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IRRIGATION MANAGEMENT NETWORK

NEWSLETTER

ODI/IIMI Irrigation Management Network 86/1a April 1986

Agricultural Administration Unit, Overseas Development Institute, London

The Overseas Development Institute (ODI) is an independent, non-profit making research institute. Within it, the Agricultural Administration Unit (AAU) was established in 1975 with support from the British Aid programme. Its mandate is to widen the state of knowledge and flow of information concerning the administration of agriculture in developing countries. It does this through a programme of policy-oriented research and dissemination. Research findings and the results of practical experience are exchanged through four Networks on Agricultural Administration, Irrigation Management, Pastoral Development and Social Forestry. Membership is currently free of charge to professional people active in the appropriate area, but members are asked to provide their own publications in exchange, if possible. This creates the library which is central to information exchange.

The International Irrigation Management Institute, Kandy

The International Irrigation Management Institute (IIMI) is an autonomous, non-profit making international organization chartered in Sri Lanka in 1984 to conduct research, provide opportunities for professional development, and communicate information about irrigation management. Through collaboration, IIMI seeks ways to strengthen independent national capacity to improve the management and performance of irrigation systems in developing countries. Its multidisciplinary research programme is conducted on systems operated both by farmers and by government agencies in many co-operating countries. As an aspect of its dissemination programme it is joining ODI in the publication of the Irrigation Management Network papers, to enable these to appear more frequently to an enlarged membership. It has also provided equipment to link ODI's Irrigation library into an international irrigation management database centered on IIMI.

NEWSLETTER

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1. ODI-IIMI COLLABORATION

We are very pleased to announce an agreement between the Overseas Development Institute (ODI) and the International Irrigation Management Institute (IIMI) for the development of the Irrigation Management Network. As our new cover shows, the Newsletter and Papers have now become a joint venture. IMMI has provided additional finance, to supplement the funding provided by the British Overseas Development Administration. This will enable us to improve services to members and to accept new members. To signalise this new era, we have reformed, and we hope, improved, the layout and appearance of the Newsletter and Papers, and introduced a new numbering system. The papers will henceforward be known as *ODI/IMMI Irrigation Management Network Papers*, and given a number which refers to the year of publication followed by the issue number, and a letter identifying the paper within the issue. Newsletters will always have the letter a, so you are now reading 86/1a. In 1986 we plan three issues instead of the normal two. The next issues will be in July (Issue 2) and November (Issue 3).

IIMI has provided us with an IBM PC/AT which will be used gradually to computerise the library and which will also be used for word-processing and publications. We have been joined by Camilla Toulmin as an additional Research Officer and Assistant Editor of the Newsletter and Papers. At the IMMI end Robert Cowell, Communication Specialist, will be responsible for liaison and for information gathered by or through IIMI. He explains the functions and plans of IIMI in Network Paper 86/1b.

Jane Johnson, IIMI's Information Specialist visited ODI in April to set up our computer systems and to provide staff training. We are still at an early stage with the new equipment, and we will be making more improvements in the publications and in the service to members. We would welcome suggestions for this.

2. NETWORK PAPERS

a. The current issue

The current issue is accompanied by four papers. Two of these deal with general topics - the work of IMMI and water charging, and two illustrate with practical examples ways to organise and develop training programmes for system staff and for farmers.

Paper 86/1b, *International Irrigation Management Institute: Program Concepts*, outlines IIMI's programme of activities. IIMI's goal is to improve the performance of irrigation systems by conducting research, providing opportunities for professional development amongst senior staff and by acting as a centre for the supply and exchange of information. It sees a large part of its job as trying to influence policy-makers through a series of workshops and training sessions and the dissemination of research findings. In this paper, Cowell emphasizes the need for IIMI's research to focus on the response of irrigated output to changes in management systems. Thus, for example, the experience of farmer-managed systems may have important lessons for use in larger government-run schemes. IIMI plans to be at the centre of a decentralized system of research and information networks. By collaborating with national research organisations, IIMI will be able to establish close contact with actual irrigation systems with the aim of identifying institutional and social factors which constrain the efficient use of water.

Paper 86/1c, *Irrigation Pricing and Management*, is by Ian Carruthers. As Network members know, many countries are feeling obliged to review their policies on recovering operation and maintenance costs from farmers because of constraints on their overall budgets, and the particular problem of financing adequate maintenance of their irrigation systems. Different charging policies have different effects on management. Any-one who is in the position of reviewing the alternatives for his own country should examine this paper, which gives the conclusions and recommendations of a study by Devres Inc. for the USAID Office of Policy Development and Program Review, Washington. The conclusions were based on five country studies: Peru, the Dominican Republic, Morocco, the Philippines and Indonesia, to which many people contributed. Ian Carruthers was the team leader.

Carruthers stresses that beneficiaries of irrigation should meet the costs of O and M at the very least. The use of direct as opposed to indirect charges is recommended since the former, being linked to the actual use of resources, should encourage their more efficient use. He highlights the advantages of earmarking funds explicitly for O & M expenditure and of allowing management to retain revenues collected on the scheme. While the case for increased participation by farmers in O & M leading to improved performance in this area is not conclusively proven for all types of system, he notes the reduction in scheme costs made possible by this shift in responsibility for maintenance from the project authority to the farmer.

IIMI has also carried out a study on irrigation service fees for the Asian Development Bank. We hope to carry a summary of their report in a later issue. Details of Workshops on the subject will be found in Section 5b.

Many training programmes for low level staff and for farmers do not succeed because they take place in the classroom, and often in an urban area where it is not possible to give practical demonstrations. Practising what participants need to know to do their job better is usually a better way of doing things than basing training programmes on theories chalked on the blackboard. Trainees may feel ill at ease in an unfamiliar situation and are not able to contribute their own practical knowledge to the benefit of their fellow students. They may feel they are treated as children rather than the important persons they are in their own environment. Papers 86/d and 86/e by Martin Burton and Ian Smout, respectively, show an economic and successful method of taking the training team to the field, rather than the students to the training centre, in East Java. *Training Programmes for Irrigation Staff* illustrates the method on a 70,000 ha irrigation scheme. *Training Programmes for Irrigation Farmers* concerns groups operating tubewells. The papers detail the requirements for the operation, from the initial thinking about objectives down to the necessity for organising food and drink and carrying spare light bulbs. As training programmes often have to be carried out by people who are trained engineers or agriculturalists, rather than trained teachers, we thought it worthwhile publishing them as a guide to how to develop and organise a training programme. They will obviously have to be adapted to the specific circumstances and needs of different groups and different countries. There is a certain amount of common material in each paper. We have split them so that each can be used on its own, as members may wish to pass them on to different departments that might be involved in training irrigation staff (86/d) and farmers (86/e). Members interested in training should also look at Belloncle's book reviewed in Section 6a.

b. Forthcoming issues

We are always glad to have the occasional paper giving practical detail on better ways of doing things, and invite members to report on field-tested methods. However, present plans are for the next issue to deal with more general topics. It will include a paper on the use of micro-computers in water monitoring. Papers, news and notes for this issue should be received by June 15 for the July issue and October 15 for the November issue.

3. REGISTER OF MEMBERS

Enclosed with this set of papers is the new Register of Members. Membership information is now being entered on to D-Base3. You will find inside the Register a new Registration Form. Please use this to correct and update the entry concerning yourself. We shall continue the policy of asking members to re-register every three years, and if you return the form we shall assume that you wish to continue as a member. During the next few months we shall be writing to existing members from whom we have not heard recently to ask if they wish to be removed from the mailing list. We expect to have two types of member: those who find the papers useful and stimulating for the way they think about their work, but who may not wish to take an active part in the exchange of research findings and the results of practical experiments and changes in management style, and those who want to participate in research programmes and publication.

The form is therefore divided into two parts. All members should fill in the first part with their name, address and employer. Those who wish to take an active part in the Network should also fill in the second part, with information on interests and experience. We shall use this information when we are asked to put members in touch with others having specific interests. The Register is intended to assist you to write directly to those who have similar interests. It is arranged alphabetically first by country, then by name. We hope this will help you get in touch with your own compatriots, and perhaps to arrange occasional in-country meetings. The lunch-time meetings held at ODI have contributed very much to the vitality of the British section, and to the interchange of ideas both between disciplines, and between practitioners and academics.

The Network is meant to assist those who are responsible for irrigation management, training or planning in developing countries, and if existing members know of persons to whom the papers will be useful, we should be glad to have names and addresses. This request is particularly addressed to Ministry staff and to aid agency personnel and consultants who are in direct touch with practitioners and planners, who might not always hear of the Network. Academics seem to have a better grape-vine! We should like to emphasise again that all members are free to photocopy papers, to pass them to colleagues, use them in discussion groups, etc.

4. IIMI AND ODI RESEARCH PROGRAMMES.

News of IMMI's research programmes on strategies to promote diversified cropping in systems designed for rice, the mobilisation of resources to improve performance, and farmer-managed irrigation is carried in Paper 86/1b.

During 1985 Mary Tiffen co-operated with Hydraulics Research Ltd, U.K., Hydraulics Research, Wad Medani, Sudan, the Sudan Gezira Board and the University of Gezira in devising socio-economic studies to complement water measurement research being carried out on one of the minors, (secondaries) on the Gezira Scheme in the Sudan. As noted in a paper reviewed in Section 6b below, yields differ according to location, and also according to the pricing situation. The management of the minor, and the issue of whether to permit watering only during the day, using the minors for night storage, is a crucial issue for the rehabilitation programme. Currently watering is de facto taking place by both day and night and farmers have evolved various techniques in response to flows considerably below design levels. The first of the socio-economic studies was a rapid survey of the attitudes of farmers in the research area to the current water situation, their beliefs on crop-water requirements and their reactions to a possible restoration of strict night storage. Although the Gezira is usually described as an autocratic scheme, farmers perceived that they got water on demand, if it was available. They blamed shortages on poor maintenance, and blockage by weeds and silt. A majority favoured a return to night storage, although recognising this might slightly increase their labour costs, as they felt increased yields would compensate. Another complementary study, being carried out by the Sudan Gezira Board, is beginning to quantify the monetary return to water. Further studies are planned.

The results of the attitudinal survey have now been published. It is available as: Abdelgadir Mohammed Ahmed and Mary Tiffen, *Water Management in the Gezira Scheme, Sudan: A survey of farmer attitudes on two minor canals*, Report No OD76, Hydraulics Research Ltd, Wallingford, Oxon, UK. Copies can also be obtained from the authors, Dr.Abdelgadir at the Faculty of Economics and Rural Development, University of Gezira, Wad Medani, Sudan, or from Dr. Mary Tiffen at ODI.

Currently Mary Tiffen is working on an analysis of the socio-economic and institutional problem areas of irrigation schemes, as revealed by evaluations carried out by the World Bank and other lending Agencies. In a sample of cases, appraisal documents or feasibility studies are being examined to see how these matters were considered at this stage. The guidelines currently used for feasibility studies are being reviewed in the light of these findings, and recommendations will be made on ways to improve preparatory studies. Many Network members have assisted by the provision of information or discussion of difficulties in incorporating socio-economic factors into planning, and a report will be available later this year.

5. NEWS FROM NETWORKERS.

a) International Programmes.

ICARDA (the International Centre for Agricultural Research in the Dry Areas) has produced Research Highlights for 1984 (Aleppo, Syria). As those interested in irrigation may not usually see this, it is worth mentioning that it contains a report on farmers' results with Faba bean pilot production plots on an irrigation scheme in northern Sudan. This is interesting both for the methodology used in the farmer trials and also for evidence of the high yield increases of 75% which were obtained. The faba bean (or broad bean), has many uses, yielding a fresh vegetable, a dry high protein bean and animal fodder. It possibly deserves greater popularity outside the Middle East.

