386
symp2006@cu.edu.tr
http://symp2006.cu.edu.tr/

24-28 April 2006
International Congress 'Ground Water in Mediterranean Countries'. Malaga, Spain
Contact: AQUAinMED, Dirección de Hidrogeología y aguas subterráneas, Instituto geológico y Minero de España, Ríos Rosas 23, 28003 Madrid, España.
Tel.:
Fax:
E-mail: aquainmed@igme.es
Web site: http://www.igme.es

17-19 May 2006
EnviroWater 2006. Concepts for Water Management and Multifunctional Land-Uses in Lowlands. Delft, Netherlands
Contact: Land Use Planning Group, Wageningen University, Gen. Foulkesweg 13, 6703 BJ Wageningen, Netherlands.
Tel.: 0317 483849
Fax: 0317 482166
E-mail:envirowater2006@wur.nl
http://www.wau.nl/rpv/isomul/envirowater2006/

18-22 May 2006
2nd International Training Workshop: Towards the Integration in Biosaline Irrigated Agriculture. Sharm El-Cheik, Egypt
Contact: Dr. Salah A. Attia-Ismail, Secretary General or Dr. Sajid Mahmood (Azeemi), Coordinator, Biosaline Workshop Secretariat, Desert Research Center (DRC), P.O. Box 11753, Matareya, Cairo, EGYPT
Tel.: +20106046244
Fax: +2026357858
E-mail: drsajid@cewre.edu.pk or saai54@hotmail.com
Website:http://www.wfto.org/BioSalinty_Brouchure2006_Egypt.doc

18-23 June 2006
22nd International Commission on Large Dams (ICOLD) Congress. Barcelona, Spain
Contact: L. Berga, ICOLD-BARCELONA 2006, Escuela Técnica Superior de Ingenieros de Caminos, Canales y Puertos, Gran Capitán, s/n. Modulo D1, 08034 Barcelona, Spain
Tel: 34-93 401 6478
Fax: 34-93 401 7357
E-mail:secretariat@icold-barcelona2006.org
Web site: http://www.icold-barcelona2006.org

5-7 September 2006
Sustainable Irrigation 2006
First International conference on Sustainable Irrigation Management, Technologies and Policies. Bologna, Italy
Contact: Rachel Green, Senior Conference Co-ordinator, SUSTAINABLE IRRIGATION 2006, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton, SO40 7AA
Tel.: 44 (0) 238 029 3223
Fax: 44 (0) 238 029 2853
E-mail: rgreen@wessex.ac.uk
Web site: http://www.wessex.ac.uk/conferences/2006/irrigation06/index.html

10-17 September 2006
57th International Executive Council Meeting, 3rd Asian Regional Conference and 7th International Micro Irrigation Congress. Kuala Lumpur, Malaysia
Contact:
Division of Irrigation and Agricultural Drainage, Ministry of Agriculture and Agro-Based Industry, Jalan Sultan Salahuddin, 50626 Kuala Lumpur, Malaysia
Tel: +603 26175671/5751
Fax: +603 26945489 E-mail: kl2006@did.moa.my
mancid@did.moa.my

26-28 September 2006
3rd International Symposium on integrated Water Resources Management. Bochum, Germany
Contact: ConventuS, Markt 8, 07743 Jena, Germany
Tel.: + 49 3641 35 33 221
Fax: + 49 3641 35 33 271
E-mail: water@conventus.de
Website:http://www.conventus.de/water

2-5 May 2007
The 4th Asian Regional Conference & 10th International Seminar on Participatory Irrigation Management. Teheran, Iran
Contact: Iranian national Committee on irrigation and Drainage (IRNCID)
No. 24 Shahrsaz Alley, Kargozar St., Zafar St
Tehran, Iran
Tel.: + 9821 2225 7348
Fax: + 9821 2227 2285
E-mail: info@pim2007.org
Web site: http://www.pim2007.org

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IPTRID Central Partners

FAO, Italy

The World Bank, United States of America

IFAD, Italy

Ministry of Foreign Affairs, The Netherlands

Ministry of Foreign Affairs, France

DFID, United Kingdom

Ministry of Agriculture, France

Ministry of Agriculture, Spain

ICID Central Office, India

IWMI, Sri Lanka

HR Wallingford, United Kingdom

Cemagref, France

Alterra-ILRI, The Netherlands

IAM-BARI, Italy

US Bureau of Reclamation, USA

CIDA, Canada

IPTRID has cooperated with more than 60 organizations in 40 countries

Contact information

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