A meeting to develop *Guidelines for Comparative Evaluation of the Technical and Economic Performance of Water Pumping/Water Lifting* was held from 27-28 January in Sussex, England and was organised by USAID's Bureau for Africa and IDRC, Canada. Details can be obtained from Janine Finnell, Office of Energy, USAID, Washington DC 20523, USA. Several agencies are now contributing to further work.

b) Meetings and Seminars.

i) Forthcoming meetings.

A Forum on Irrigation Systems : Research and Applications is to be held from May 13-15, 1986 at Cornell University, U.S.A. It is being sponsored by the Water Management Synthesis II Project and is designed to promote discussion of key issues in irrigation management and their implications for programmes and policies in this area. For further information contact : Fua Hazleman, Irrigation Studies Group, International Agriculture Program, 372 Caldwell Hall, Cornell University, Ithaca, New York 14853, USA.

The World Water '86 Conference, organised by the Institution of Civil Engineers is to be held in London from 14-16 July, 1986. Topics cover irrigation and drainage as well as drinking water supply and sewage. The emphasis is on recent technical developments but some management and social issues will also be discussed. It is followed on the 17 and 18 July by a Conference on Drought and Famine, under the auspices of the International Water Supply Association and a special fee is offered to those delegates attending both conferences. Further details from the Conference Office, Institution of Civil Engineers, 1-7 Great George Street, London SW1P 3AA, telephone 01-222-7722.

Many people in the Middle East are conscious of the constraints on their water supply and the need to make best use of every resource. The resource situation was reviewed at a Regional Symposium held in Kuwait 17-20 February 1986. An FAO seminar on the reuse of sewage effluent was held in Cyprus in October 1985. As a follow up, Jordan requested technical assistance in the use of municipal and industrial waste water for agriculture and a workshop on the resulting findings is planned for August. For details contact Dr. Abdullah Arar, Senior Regional Officer, AGL, FAO, Rome.

The Asian Development Bank will be holding a seminar in July to discuss the results of the study on *Financing of Irrigation Services* carried out for it by IIMI. The report will be subsequently published jointly by ADB and IIMI. Details from Dr. Leslie Small, at IMMI.

The FAO is holding an Expert Consultation on *Irrigation Water Charges* in Rome from 22-26 September. Three topics will be discussed : criteria for the recovery of irrigation investments, the need for suitable management of schemes for recovery of O & M costs, and appropriate social, institutional and administrative mechanisms to increase the collection of funds. Details from J. Sagardoy, FAO, Rome.

A Symposium on *Irrigation Design for Management* is to be held in Sri Lanka from 16-18 February 1987. The main question to be addressed by the meeting is "Considering the past performance of irrigation schemes, can new projects be designed to avoid such problems and to what extent can existing problems be rectified during rehabilitation and modernisation?" This symposium is being jointly organised by the Overseas Development Unit, Hydraulics Research Ltd., U.K.; the International Irrigation

Management Institute and the Sri Lankan Irrigation Department and is being sponsored by the Overseas Development Administration UK and IIMI. Further information can be obtained either from : R.Wooldridge, Hydraulic Research, Wallingford, OX10 8BA, U.K., or from The Organising Secretary, Symposium of Irrigation Design for Management, IIMI, Digana, via Kandy, Sri Lanka.

The 6th Afro-Asian Regional Conference of the International Commission on Irrigation and Drainage will be held from 9-16th May 1987 in Cairo, Egypt. The theme of the conference is *Water Management in Arid and Semi-Arid Areas*. Within this overall subject area, two main topics will receive particular attention : the non-conventional uses of water resources and irrigation strategies and techniques in arid and semi-arid areas. The full text of papers should be submitted before May 31st, 1986. The registration fee for participants is US$300. Further details can be obtained from the Secretary General, Dr. Mohammed A.H. Rady, A.R.E. National Committee of Irrigation and Drainage, 22 El-Galaa St., Bulaq, Cairo, Egypt.

ii) Past Meetings.

Details of IIMI's 1985 meetings and resulting publications will be found in 86/1b. Topics include research priorities, irrigation and vector borne disease transmission and participatory management in Sri Lankan schemes.

The FAO held an Expert Consultation on *Irrigation in Africa* at Lome, Togo from 21-25 April 1986. Three principal topics were dealt with by the conference : the present and future role of irrigation in African agriculture; policies and strategies most likely to speed the development of irrigation; follow-up action through national programmes and external support needs. The proceedings of the Consultation will be published as an FAO Irrigation and Drainage Paper by the end of 1986. Further information can be obtained from Water Resources, Development and Management Services, FAO, Via delle Terme di Caracalla, 00100 Rome, Italy.

c) *Training*, Research and New Journals.

The next course by the Overseas Development Group at the University of East Anglia, U.K. on *Irrigation in Development Planning* will take place over 8 weeks from July to September. The course combines an examination of technical, environmental, economic, social and managerial aspects of irrigation development and includes the use of microcomputers. For more details, write to Dr. Tony Barnett, Overseas Development Group, University of East Anglia, Norwich, NR4 7TJ, U.K.

A Workshop on *Irrigation Data Management* using microcomputers has been developed by the Water Management Synthesis Project at Colorado State University. It is aimed to help professionals understand the role of microcomputers in and develop microcomputer skills for irrigation management. The workshop is designed to be held over a two week period, although the time schedule and content can be adjusted to suit the needs of particular institutions. Further details of this training programme can be obtained from Dr. Tom S.Sheng, Water Management Synthesis Project, University Services Center, Colorado State University, Fort Collins, Colorado, USA 80523 (telephone 303.491.6991).

A new journal, *Water Management Review*, has been started by the Water Management Synthesis Project at Colorado State University. Its aim is to provide a forum for the exchange of ideas, the exploration of new concepts and the development and transfer of social and technical information on water management. Short articles, of two to four typed pages, are invited from those working in this field and should be sent to Dan Lattimore, Managing Editor, Water Management Synthesis Project, University Services Center, Colorado State University, Fort Collins, Colorado, USA 80523.

Hydraulics Research, Wallingford, Oxon, OX10 8BA, has a new bulletin on its overseas work. For details of this ODU Bulletin contact Dr K Sanmuganathan at the above address. The April issue, which is accompanied by a Publications List, is concerned mainly with spate irrigation.

The Agrarian Research and Training Institute, PO Box 1522, Colombo 7, Sri Lanka, is issuing a quarterly publication, *Diyawara,* with details of its research and seminars.

6. PUBLICATIONS.

a) New Books.

The proceedings of a symposium held last year at the Royal Society, 6 Carlton House Terrace, London SW1Y 5AG on *Scientific Aspects of Irrigation Schemes* have now been published, price £31 (UK addresses) and £33 (other addresses). The main papers are on crop/water/soil relationships, but there are also papers on economic and social constraints, philosophical issues and other general topics. The editors are Sir Charles Pereira, M J Hamlin and M Mansell Monlin.

Women in rice farming published by Gower, Aldershot, U.K. and the International Rice Research Institute contains 30 papers presented at a Conference on Women in Rice Farming Systems held at IRRI, Manila, in September 1983. This valuable and wide ranging collection of articles, which together take up more than 500 pages, is largely concerned with documenting the importance of women's labour in rice production and processing and with assessing the impact of new technologies on the welfare of rural women. Almost all of the work is drawn from Asia and ranges from Japan, China and the Philippines to India, Bangladesh and Nepal. The evidence presented by these studies shows not only the central role played by women in crop processing but also that they often provide a major share of the labour required for cultivation. While many writers note that the introduction of new rice production technologies has often had detrimental consequences for the earnings and status of rural women, they also stress the need to differentiate between the effects on women of differing social class. The book ends with a series of recommendations developed at the conference concerning the need for women's interests and welfare to be explicitly considered by national governments and development agencies before interventions are undertaken.

An interesting book by Guy Belloncle, in French, describing his experience with literacy programmes among farmer groups on a number of

West African irrigation schemes stresses the fundamental role of farmers' associations in improving levels of maintenance *(Participation paysanne et aménagements hydro-agricoles*, Karthala, Paris 1985). The main concern of Belloncle's work has been to transfer to farmer groups the techniques required to keep accounts and manage the group's organisation. A short account of this work was published in English as ODI Irrigation Management Network Paper no.9c *Giving management skills to farmers' groups*, Guy Belloncle, April 1984. His discussion ranges widely over the need for greater farmer participation in water management and system maintenance, the problems of growing indebtedness among many tenants, especially on schemes in Mali and Cameroon, and the very wide variation in yields obtained by different farmers within the same scheme.

b) Articles and Reports.

Two recent publications by Paul Mathieu, both in French, examine irrigation development in the Senegal River Valley and in the Korioumé Perimeter near Tombouctou, Mali. In *L'Aménagement de la Vallée du fleuve Sénégal* (in Monde en Développement, vol.13, no.52, 1985), he describes the effects of recent changes in land tenure law and agricultural pricing policy on competition for land and the performance of irrigated rice production. He concludes that land will become increasingly under pressure from those with the capital to invest in equipment, with consequences for the distribution of irrigated land holdings and access to land for poorer farmers. In the *Evaluation du Périmetre Korioumé, Ile de Paix de Tombouctou,* June 1985, Mathieu describes the progress of a small-scale scheme funded by a NGO and benefitting some 8,000 people in Mali. He emphasizes the need for the NGO to reinforce the co-operative organisation among farmers if problems of poor maintenance, low input use and falling yields are to be addressed.

Papers from a conference on water management in the Gezira, Sudan, are presented in *Water distribution in Sudanese agriculture : productivity and equity,* edited by O.A. Fadl and C.R.Bailey, University of Gezira, Wad Medani, Sudan, 1984. Copies cost US$6.00 (including mailing) and can be obtained from Professor Osman Fadl, by sending a coupon made payable to Water Management Programme, University of Gezira. The collection includes a paper by Hamid Fakki, Ahmed El Bedawi and Charles R. Bailey on *The effect of farm location on cotton yields and farm incomes in the Gezira scheme.* This paper investigates differences in cotton yields and farm incomes over the period 1979-83, for fields according to their location within the scheme. The differences in yields and incomes are most marked at the level of minor canals and the tertiaries which would imply that better water management at this level would significantly raise overall productivity. The data presented covers the change-over in 1981/2 in the method of charging tenants from the Joint Account to the Individual Account system. The latter involves a much closer correspondence between levels of input use and the charge made by the Gezira Board, in contrast to the flat charge made upon the volume of cotton delivered under the Joint Account system. The change in the method of accounting, coupled with a rise in cotton prices, has nearly doubled yields on all tenancies, illustrating the extreme importance of pricing policy.

A *Comprehensive Bibliography on Farmer Involvement for Irrigation Performance Improvement* has been brought out by the Division of Irrigated Agriculture, USAID, New Delhi, January 1986 (74 pp). The aim of the publication is to help those concerned with increasing farmer involvement in the design, operation and maintenance of irrigation systems. The bibliography is classified both by theme and by region. Thus, the first part includes literature on the historical development of irrigation, workshop and conference reports, planning guides and training manuals, and on the role of women in irrigation. While the literature cited in the second part covers irrigation development throughout the world, the major share comes from south-east and south Asia, with documentation on Indian irrigation especially strongly represented. USAID, New Delhi invites readers to bring new literature on this subject to their attention for incorporation in later editions.

The progress achieved by the Gal Oya project in Sri Lanka since its inception in 1979, is described in *Gal Oya Water Management Project : Mid-term Impact Assessment* Research study no.63, Agrarian Research and Training Institute, Colombo, Sri Lanka, February 1985. The physical rehabilitation of the irrigation structure has been pursued alongside an active policy to mobilise farmer participation in the design, construction, operation and maintenance of the system, as also described by Widanapathirana in Irrigation Management Network Paper no.10c, November 1984, *The Gal Oya Experiment*. While the report notes that it is too early to fully assess the effects of the project, it finds indications of improved water management by farmers, reduced conflict among farmers over water distribution and greater co-operation between farmers and project staff. However, it also mentions the difficulty in maintaining interest and active participation among farmers and the central role played by Institutional Organisers in establishing effective farmer groups.

7. ODI LUNCH TIME MEETINGS

On February 28 Mark Svendsen, Senior Water Management Specialist, Office of Technical Resources, USAID, spoke on *Irrigation System Recurrent Costs: A Donor Perspective*. Professor Ian Carruthers took the chair.

8. NEW APPOINTMENTS IN THE AGRICULTURAL ADMINISTRATION UNIT

Jon Moris has joined ODI to be responsible for the Pastoral Development Network. Many Members of this Network will know him for his work on irrigation, both for his book (with Robert Chambers) on the Mwea Scheme in Kenya, and for his more recent work with the Water Management Synthesis Programme at Utah State University. He has recently also participated in FAO's surveys of African irrigation. His breadth of interest makes him a valuable addition to the Unit. We anticipate cross-fertilization of ideas, particularly in the realm of livestock keeping in irrigated areas. This process will be assisted by the fact that Camilla Toulmin, whose previous work has been on livestock, has joined the Irrigation Management Network.

The Agricultural Administration Network is changing its focus away from extension and towards the organisation and management issues in agricultural research, and the links between research, extension and farmers. John Howell remains in charge, but hopes soon to appoint a new research officer for this area. If any reader is interested, details can be found on the enclosed advertisement.

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Camilla Toulmin

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IRRIGATION MANAGEMENT NETWORK

INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE PROGRAM CONCEPTS

Robert Cowell

ODI/IIMI Irrigation Management Network 86/1b April 1986

Papers in this set

Please send comments on this paper either to the author or to

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Comments received by the Editor may be used in future Newsletters or Papers.

The opinions represented are those of the author and do not necessarily reflect the policies of the ODI, IIMI or any organisation with which the author is connected.

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INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE

PROGRAM CONCEPTS

Robert Cowell

Contents

Dr Robert Cowell is Communication Specialist at the International Irrigation Management Institute and is in charge of their publication and information program.

INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE PROGRAM CONCEPTS

Robert Cowell

The need to improve the management and performance of irrigation systems in developing countries has long been recognized by national governments and agricultural development experts. In September 1983, a group of international donors, coordinated by the Consultative Group for International Agricultural Research (CGIAR) and the Ford Foundation, signed a Memorandum of Agreement with the Government of Sri Lanka to establish the International Irrigation Management Institute (IIMI). IIMI's Charter came into force in December 1983, and the Institute became operational at Digana Village near Kandy in July 1984.

Financial support was undertaken by the IIMI Support Group, consisting of the Aga Khan Foundation, Asian Development Bank, Australia, France, Ford Foundation, General Services Foundation, International Fund for Agricultural Development, India, Japan, Netherlands, Pakistan, Philippines, Rockefeller Brothers Fund, Rockefeller Foundation, Sri Lanka, United Kingdom, United Nations Development Programme, USA, and the World Bank. Day-to-day administration of IIMI is in the hands of the Director General and a small staff of international and local researchers who operate under the policy direction of an international board of governors.

IIMI's goal is to help strengthen independent national capacity to improve irrigation performance through better management. Performance means maximizing benefits for small-scale farmers, including increasing their productivity, improving equity, and minimizing any adverse environmental, social, and health effects of irrigation. The people IIMI tries to reach are the policy-makers and technical professionals who are influential in planning and managing irrigation systems.

IIMI approaches its goal of strengthening national irrigation programs from three directions: 1) research; 2) professional development, and 3) communication and information exchange.

RESEARCH

IIMI uses its unique position as an international institute for research activities that will benefit many countries. The selection and conduct of projects are based on six principles:

1) IIMI focuses research on irrigation management rather than on the design of irrigation systems. However, this does not mean that IIMI overlooks design issues because management options are frequently constrained by how irrigation systems are planned and built.

2) Research focuses on how irrigation performs in response to management. Irrigation performance has rarely been documented even in countries with advanced irrigation technology. At a minimum, performance criteria include acceptable agricultural productivity levels in relation to the water supplied to the crops, and equity of water distribution among farmers whose fields are located in different parts of a system.

3) Field research seeks ways to validate broadly-based models. Applied field research is important for maintaining a practical problem-solving approach at IIMI. For maximum effect, however, the field data should be used in models which allow site-specific results to be applied in as many systems and locations as possible.

4) A comparative approach to research, both in terms of location and time, and research that integrates different disciplines are used. Comparative and multidisciplinary research provide the tools for achieving results that can be applied to a broad range of conditions and situations.

5) Collaborative research underlies all of IIMI's activities, and will be discussed in detail later.

6) IIMI's research has a strong policy-orientation.

Research program areas. IIMI research is broken down into three program areas based on irrigation processes 1) irrigation system management, 2) rehabilitation and design for management, and 3) farmer-managed irrigation.

1. Irrigation management. Research in this area is concerned primarily with planning, operating, and maintaining systems under government administration. Studies are designed to find out how different management practices can improve irrigation performance of the whole system -- from the headworks, through the network of canals and field channels, and onto farmers' fields. A key objective is to accurately define the scope of irrigation systems, which is often arbitrarily limited to mapped areas.

2. Rehabilitation. Irrigation development is relatively mature in many countries, particularly those in Asia with large irrigated areas. New sources of irrigation water are often scarce and expensive. As a result, projects to rebuild existing systems are becoming increasingly important. But there are still many unanswered questions about how to plan and implement projects designed to rebuild irrigation systems and raise performance levels.

Rehabilitation usually means restoring a system to its original design specifications. IIMI's research explores different criteria for rebuilding and modifying specifications. This research philosophy views rehabilitation not simply as a set of physical activities, but as an opportunity to introduce management innovations.

3. Farmer-managed irrigation. Systems managed by farmers are important because they involve over half the irrigated area of many countries. Furthermore, farmers may use management principles that can be applied to larger systems. Relatively little is known about the interplay of institutional, agricultural, and physical factors that affect the performance levels of community-based systems, which are among the most and least

successful of systems. Many governments today are seeking to "privatize" their agency-managed systems in a bid to economize and improve performance levels.

4. Other research. IIMI wants to retain some flexibility in conducting new and promising research which does not fall into the three main categories. Some research may be considered "radical" and carry a low probability of success but could nevertheless have exceptional impact. Such research may involve graduate students or limited consultancies on specific topics.

Management dimensions. Cutting across these four research categories are five management dimensions closely related to the disciplines represented by core IIMI research staff:

1. Institutional and social dimension. The key to improving the management of irrigation systems is understanding the people who control the water. Very little research has been conducted on the organization, incentives, and disincentives of project authorities who are responsible for planning and operating systems. Because organizational behavior is shaped to a large extent by institutional constraints such as legal and social codes, IIMI's research strongly emphasizes the institutional context.

2. Physical dimension. Especially important in rehabilitation and design, this dimension focuses on spatial and hydraulic variables.

3. Biological dimension. Biological issues include understanding how crop production and the biological environment respond to different irrigation methods, as well as how irrigation affects human health conditions.

4. Information dimension. Included in this dimension are studies on how to organize irrigation monitoring and feedback processes, and how farmers and irrigation agency staff exchange information effectively.

5. Financial dimension. Irrigation officials are often unable to support management activities because of financial constraints. This dimension

explores feasible options open to governments in financing the recurring costs involved in planning, operating, and maintaining systems. Other issues include methods of recovering reasonable costs from farmers and other beneficiaries, and methods to extend the financial analysis to farmer-managed systems.

Network research. With limited resources and no irrigation systems of its own, IIMI cannot carry out a research program by itself. Essentially all field research is planned as network research in collaboration with appropriate national organizations. In most cases these are the government agencies which plan or operate irrigation systems. There are two important benefits to these arrangements: a professional development role is included in collaborative research, and IIMI can relate its programs directly to operating systems over a range of conditions.

A national Sri Lanka-IIMI Consultative Committee was appointed according to terms of reference worked out by IIMI and officials of the Government. It provides an organized forum which IIMI can consult about its research program, assistance in implementing activities with collaborating agencies, and help interpreting research results. Similar consultative committees are under consideration in other countries in which IIMI has research networks.

The first Institute-supported research network, on irrigation management strategies to promote diversified cropping in systems designed largely for rice, has already begun work in Sri Lanka, Indonesia, and the Philippines. Dr. Senen Miranda coordinates this network. A second network, coordinated by of Dr. Leslie Small, is being set up to study the mobilization of resources to improve irrigation performance. The third network involves research on farmer-managed irrigation and is coordinated by Dr. David Groenfeldt and Dr. Ed Martin. Locations for these and another network on canal regulation and design issues have not yet been finalized. All the above can be contacted at IIMI HQ, Digana Village, Via Kandy, Sri Lanka.

Field research. The location of IIMI's first field research project is in North Central Province in Sri Lanka's dry zone and is coordinated by Dr. Chris Panabokke, also at IIMI HQ. The selection was based on criteria emphasizing diversity of irrigation conditions, potential for a range of different crops and cropping patterns, interest on the part of collaborating Sri Lankan agencies, and availability of baseline data. The location includes small systems under the authority of the Agrarian Services Department but managed by farmers; larger systems under the Irrigation Department; and part of Mahaweli System H, which is operated by the Mahaweli Authority. Data collection for baseline studies, started in April 1985 on irrigated rice land, will support research on management techniques for irrigating diversified crops during the dry season. A second field location will soon complement the Anuradhapura site.

Branch activities. Because IIMI research must be taken to the irrigation sites and conducted in close collaboration with local irrigation professionals, IIMI is designed as a decentralized research organization. Its headquarters in Sri Lanka serves as a resource center and coordinating hub for what may develop into a ring of several autonomous international centers or "branches" in other countries. Branches will support and coordinate local research activities and report to IIMI's Governing Board through the Branch Director and the Director General. The first IIMI branch will be established in 1986 in Pakistan, where the scale of systems, cropping patterns, and climatic regime differ strikingly from those of Sri Lanka.

Resident scientists. IIMI has posted Resident Scientists in the following countries to help establish an international network of irrigation management professionals and to assist relevant agencies set up network research projects:

The Philippines. Dr. Fred Valera, IIMI Liaison Office, 4th Floor, NIA Bldg, EDSA, Diliman, Quezon City, Philippines. Telex 22456 IRI PH.

Indonesia. Dr. Sam Johnson, IIMI, PO Box 435 KBY, Jakarta 12001, Indonesia. Telex 61894 FF JKT IA.

Nepal. Dr. Robert Yoder, IIMI, PO Box 3975, Kathmandu, Nepal. Telex 2262 NARANI NP.

Additional postings of resident scientists are being considered for other countries including Morocco, Thailand, and the Sudan.

Other international activities. Two IIMI exploratory missions have investigated the feasibility of cooperative involvement in sub-Saharan Africa, and the Institute has prepared a strategy paper for consideration by the Governing Board and selected African countries. Initial steps have been taken to study the possibility of modest activity in Latin America.

PROFESSIONAL DEVELOPMENT

IIMI's professional development program is designed to prepare key people for leadership in strengthening irrigation management in their countries. The program is oriented to relatively senior officers of relevant government agencies and to researchers. IIMI will help countries strengthen their national training programs, but cannot itself meet the demand for specialized local training in the many countries with which it collaborates. Because the professional development program is integrated with the research program, IIMI has no separate training section as such. Senior staff participate in professional development activities such as:

1. Workshops. IIMI has hosted and co-sponsored several international workshops on various irrigation-related topics. These workshops are an effective means of enlarging the network of professionals and institutions involved in irrigation management, organizing network research projects, and promoting better irrigation management practices.

In January 1985, IIMI co-sponsored with USAID and Cornell University a one week workshop on "Research priorities for irrigation management in Asia." A report of the results is currently available from IIMI. A follow-up workshop on "Selected research issues in irrigation management" was held in July, and the collected summaries of the papers are available from IIMI. In April and May 1985, IIMI hosted and co-sponsored the World Bank Economic Development Institute's six-week irrigation training course, and will host the course again in 1986. A workshop on Irrigation and Vector Borne Disease Transmission, sponsored by the Panel of Experts for Environmental Management (PEEM) and hosted by IIMI, was held in October. The proceedings will be available in April. A workshop on Participatory Management in Sri Lanka's Irrigation Schemes will be held at IIMI 15-17 May 1986. Proceedings will be prepared from the invited papers. The Overseas Development Unit of Hydraulics Research Ltd., the Sri Lankan Irrigation Department, the ODA, and IIMI will sponsor an Asian Regional Symposium on Irrigation Design for Management from 16 - 18 February 1987 at IIMI headquarters.

2. Fellowships. IIMI is supporting graduate students at the MSc (Scholars) and PhD (Fellows) levels to conduct their thesis work under the direction of IIMI staff. Selections are made largely on the basis of how closely the proposed research topic fits IIMI's program. Scholars and Fellows may be supported to work in any of the countries where IIMI has collaborative programs, and will be recruited from a wide range of universities. Presently two scholars and two fellows are in residence at work in Sri Lanka and one in the Philippines.

3. Post-doctoral awards. IIMI has initiated a program of post-doctoral awards with two awardees currently posted in Sri Lanka and one in Indonesia.

4. Special awards. In 1986, IIMI will launch a program to bring a number of professionals from Asia, Africa, and Latin America to Sri Lanka for a few months to provide them with substantive, computational, and publication support to develop and publish promising research or case studies.

5. On-the-job training. To implement its research projects in collaborating countries, IIMI works closely with irrigation officials. An example is the study on managing irrigation to promote diversified cropping. This research requires the active involvement of irrigation officials to implement different scheduling and water application practices. By working with close support from IIMI staff, they have the opportunity to learn research concepts as well as management skills. By rotating the assignment of staff to such research projects, agencies can maximize the number of their people who benefit from the training.

6. Research on issues of professional development. The field of irrigation management itself has no recognized training syllabus at the university level, and few resources for developing the field within irrigation agencies.

However, training support for irrigation management is expanding rapidly and substantial funds are being put at the disposal of Asian and African countries. IIMI contributes to this process by helping to develop new irrigation management training materials and methods, and by helping to organize and expand the field's substance and content. A study, planned for 1986, and coordinated by Dr. Senen Miranda and Dr. P. S. Rao, will review the methodology and content of selected training programs in irrigation management.

7. Submission of applications for fellowships and awards. Interested candidates should write to: The Director General, IIMI, Digana Village via Kandy, Sri Lanka. Please enclose: a) bio-data; b) a brief description of current courses, research, and/ or professional work; c) a two-page summary of research and professional accomplishments during the past few years; and, d) a proposal of the work to be pursued at IIMI. The proposal should provide the following information concisely: a) the objective of the proposed project; b) theoretical or practical justification for the work; c) the anticipated methodology; d) the location and timing; and e) the relevance to IIMI's research activities. New Ph.D. students should submit an extended abstract of their thesis. Candidates selected during the preliminary screening will be sent application forms for endorsement by employers or university professors.

COMMUNICATION AND INFORMATION EXCHANGE

Communication and information exchange at IIMI supports research and professional development through three interrelated activities:

1) the establishment and support of a network of individuals and organizations involved in irrigation management and related fields;

2) the operation of a database and documentation center to facilitate the movement of up-to-date information among network members;
3) the publication of documents on irrigation management and related subjects for distribution to an audience of researchers, practitioners, policy makers, and educators.

1. Irrigation Management Network (IMN). IIMI's network of professional contacts in irrigation management is the backbone of both research and professional development at the Institute. At an interpersonal level, these people are linked with each other through workshops and conferences, and with IIMI's researchers through correspondence and staff visits. Such personal contact is supported with information provided by IIMI's publications and database. At the organizational level, agencies that can provide resources, services, and expertise are linked with those in national governments that need assistance and support. The cooperative agreement between IIMI and the Overseas Development Institute (ODI) strengthens and expands the information services available to irrigation professionals and practitioners by uniting ODI's Irrigation Management Network with IIMI's network of contacts.

IIMI's participation in publishing the ODI Irrigation Management Network Newsletter opens new doors for disseminating information about irrigation management, and the proposed expansion of the IMN potentially increases the audience of users at the interpersonal level who can guide and improve irrigation management at the organizational level. The agreement between IIMI and ODI also makes possible exploration of other areas of cooperation. IIMI and ODI will cooperate with the Centre de Formation Internationale à la Gestion des Resources en Eau (CEFIGRE)[1] to produce French language translations of the joint-newsletter for distribution in Francophone Africa and other French-speaking areas.

2. Library, documentation center, and database. The IIMI library serves the headquarters research staff and participants in IIMI's professional development programs, and will provide a resource which network members and cooperating organizations can draw upon through IIMI's database and

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[1] Its address is: Sophia Antipolis, BP 13, 06561 Valbonne Cedex, France.

documentation center. IIMI's primary collection consists of hard to get unpublished literature obtained through contacts with professionals in IIMI's network, as well as a limited number of basic and technical texts on irrigation management and related fields. ODI is sharing the material in its irrigation library with IIMI. The collected materials will be cited in IIMI's computerized database along with the citations of relevant documents held by cooperating organizations. By searching the database, researchers have access to information about a wide variety of irrigation management literature. The documentation center will assume responsibility for acquiring copies of requested documents wherever they might be located and then expediting the copies to the user. A glossary of commonly used irrigation and irrigation management terms that will provide the basis of a keyword directory for data retrieval is being prepared in cooperation with Wye College in England. Eventually, citations in the database will enable IIMI to generate a union catalog listing the whereabouts of irrigation management literature worldwide.

3. Publication. When complete, IIMI's in-house publishing facility will support all the printing needs of the Institute. The typesetting unit will be fully compatible with the equipment used by IIMI's research staff for computation and word processing and by the library and database for record-keeping, thus allowing IIMI to rapidly convert manuscripts and library accession lists into finished research publications and citation indexes for dissemination to network members. The Institute also maintains an extensive computerized mailing list containing the addresses of network members. The list is structured so that targeted mailings can be made to insure that individuals automatically receive specified publications. Individuals wishing to be placed on IIMI's mailing list should write to the Communication and Publication Office, Digana Village via Kandy, Sri Lanka.

CONCLUSION

In just over a year IIMI has charted a program of research, professional development, and information activities designed to enhance the planning and management of irrigation systems in parts of Asia, Africa, and Latin America. This program is based on the assumptions that people and agencies in countries associated with IIMI are seeking ways to improve irrigation performance, and that interaction among many people from different countries will best promote the objectives of the program.

ODI's Irrigation Management Network, with its Newsletter and Papers, are now being integrated with IIMI's activities as effective instruments of a people-oriented approach. IIMI has become co-sponsor and co-producer of the Network, and the Newsletter and papers. Dr Mary Tiffen remains Editor and is based at ODI in England, but increasingly IIMI will participate in providing and channeling information to the Newsletter. Through such cooperative activities, IIMI looks forward to working with the people and agencies who share its interests in improving irrigation performance, and to gaining a better understanding of irrigation issues and the needs of irrigation professionals in different parts of the world. The effectiveness of this network, and of IIMI's program, is directly linked to the participation of individuals who have been and will be active in the continuing dialogue of how best to manage irrigation systems.

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IRRIGATION MANAGEMENT NETWORK

IRRIGATION PRICING AND MANAGEMENT

Ian Carruthers

ODI/IIMI Irrigation Management Network 86/1c April 1986

Papers in this set

Please send comments on this paper either to the author or to

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Comments received by the Editor may be used in future Newsletters or Papers.

The opinions represented are those of the author and do not necessarily reflect the policies of the ODI, IIMI or any organisation with which the author is connected.

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IRRIGATION PRICING AND MANAGEMENT

Ian Carruthers

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Dr Ian Carruthers is Professor of Agrarian Development at Wye College, University of London, Near Ashford, Kent TN25 5AH, UK. He is the author (with C Clark) of The Economics of Irrigation Liverpool University Press, 1981, and many other papers on irrigation management and rural development.

IRRIGATION PRICING AND MANAGEMENT

Ian Carruthers

INTRODUCTION

During 1985 I led a team[1] commissioned by USAID to study financial policies and their relationship to irrigation management. The following notes are a summary of the report.

Despite the diversity of irrigation systems this study has produced some valid general conclusions. Public sector financial pressures are severely affecting irrigation departments as all other public services. Governments are turning again to the old intractable area of user fees and water tariffs. "Get the prices right" is the current slogan in agricultural policy and it is now dawning that this means get the input prices right as well as the product prices. There is not much enthusiasm in irrigation departments for economic pricing policies, partly because economists and financial analysts cannot agree on precisely what this means. Another major problem is that any revenue raised by irrigation systems or districts is generally not retained by the local entity that raised it or even by the national irrigation department.

Several aid donors have recently or are currently sponsoring studies to find new approaches to securing finance for O & M, with farmers

[1] The team was assembled by Devres, a Washington based consultancy group and included N.S. Peabody III, A.A. Bishop, A.D. Le Baron, Rekha Mehra, Ramchand Oad, Dean Peterson and Dennis A. Wood. The 5 volume study (OTR-0091-C-00-4466-00 -30 Sept. 1985) is available for public use and enquiries should be made to Ms. Joan Atherton at USAID, Bureau of Program and Policy Coordination, USAID, Washington.

contributing more than hitherto. Whether or not this is successful, there is little doubt that irrigation departments will soon have to reassess the scope and purpose of their workload and possibly hand over some of their responsibilities to farmers.

As efforts to make irrigation more effective and to find new financial resources for irrigation activities have proceeded, inevitable policy conflicts have arisen. For example, research reveals how beneficial a water extension service can be, and aid agencies are promoting below outlet public sector investment. However, other groups in the same donor agencies, through policy dialogue, are urging withdrawal of public services to match the declining public sector financial resources available to irrigation. This study is intended to be a timely contribution to this and other current debates.

PURPOSE

The purpose of this study is to investigate ways to improve the effectiveness of functioning irrigation systems by examining the role of:

~ Direct and indirect charges in meeting recurrent costs: this is based on the premise that successful mobilisation of local resources from users will promote irrigation efficiency directly through improved water utilisation, and indirectly, through better Operations and Maintenance (O & M); and

~ Increased farmer participation in system management: there is a growing belief that the mobilisation of human resources in this way will impact favourably on both O & M and cost recovery.

Five issues dealing with the pricing and management of irrigation water were examined in-depth and they are outlined later.

PROCEDURE

To achieve the above objectives several interrelated activities were carried out.

~ Relevant irrigation literature was obtained, reviewed and abstracted, thereby expanding upon each of the issues to be dealt with during the assignment;

~ A preliminary report was prepared, setting out in detail the issues to be examined and specific countries and irrigation schemes where they might be reviewed best;

~ Detailed case study and final report outlines were prepared to ensure comparability between field studies and the comprehensiveness of the entire effort;

~ Field work was carried out by two teams, one carrying out case studies in Morocco, the Philippines and Indonesia, the other carrying out case studies in Peru and the Dominican Republic.

~ The field study teams were composed of three persons each - an irrigation economist, an irrigation engineer, and a social/institutional specialist to ensure a broad based interdisciplinary review of each case study and issues.

The case studies in the five countries were carried out by two teams during a five-week period in March/April 1985. Preparation of the case studies and final report was completed by the teams and Devres' home office staff during May/June 1985.

CONCLUSIONS AND RECOMMENDATIONS

In developing countries there is an immense diversity of irrigation farming. Therefore, all generalisations about irrigation are likely to be untrue (except this one). However, there is little doubt that the general severity and extended duration of the economic and financial problems faced by all developing countries has placed unprecedented difficulties upon public sector budgets and upon irrigation departments in particular. As a result, the increasingly important irrigation service is seriously below potential. Within this context, ways to realise fully the potential of irrigation must be identified and implemented.

The main conclusion of this study is that the resources for maintaining irrigation inputs must come from the direct beneficiaries.
However, appropriate decisions on the level and form of service fees can only be taken whilst simultaneously reviewing the general policy regime applicable to each country and irrigation project. Thus, while the conclusions and recommendations that follow provide overall guidance for achieving more of the potential available from existing and future irrigation systems, they need to be applied by senior administrators and policy makers in their specific technical, economic and political situations. For this reason, it is important to communicate the outcome of this and similar studies to politicians, administrators and others who can adapt, apply, and refine the recommendations in specific situations.

1. To what extent is cost recovery through direct and indirect charges a feasible goal in irrigation systems?

a. Conclusions

- It is essential to devise politically-supported policies that will raise revenue at least to the level of full O & M costs;

- Cost recovery through direct charges to farmers is feasible, especially to meet O & M requirements;

- It is not essential for fees to be monetised. In fact, there may be advantages to fees collected in-kind, particularly in the largely subsistence agricultural sector of many developing economies. In addition, there is an element of automatic indexation inherent in in-kind payments;

- The feasibility of increased cost recovery through direct charges in each specific case is dependent upon decision makers recognising the true nature of the complex financial problems they face and acting firmly on the basis of these insights with appropriate policies. One example of devising an appropriate policy is to make provision for gradually phasing in a full fee over a period of years, particularly on a new scheme which may take several years to achieve full operational capacity;

- Indirect charges also can be used to pay for irrigation costs and they may ultimately work as well as direct charges in achieving cost recovery objectives. However, they are a second best alternative because they do not inform farmers about the real costs of their irrigation system nor involve them sufficiently in taking responsibility for or participating in aspects of the system; and

- Highly subsidised water supplies are an inequitable and inefficient form of farm income support. Irrigation farmers, though often poor, are seldom ultra-poor and often they have a relatively satisfactory and secure income.

b. Recommendations

- Increased direct charges to farmers must be an accepted policy goal. However, any charging scheme must be sensitive to the numerous factors which influence particular farmers' benefits from the irrigation system - variations in production from year to year, especially poor farmers, inequitable water distribution patterns in the system, etc.;

- If direct charges do not match minimum financial needs sufficient amounts must be provided from indirect charges to the irrigation system to guarantee proper O & M services. Sufficient revenues raised from indirect charges must be transferred to the irrigation scheme to enable it to maintain proper service.

2. <u>Do increased farmer participation and control contribute to improved cost recovery?</u>

a. <u>Conclusions</u>

~ Increased farmer participation and control do seem to contribute to improved cost recovery; and

~ Increased farmer participation and control can improve cost recovery <u>directly</u> by their accepting more responsibility and paying higher user charges or <u>indirectly</u> by their becoming responsible for more of the O & M work required by the system, thereby reducing public costs.

b. <u>Recommendations</u>

~ Additional action research should be undertaken on means to transfer responsibilities to farmers for support services thus reducing public costs. Programs implementing the findings of such research should receive sympathetic donor consideration for financial under-writing. For such transference policies to work, there will have to be increased farmer benefits;

~ The action research undertaken should be consistent with the realities faced by the public sector in terms of financial, personnel and policy limitations. It should identify and analyse specific successful interfaces that join necessary governmental and farmer contributions so as to optimise system benefits and the sharing of system responsibilities.

3. <u>To what degree does improved cost recovery depend upon reliable water supply, adequate water supply, water delivery and measurement technology.</u>

a. <u>Conclusions</u>

~ Unless a water supply is reliable, it is unlikely that improved cost recovery can be achieved and sustained. Seldom is financial performance satisfactory when the main system supply is unreliable. It is difficult, however, to prove that improved cost recovery depends upon a reliable supply of water. Thus, although a reliable water supply may be a necessary condition for improved cost recovery, it is not sufficient. On the other hand, use of mechanisms such as charging in advance may make it possible to improve cost recovery even where water delivery is unreliable;

~ The <u>adequacy</u> of water supply does not appear to be directly linked to improved cost recovery. Farmers rarely consider their supplies to be adequate and water supplies are always inadequate at some times and in some areas within every system; and

~ Since successful cost recovery is possible even without water measurement at the tertiary level it follows that sophisticated water <u>measurement</u> technology is not necessary for improved cost recovery. Water measurement technology is important only if rates are levied on an actual volumetric basis which is relatively rare in gravity irrigation systems.

b. <u>Recommendations</u>

~ Reliability and adequacy of water supplies should be an important part of any effort to improve cost recovery. Even though they cannot be shown to be essential to the achievement of cost recovery objectives, their improvement will provide long-run insurance that cost recovery successes can be maintained. Direct charges should be used when possible because they are the most appropriate means for involving farmers for the reasons indicated earlier; and

~ Pending improvements in water measurement technology at the tertiary level, it may be possible to experiment with wholesaling larger quantities of water as these can be more easily and effectively measured at the primary and secondary levels. The water could be wholesaled to groups of farmers (rather than the individual farmer) and this could be made a basis for improved interaction between irrigation authorities and farmers based on mutual accountability.

Such an experiment has potential for improving cost recovery and is deserving of donor assistance.

4. <u>Are increased water charges a necessary and sufficient condition for improved O & M? To what extent does efficiency of water use vary with the cost of water?</u>

a. <u>Conclusions</u>

~ Increased water charges appear to be necessary to achieve improved O & M. However, they will not be sufficient;

~ Efforts to increase water charges are likely to be more successful if they are combined with visible system improvements which result in making the system more reliable and system rehabilitation can be made conditional upon guarantees of price policy reform; and

~ While the cost of water and application efficiency do not appear to be directly linked, the value of water and application efficiency are linked. This is clearly shown in farmer- controlled tubewell systems and on gravity schemes at crucial times of the year.

b. <u>Recommendations</u>

~ Water charges should be used as an integral part of efforts to improve cost recovery and O & M. They are only a part of the overall solution, however, and must be integrated with other aspects necessary to achieve O & M improvement such as farmer participation, more "earmarking" or utilisation of funds collected directly for O & M activities, equity of distribution within the system, etc.;

~ Water charges should vary more between and within developing countries. The two guiding principles for developing such charges should be (1) separate budgets for each irrigation scheme and (2) retained revenues for each scheme. Retaining revenue effectively shifts irrigation departments from being only public service entities to being public utilities. Scheme charging, perhaps more controversial, is advised on efficiency grounds to indicate the real costs of new, ambitious and technically difficult schemes and the high costs of necessary improvements such as pumped drainage; and

- Attempts to bring the cost of water to farmers closer to the value of water to the individual farmer should be made for specific irrigation projects. This could help provide financial resources needed to improve O & M and may increase application efficiency if the cost can be made to accurately reflect the value of water to the individual farmer.

5. Do institutional arrangements whereby farmers participate in and control irrigation systems improve O & M?

a. Conclusions

- Institutionalised farmer participation in the operation and maintenance of irrigation systems appears to result in improved O & M, especially in the case of tubewell systems. However, the degree to which it is true of canal systems is unclear; and

- There are few canal or tubewell systems in which irrigation officials have transferred much O & M responsibility to farmers. The Philippines experience is the most extensive in this regard and a few examples of improved O & M are available where such transfers have been made. However, since the transfer of O & M responsibility is not yet widespread, any positive results must be regarded as promising but not yet generalisable.

b. Recommendations

- Increased farmer participation in O & M activities is desirable and, in the long term, necessary particularly in bearing a larger share of the cost of running the irrigation system. Therefore, moves in this direction should be an important part of irrigation policy. This can be expected to contribute to several aspects of irrigation system improvement - one of which may be better O & M.

Network members may wish to react to these conclusions and bring supporting or contradictory evidence and conclusions. This important topic is unlikely to diminish in importance in the coming years and a solution to the problems posed are central to sustaining and improving irrigation services.

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IRRIGATION MANAGEMENT NETWORK

TRAINING PROGRAMMES FOR IRRIGATION STAFF

Martin Burton

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TRAINING PROGRAMMES FOR IRRIGATION STAFF - AN EXAMPLE FROM EAST JAVA, INDONESIA

Martin Burton

Martin Burton worked with Sir M MacDonald and Partners, Asia Consulting Engineers before taking up a research post at Southampton University in September 1984. He will be taking up a temporary lectureship in Management and Operation of Irrigation Systems, in the Institute of Irrigation Studies, Southampton University in May 1986. Between August 1983 and August 1984 he was Training Officer, East Java Irrigation Project Indonesia. Contact address: Institute of Irrigation Studies, The University, Southampton, SO9 5NH.

TRAINING PROGRAMMES FOR IRRIGATION STAFF - AN EXAMPLE FROM EAST JAVA, INDONESIA

Martin Burton

INTRODUCTION

This paper describes the setting up and running of one of two ongoing training programmes in East Java, Indonesia. This paper describes the East Java Irrigation Project training programme which covers the majority of the irrigated area in East Java and is designed for irrigation staff, both managers and operators. The companion paper by Ian Smout (86/1e) describes the Madura Groundwater Irrigation Project training programme for tubewell operators and officers of water users associations. Although the training programmes described are for two separate projects, they have been developed and implemented along similar lines as a consequence of close liaison between the two training units.

The papers set out to be some practical use to others involved in setting up such programmes. It is hoped that by providing sufficient detail and insights into the practical issues involved, some of the experience gained can be passed on and used to good effect elsewhere.

The two papers have a common set of conclusions as many of the issues involved are relevant to both programmes.

1. THE EAST JAVA IRRIGATION PROJECT

1.1 Brief Introduction of the Project

The East Java Irrigation Project was established to carry out survey and rehabilitation work throughout the Province of East Java. Phase I of this project commenced in 1982 to carry out survey, design and construction for the rehabilitation of canal networks, commanding 70,000 ha of irrigated land, together with two sub-projects covering system operation and maintenance and staff training on previously rehabilitated areas totalling 140,000 ha. (Figure 1.1)

The East Java Irrigation Project (EJIP) has benefitted from lessons learnt on previous World Bank assisted East Java rehabilitation projects where difficulties have been encountered at the end of the project in transferring the "project" works and facilities back into the East Java Irrigation Service structure. To overcome this and other difficulties encountered with projects established outside the existing administrative framework in the Province, the East Java Irrigation Project has been incorporated with the East Java Irrigation Service (EJIS). The Provincial Head of EJIS is also Project Manager of EJIP, though the day-to-day management of EJIP is the responsibility of the Deputy Project Manager.

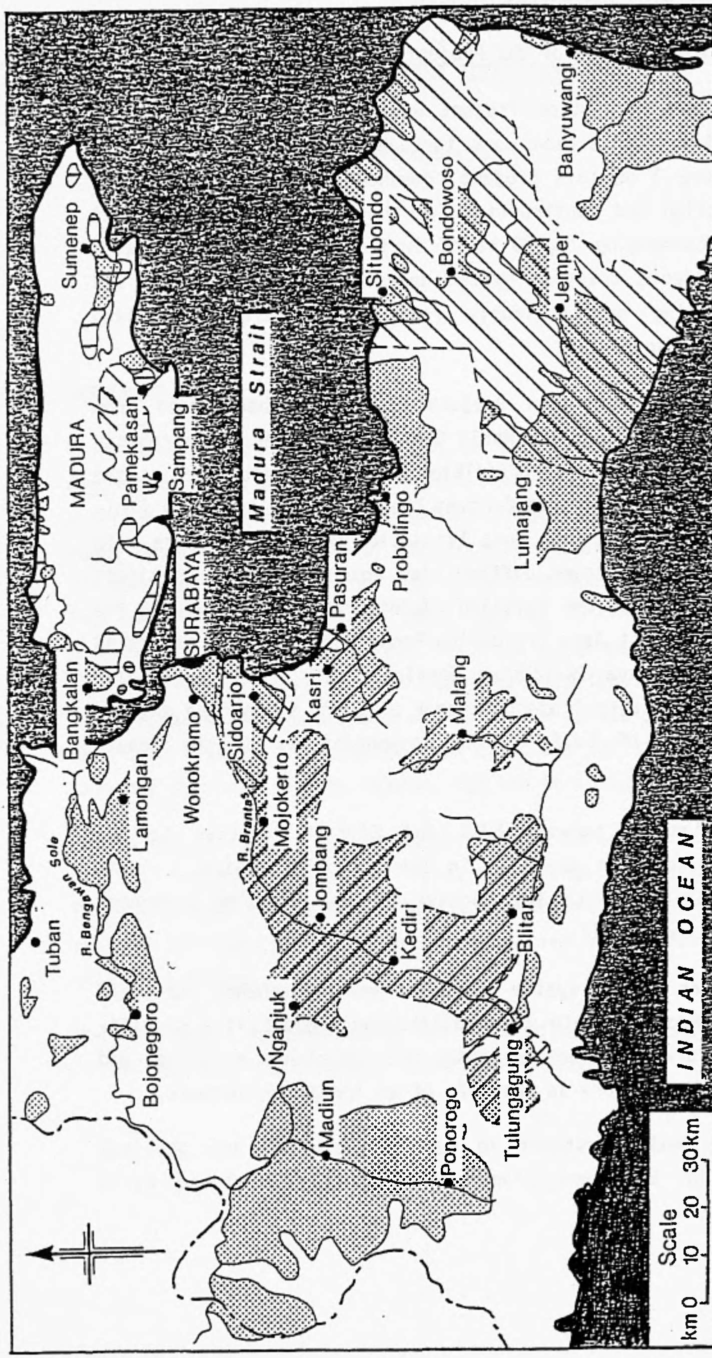
This relationship between EJIS and EJIP is central to the following discussion and has, in the author's opinion, contributed significantly to the success of the training programme established under EJIP.

The inclusion of the system operation and maintenance and staff training components into a rehabilitation project is a significant step forward in acknowledging the importance of social and administrative factors in the life of an irrigation network.

Expenditure and investment in rehabilitation of the physical structure of the irrigation network must be matched by a

Figure I

Location of Training Programmes



LEGEND

- District/Section Office
- Irrigation Area
- Areas covered by EJIP training programme.
- Extension areas for EJIP training programme.
- Tubewell development zones, and areas included in Madura training programme.

commitment to restructuring and revision of the operation and maintenance framework, together with a comprehensive training programme to enable new procedures to be fully explained and adopted throughout the Province.

1.2 Description of the Irrigation System and Organisational Structure

The Province of East Java has a total irrigated area of some 950,000 ha, the great majority of which is surface irrigation, though there are areas where ground water irrigation has been developed.

As a consequence of the volcanic origins of the island of Java, East Java has a very varied topography. Irrigation systems are generally run-of-the-river, where a weir constructed across the river may provide command for areas ranging from 100 to 10,000 ha.

The irrigation network is extensive and well developed. Compared to many irrigation systems in the world, the East Java network is extremely sophisticated, with good control and measurement facilities down to the tertiary unit head, (50-150 ha command area). Within the tertiary unit quaternary channels and structures have been constructed by the farmers enabling effective control and management of irrigation water down to the quaternary block (5-20 ha), and field basin (0.25-2 ha).

Landholdings are small, with an average of 0.25 to 0.30 ha per farming family. Basic subsistence is possible from such a small land holding largely as a consequence of benevolent climatic and physical conditions. The wet season rainfall (November - April) of between 1500 and 3000 mm provides sufficient water to support 2-3 irrigated crops per year, while adequate sunshine and only minor fluctuation in seasonal temperatures, allow year-round crop cultivation. The soils, being of volcanic origin, are extremely fertile. The predominant crop is paddy rice, which is grown whenever water supplies permit. Sugar cane and tobacco are significant cash crops, whilst maize, groundnuts, soyabean and cassava are the major dry season crops.

Irrigation water resources are controlled and managed by the East Java Irrigation Service, the organisational structure of which is shown in Figure 1.2. The Irrigation Service is responsible for the irrigation network from the water source down to the tertiary gate, thereafter it is the responsibility of the village administration and the farmers.

Water schedules are prepared and implemented for most parts of the irrigation system. Data reporting, processing and analysis are based on a thrice monthly or 10-day cycle which enables water schedules to be adjusted each 10 days to suit crop requirements and water availability. The facilities and operation and maintenance procedures in East Java are generally accepted as being amongst the best in Indonesia.

1.3 The Training Programme

The training programme for the two previously rehabilitated areas of Bondowoso District and Sidoarjo Section (totalling 140,000 ha) commenced in August 1983 and was completed by May 1985. In that time training needs had been identified, training staff located, training material prepared, training carried out and the training programme evaluated. A total of 380 irrigation staff received training in the performance of their basic duties and responsibilities. As a consequence of the success of this programme, training has been extended to other areas in East Java. The overall work programme for the training programme is shown in Figure 1.3 and the procedure followed in Figure 1.4.

Figure 1.2

East Java Irrigation Service Organisation Chart

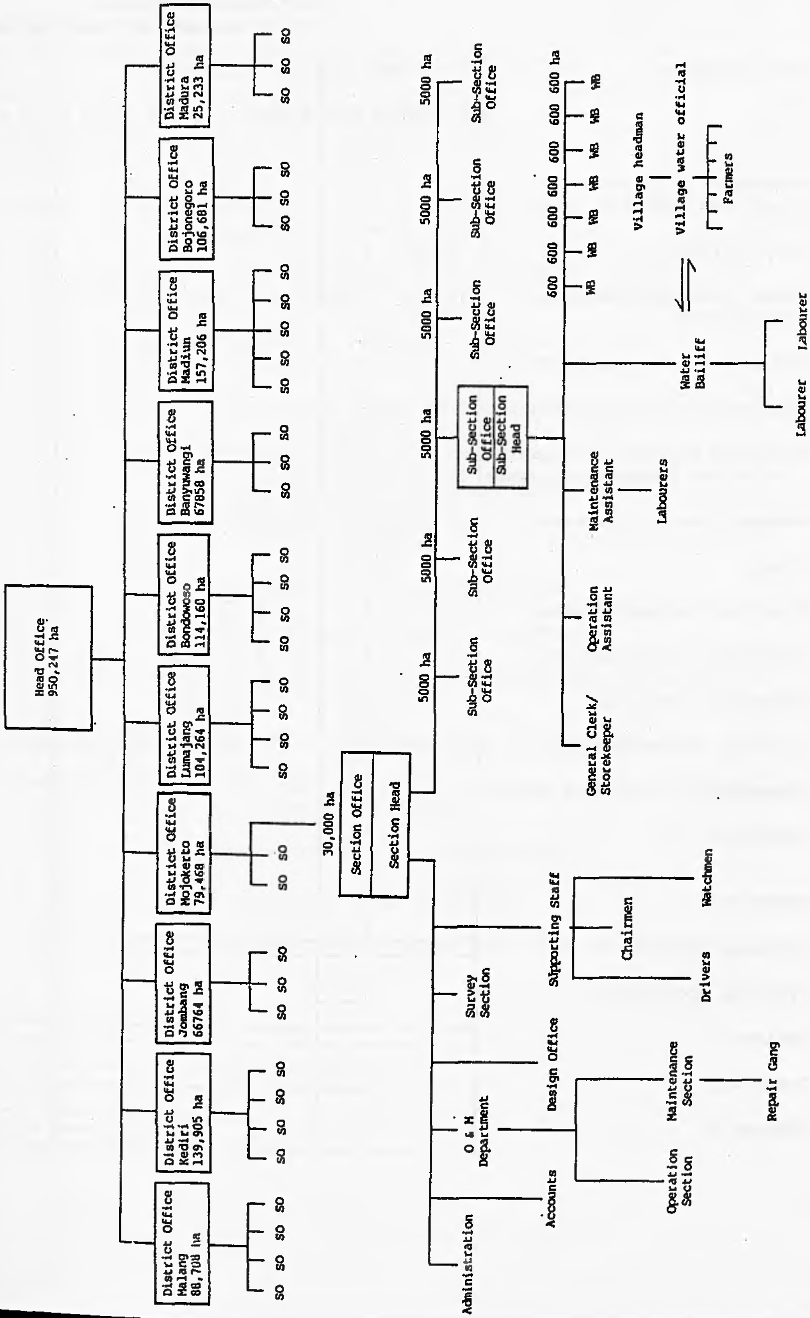


Figure 1.3

EJIP TRAINING PACKAGE
Work Programme and Staffing Schedule

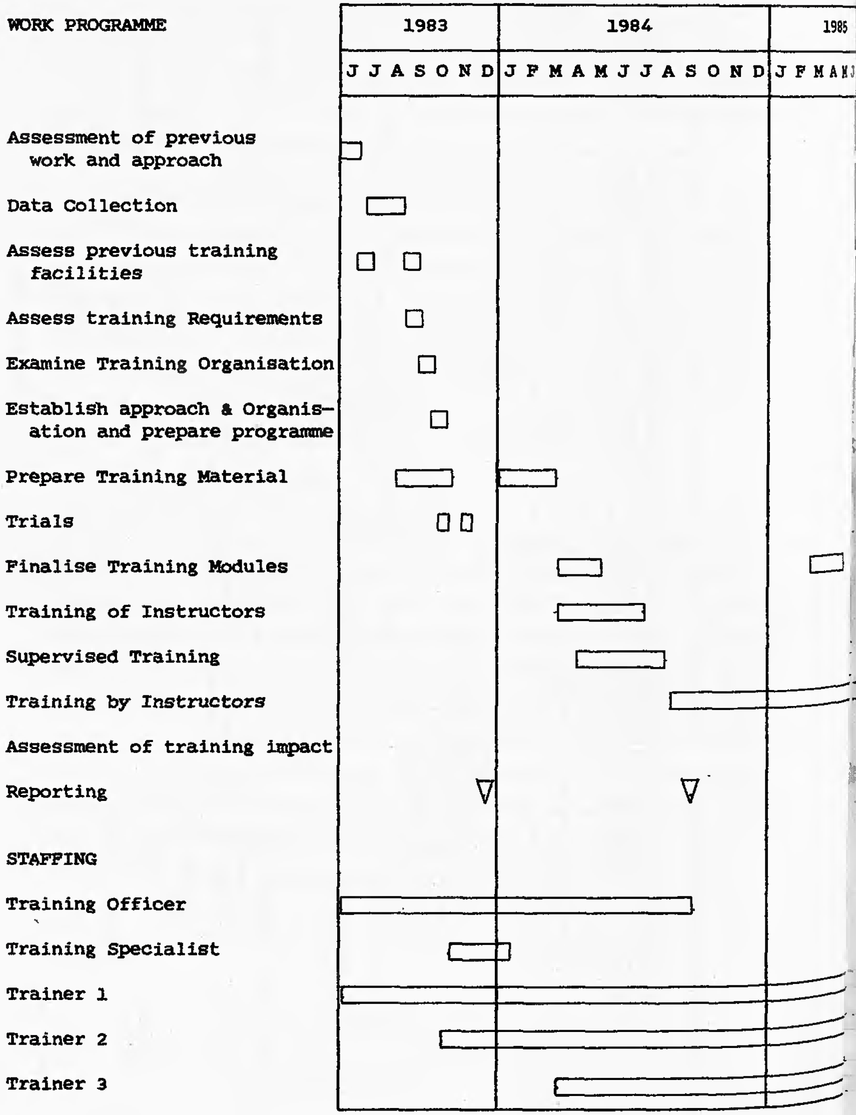


Figure 1.4

PROCEDURE FOLLOWED IN ESTABLISHING THE EJIP TRAINING PROGRAMME

Locate suitable trainers and involve them in the formulation of training programme and training material.

Carry out survey of irrigation system staff duties and responsibilities, obtain opinions on perceived training needs.

Formulate ideas on training needs and objectives. Discuss and agree with Irrigation Service.

Finalise discussions on
- who to train
- training objectives and requirements
- training methods
- training location and set up
- format of training material
- timetable

Write and prepare training material

Identify and purchase training equipment

Carry out a trial run of the training procedure, make amendments as required.

Notify trainees of training programme and timetable.

Commence training. Arrange for official opening ceremony by Head of Irrigation Service.

Monitor training and job performance.

Evaluate training programme.

Amend training programme, if required, following evaluation.

1.3.1 Establishing Training Needs

An initial survey was carried out to identify the subject areas to carry out training in and the level of staff at whom to direct the training. This survey involved visits to District, Section and Sub-Section officers (Figure 1.2) and field visits. The survey was looking at how well the system performed, how well staff were discharging their duties, how aware they were of what their duties and responsibilities were, and what the shortcomings were. In this survey every effort was made to get at real problems and to elicit real answers from the staff concerned. There is a tendency in such exercises to be supplied with answers which the staff feel the investigators would like to hear. A high point of the survey was for the survey team to travel around one water bailiff's area on standard-issue bicycles (painful seats and no brakes!) with the water bailiff, Sub-Section Head and Sub-Section Operation Assistant in attendance. This gave a good insight into the time required by the water bailiff to visit each control structure, and how familiar he was with what was happening in his area. The survey team was able to raise points which would not have been apparent were the water bailiff simply questioned in the office.

This survey established that the key to irrigation in East Java lay with the Sub-Section office staff and the water bailiffs. These were the staff who were responsible for deciding on, and controlling, water distribution to the tertiary units. There was an obvious need to train these staff in the performance of their everyday tasks, how to read water level gauges, complete data reporting forms, calculate water allocations and monitor canal discharges. The majority of these staff had received no formal training in these areas.

1.3.2 Planning, Organisation and Structure

Having established the two primary training needs of whom the training is for, and what area the training is to cover, further points have to be considered, namely:

(i) What are the training programme objectives?

(ii) What are the key distinguishing features?

(iii) How and where is the training to be carried out?

(iv) What are the detailed topics to be taught?

(v) How is the training material to be presented?

(vi) Who is to carry out the training?

(vii) How is the training course to be structured?

These points are discussed in more detail below.

(i) What are the training programme objectives?

The overall objective of the training programme can be stated as: "By expanding the knowledge, understanding and practical abilities (including facility in the necessary calculations) of EJIS field and office staff, to promote a positive and stable improvement in the efficiency of Operation and Maintenance of the irrigation system, that will result in enhanced yields of rice and other crops, and thereby an increase in the prosperity of farming families, and in the national economy."

This altogether laudable objective requires breaking down into its component parts and specific objectives identified which can be quantified and which will lead to the attainment of the overall objective. Such objectives are:

a. That data, for system operation, especially that of discharge, rainfall and crop area, is measured and collected, correctly and accurately.

b. That data is collected, processed, analysed and recorded in a systematic, logical and retrievable manner.

c. That water distribution is planned, allocated and controlled, to maintain the prescribed discharges at control points.

d. That basic preventative maintenance requirements are recognised and acted upon in good time.

e. That there is a real understanding of the interdependence of water and crop production and an appreciation of the relation between an optimum supply of water, and increased crop yields.

(ii) What are the key distinguishing features?

Following the initial survey the key decisions pertaining to this training programme were identified. These are listed in Table 1.1.

Table 1.1: Key Training Programme Decisions

1. Training to be for Sub-Section office staff and Water Bailiffs.

2. Training to be related to day-to-day work. Theoretical content to be limited.

3. Training has to be seen to be relevant. Training therefore in trainees' own area. Trainers had to travel.

4. Training programme has to be made practical

- use field visits

- use practical exercises in the office/classroom.

5. Want to break down traditional teacher/pupil relationship to encourage dialogue.

6. Keep training groups to around 15 people.

7. Prepare training material in a very tightly structured format which is easy to use and to follow.

8. Training programme must not interfere too heavily with trainees' work.

9. Set up training programme to be able to cover wide range of abilities and education levels.

10. To ensure wide adoption of the programme it has to be relatively inexpensive.

(iii) How and where is the training to be carried out?

Previously in East Java, training for Irrigation Service staff had been carried out at a central training centre in Surabaya. Each year one or two staff would be selected from Sub-Section offices all over East Java to take part in this course.

This arrangement is well suited to training staff recently appointed to the Irrigation Services but becomes infeasible when considering the logistics and cost of transporting the number of trainees required under the EJIP scheme. Accordingly the concept of a mobile training team who would carry out the training in each Sub-Section office was developed. This approach has significant advantages, namely:

a. Training is carried out in surroundings familiar to the trainees. Trainees are more relaxed.

b. Field visits can be made to trainees' own areas. Trainees get guidance on problems which are real to them.

c. As a consequence of b. above, trainers get an extremely good first hand knowledge of the system. In the early stages field visits are a difficult and stressful time for trainers, but as their experience and knowledge grows so they become more confident and are able to pass each new experience on to trainees on subsequent courses.

d. Cost effectiveness - for training large numbers of staff a mobile training unit is extremely cost effective.

e. Variety for the trainers - each new area held new challenges which was stimulating for the trainers.

f. Less disruptive of everyday work and social life. Trainees sent to the central training centre are away from their work and their families. Training carried out in the Sub-Section office means that trainees can keep in touch with their work.

g. Trainees from one Sub-Section office can be taught as a group. It would not be possible to take all staff away from a Sub-Section office to a central location for training as this would leave the irrigation system unattended.

(iv) What are the detailed topics to be taught?

Training material was produced for the subjects listed in Table 1.2. Brief introductions were given to general topics, such as Soil, Crop and Water, and Irrigation System Design, but more emphasis was placed on specific topics such as Discharge Measurement and Use of Schematic Operation Maps for Operation.

(v) How is the training material to be presented?

As the trainees' jobs involved a lot of fieldwork the training programme had to be practical rather than theoretical. Lectures were given, but field visits and office-based practical exercises were also used.

The training material was produced in a series of discrete modules (Table 1.2) which had several formats:

- Training Module Text - Acetate Roll Text - Lecture Notes - Training Handbooks	for use by the trainers
- Memory Cards - Practical Exercises - Field Visits	for use by the trainees

The training module text was produced first. This was a detailed exposition of the subject for the trainer to read and learn from. It was written in English and then translated into Indonesian, particular attention being paid to using simple, straightforward Indonesian grammar and diction. From the training module text a sequence of colour transparancies were prepared on a continuous roll of acetate for use on an overhead projector. This material was further summarised on the Memory Card which was given to the trainees. The purpose of the Memory Card was to summarise the subject and act as a memory prompt for training at a later date. It was a deliberate intention not to hand out too much written text to the trainees, which they might find too overpowering. Voluminous texts are not often referred to whilst succinctly presented subject matter can be.

(vi) Who is to carry out the training?

Good trainers are obviously one of the most important elements, if not the most important element, in a training programme. They are also extremely difficult to find.

This training programme was extremely fortunate in obtaining the services of a well experienced, naturally able senior trainer. He in turn was able to locate and have transferred to the training programme an able and experienced colleague, who had at one time been Head of a Sub-Section. A further trainer was selected from the Bondowoso District office. What this trainer

Table 1.2

Training Material Produced

GENERAL HEADING	List of Training Modules	
	Nr	Title
SOIL, CROP AND WATER	1.1 1.2 1.3	Soil Crop Water
DESIGN MAPPING AND RECORDS	2.1 2.2 2.3 2.4 2.5	Irrigation System Design Maps for Irrigation Irrigation System Manuals Basic Irrigation Records Schematic Operation Maps - Survey and Mapping
OPERATION	3.1 3.2 3.3 3.4 3.5 3.6	Principles of Water Control and Operation Discharge Measurement Schematic Operation Maps - Use for Operation Schematic Operation Maps - Use for Checking Rotation of Water Supplies * Specific Operation Procedures *
DATA PROCESSING	4.1 4.2 4.3	Data Collection Data Processing Data Analysis
MAINTENANCE	5.1 5.2 5.3 5.4 5.5 5.6 5.7	Introduction to Maintenance Organisation of Maintenance Regular Maintenance Periodic and Emergency Maintenance Annual Maintenance Cost of Maintenance Maintenance Gangs
	Nr	**List of Trainers' Handbooks**
	1 2 3 4 5 6	Introduction to the Training Programme Presenting Training Modules Planning and Organising Field Visits Presenting Practical Exercises Operation and Maintenance of Training Equipment Monitoring and Evaluation of the Training Programme

* Training Modules prepared but not used due to time constraints.

lacked in field experience he made up for in administrative ability, (which was not the strong point of the other two trainers).

The main criteria for the trainers in this training programme were:

a. They should be capable of presenting the training material in a simple and straightforward manner.

b. They should have good practical experience in order to cope with the many questions that arise.

c. They should be motivated and believe in the objectives of the training programme. It is important therefore to involve them in the planning and organisation right at the start.

(vii) How is the training course structured?

From consideration of various factors, such as the overall time available and the nature of the training programme, a 6-day training course was felt to be appropriate. Too lengthy a course would run the risk of overloading the staff with too much information, whilst too short a course would not have sufficient impact. In order not to overload the trainees and to avoid interfering too much with their regular duties, the training was given for 2 days each week over a 3-week period.

In one week two Sub-Section offices would receive training, office A on Monday and Tuesday, and office B on Wednesday and Thursday. This routine worked extremely well and was certainly worth the additional work of tranferring between offices mid-week. One point worth noting was that initially this routine was used, but in practice it was adapted to office A on the first Monday and Tuesday, office B on the first Wednesday and Thursday, then office B again on the second Monday and Tuesday, moving back to office A on the second Wednesday and Thursday. This reduced the number of times the equipment had to be moved between offices.

The training unit were required to train staff in 29 Sub-Section offices, and 5 Section offices. Although the staff in the Section office performed more administrative tasks than the staff of Sub-Section offices, it was considered important that Section staff appreciated the work that the Sub-Section staff were required to perform. Therefore before commencing training in any of the Sub-Section offices in a particular Sections area, the training course was given to Section O&M staff <u>and</u> Heads of Sub-Sections. The inclusion of Heads of Sub-Section was important on two counts:

a. It gave the trainers an opportunity to explain to Heads of Sub-Sections what their duties and responsibilities were. This task could not be performed in the Sub-Section office, where the Head of Sub-Section was in the company of more junior staff.

b. When the training unit transferred to give the training in the Sub-Section offices the Head of Sub-Section, having already received the same training (but in the company of his peers) was then able to assist the training team. In this way Heads of Sub-Sections take on the training programme, and are better motivated to continue procedures developed during the course after the training unit have moved on.

1.3.3 Implementation

The training courses commenced in April 1984 and were completed in May 1985. In that time (60 weeks) the following categories and number of staff had received training:

	No.
- District office O&M staff	6
- Heads of Section	5
- Section office O&M staff	21
- Heads of Sub-Section Office	29
- Sub-Section office	87
- Sub-Section office field staff (water bailiffs)	232
Total	380

The daily routine was quite straightforward. The trainers departed from the District office at 7 am and were ready to commence training in the Sub-Section office at 8 am. The daily training routine varied slightly but generally a short break was held at around 11 am with lunch at 12.30 pm for one hour and another short break at 2.30 pm. The training extended until 3.30 pm or occasionally later depending on the circumstances.

The training course was deliberately tightly structured. This was achieved by using the overhead projector rather like an auto cue; sufficient detail had been transferred from the Training Module Texts onto the acetate roll in the form of discrete "slides" of text or diagrams to be used as a prompt for the trainer. The procedure was most reassuring for the trainer in the initial courses; in the later stages, as the trainers gained confidence, they began to expand on their presentations.

Office-based practical exercises and field visits were initially interlaced with the lectures as shown in the timetable (Figure 1.5). However after a time the training team preferred to combine the field visit exercises and allocate a full day to the field work.

Figure 1.5

EJIP Training Timetable

	Week 1		Week 2		Week 3	
	Day 1	Day 2	Day 1	Day 2	Day 1	Day 2
08.00	Introduction to the training Programme	TM 2.1 IRRIGATION SYSTEM DESIGN	Recapitulation	TM 3.3 SOM-USE FOR OPERATION	Recapitulation	TM 5.2 ORGANISATION OF MAINTEN-ANCE
09.00	Baseline test	TM 2.2 MAPS FOR IRRIGA-TION	TM 3.1 PRINCIPLES OF WATER CONTROL AND OPERATION		TM 4.1 DATA COLLECTION	TM 5.3 REGULAR MAINTENANCE
10.00	BREAK	BREAK	BREAK	BREAK	BREAK	BREAK
11.00	TM 1.1 SOIL	PE 2.2.1 using a map	TM 3.2 DISCHARGE MEASUREMENT	PE 3.3.1 calculation using the SOM	TM 4.1.1 COMPLETING FORMS	TM 5.4 PERIODIC AND EMERGENCY MAINTENANCE
	PE 1.1.1 Soil types	TM 2.3 IRRIGA-TION SYSTEM MANUALS	FV 3.2.1 Field discharge *measurement*	TM 3.4 FIELD CHECKING OF DISCHARGES	TM 4.2 DATA PROCESSING	TM 5.5 ANNUAL MAINTENANCE
12.00	TM 1.2 CROP					FV 5.2.1 Maintenance inspection
13.00	LUNCHBREAK	LUNCHBREAK	LUNCHBREAK	LUNCHBREAK	LUNCHBREAK	LUNCHBREAK
14.00	TM 1.3 WATER	TM 2.4 BASIC IRRIGATION RECORDS TM 2.5 SOM SURVEY AND MAPPING	PE 3.2.1 Discharge Measurement	3.5 PE 3.4.1 Field checking of discharges	PE 4.2.1 Processing forms TM 4.3 DATA ANALYSIS	PE 5.2.1 Maintenance priorities TM 5.6 COST OF MAINTENANCE
15.00		FV 2.5.1 SOM-field survey			TM 5.1 INTRODUCTION TO MAINTEN-ANCE	TM 5.7 MAINTENANCE GANGS
16.00		PE 2.5.1 Drawing up a SOM				EVALUATION - *Final Test*

TM = Training Module FV = Field Visit PE = Practical Exercise SOM = Schematic Operation Map

The practical exercises and field visits worked in a complementary fashion, with the practical exercises simulating and duplicating certain procedures which were later repeated during the field visits. This approach was a development of some previous work by the author (Burton and Carruthers, 1984). No two Sub-Section offices had identical irrigation system layouts, so the outcome of the field visit exercises was not assured. The practical exercises overcame this difficulty by standardising and simplifying the various procedures, plus condensing them into a shorter time scale.

1.3.4 Monitoring and Evaluation

Monitoring of staff who had taken part in the training programme was carried out by one member of the training team. The monitoring work involved carrying out a field check of canal discharges on Day 6 of the 10-day period, and then being present on the reporting-in day (Day 10) to check whether the reported discharge figures were in accordance with the monitored figures. At the same time procedures for form filling and completion of schematic diagrams (used for scheduling of water) were checked and advice and guidance given.

The evaluation exercise was carried out 3-6 months after the training course had been given in a Sub-Section office. It was quite similar to the monitoring exercise, though its purpose was different. The evaluation was necessary to gauge the success of the training programme in bringing about changes in the way the Sub-Section office staff performed their duties. It was not intended to evaluate the ability of the staff themselves. The measure of success of a training programme is its ability to effect change, to the extent prescribed by its starting objectives. Failure to achieve this change is a failure of the training programme, not of the trainees. The capabilities of the trainees were established at the outset together with the programme's objectives; the structure and set up of the training programme must therefore have been such as to cater for these factors.

The evaluation exercise took 4 formats:

a. a questionnaire and test for the Sub-Section staff to see how much they remembered about the course and whether their theoretical ability in the standard before-and-after test had changed.

b. a structured analysis of the Sub-Section office's ledgers, standard forms and schematic operation maps. This evaluation gave particularly good insights into how effective the training programme had been.

c. a questionnaire for the Head of Sub-Section to ask his opinion of changes in his staff's performance following the training programme.

d. a field evaluation of discharges at control and measurement structures. Two water bailiffs were selected at random and visits were made to their areas to check:

   i) Whether the actual discharges in the canals was the same as the required (instructed) discharge for that date.

   ii) Whether the discharges were being reported correctly.

   iii) Whether the condition and dimensions of control and measuring structures were correctly recorded in the water bailiff's and Sub-Section office files.

This rather rigorous evaluation procedure showed that the training programme was effective in producing a positive change and improvement in the execution of O&M duties, and in the manner in which water distribution was calculated, reported and distributed.

It did however show up a significant failure of the programme in respect of identification and reporting on maintenance work requirements. This was not being carried out to anywhere near the extent envisaged and detailed as necessary by the training programme. As a consequence of the evaluation this aspect of this programme has been revised, and further work carried out on more structured reporting procedures and reporting proforma.

1.3.5 Costs and Equipment

The total cost of the training programme was Rps 30.98 million (1000 Rps = £0.70 sterling, 1984 value). This was divided into capital costs (equipment, etc.) of Rps 6.15 million and running costs (Hire of training bus, fuel, etc.) of Rps 24.83 million. Total costs per person trained were of the order of Rps 81,500 (£54 sterling). A rough breakdown of these figures is given in Tables 1.3 and 1.4 below. These figures exclude consultant staff costs and trainers' basic salaries.

1.3.6 Points of Note

There are certain observations and opinions on the training programme described in this paper which are best presented as a list. These are detailed below.

1. Organise an official opening of the training programme. This training programme was fortunate enough to have three, the final one being by the Director of the Irrigation Service himself. Such events can be very stimulating and provide motivation to staff at all levels.

2. Involve as many senior members of staff as possible in the formulation of the programme. Seek their views and opinions, and report back to them. This work can seem quite onerous and unremunerative at the start, but pays off during the implementation stages when these senior staff take an interest in the outcome of the training.

3. Look for trainers at the start and involve them in the early stages of development of the programme. The trainers have to come to feel that they are a part, or own a part, of the

Table 1.3

Training Programme Capital Costs

	Description	Amount '000s Rps
1.	1.4 Kw petrol generator and ancillary equipment	1109
2.	Overhead projector and ancillary equipment	803
3.	Overhead projector special stand, OHP screen and wipeboard	200
4.	Portable furniture - folding chairs, OHP table	640
5.	Training Unit office furniture	711
6.	Training equipment, calculators, stopwatches, clipboards, etc.	433
7.	Cameras	330
8.	Draughting and photocopying costs	1050
9.	Translation and production of training modules and Handbooks in Indonesian	870
		6146

Table 1.4

Training Programme Running costs (14 months)

	Description	Amount '000s Rps
1.	Rental and running costs of 13 seater bus	8400
2.	Rental and running costs of 1 jeep	8400
3.	Bus driver's allowance	280
4.	Jeep driver's allowance	280
5.	Trainers' allowance (3 Trainers)	4200
6.	Trainees' lunches and refreshments	3024
7.	Stationery/photocopying costs	100
8.	Generator running costs	142
		24821

training programme. If they have developed it they will take good care of it during the implementation stage. Unfortunately, good (ie. natural) teachers with experience are difficult to locate, though this project was extremely fortunate in that respect.

4. Be prepared to take on board other people's views and opinions, especially those expressed by the trainers in the implementation and evaluation stage. Training is dynamic and relies on feedback to adapt and improve.

5. Encourage the trainers to take a somewhat lighthearted approach to the training programme and to use jokes and similies which will amuse the trainees. The approach was most successful for this training programme, and helped to break down any trainer/trainee barriers.

6. Do not lecture down to the trainees, as they are people with more field experience than any trainer is likely to have. Get trainers to draw out this experience by involving trainees in discussion. Practical exercises and field visits are particularly useful in this respect.

7. Ensure that trainers get adequate remuneration for their efforts. While enthusiasm and motivation cannot be bought, they can certainly be dampened by a failure to provide adequate reward for hard effort.

8. Be most careful with translation of material into the local language. Employ a technical person familiar with the subject. The best solution is to use one of the trainers to do the translation, and to pay him extra for the additional work.

9. Carry out a trial run of the training programme in good time before the full scale event. Try out the format of the courses and any novel features. Be careful to appraise trainees' perceptions, especially of practical/simulation exercises.

10. Don't forget to provide food and drink for the trainers and trainees during the day.

11. Try to consider likely eventualities. Carry spare overhead projector bulbs, take care to maintain the generator, etc.

12. Prepare and issue in good time a timetable for when the training unit is visiting each training location.

13. Use of cartoons. This was not done effectively on this training programme due to the inability to find and fund a technical illustrator (cartoonist). Comic strip can be a most effective way of getting across a training message.

14. Group trainees in pairs. People work better and discuss more in pairs, whereas as individuals they may feel threatened when asked to carry out practical exercises or field visit exercises. Get each pair to participate and provide answers to these exercises - if their answer is wrong their colleagues will soon tell them!

15. Try to prepare the evaluation format and questionnaires at the planning stage. It is then possible to carry out surveys of staff capabilities before and after the training which take the same form. This can appear to be an onerous task but one which will prove its worth in the end.

1.4 Conclusions

These two papers have briefly described the setting up and implementation of two successful training programmes. Their success has depended on many factors but some of the key points are considered to be:

- The training has been directed at the trainee's everyday work.

- The training has been practical and involved the trainees doing and thinking about their work.

- The emphasis of the training has been on discussion and exchange between trainee and trainer. This has encouraged the trainees to feel that their views and experiences are important and relevant.

- The training has been conducted in the trainees' own areas in familiar surroundings. The training has therefore been seen to be both very real and very relevant to the trainees.

- Suitably experienced and well motivated trainers have instilled a significant degree of enthusiasm amongst the trainees, which in turn has provided satisfaction for the trainers in seeing that they are having an effect upon, and benefitting, the trainees' work.

- Senior staff have taken a keen interest in the success of the training programme. This enabled periodic organisational and budget allocation constraints to be resolved. It has also meant that action has been taken on feed back given to senior staff by the trainers, which has shown the training programme to be a very dynamic fact of life.

- The training programme has been quite tightly structured, using prepared material on the overhead projector for lectures and set routines and procedures for field visits. Established routines help build the trainers' confidence.

Measuring the worth and effect of training programmes is difficult, though this was measured to a degree in the EJIP programme using pre- and post-training tests, questionnaires and evaluations. What is central to irrigation management is the motivation of those involved, and this is not readily measured. It is believed from the trainees' reactions to the training course and the feedback during post training monitoring and evaluation, that the motivation of the trainees to 'do a good job' has been increased.

The EJIP training programme has provided a vehicle for communicating to field staff the importance and value of their work to the Irrigation Service. Trainees have come to better appreciate their role and status in the community as a result.

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IRRIGATION MANAGEMENT NETWORK

TRAINING PROGRAMMES FOR IRRIGATION FARMERS

Ian Smout

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TRAINING PROGRAMMES FOR IRRIGATION FARMERS - AN EXAMPLE FROM EAST JAVA, INDONESIA

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TRAINING PROGRAMMES FOR IRRIGATION FARMERS - AN EXAMPLE FROM EAST JAVA, INDONESIA

Ian Smout

INTRODUCTION

This paper describes the setting up and running of one of two ongoing training programmes in East Java, Indonesia. This paper describes the Madura Ground Water Irrigation Project training programme for tubewell operators and officers of Water Users Associations. The companion paper by Martin Burton (86/1d) describes the East Java Irrigation Project training programme which is designed for irrigation staff, both managers and operators. Although the training programmes described are for two separate training programmes, they have been developed and implemented along similar lines as a consequence of close liaison between the two training units.

The paper sets out to be some practical use to others involved in setting up such programmes. It is hoped that by providing sufficient detail and insights into the practical issues involved, some of the experience gained can be passed on and used to good effect elsewhere.

The two papers have a common set of conclusions as many of the issues involved are relevant to both programmes.

2. THE MADURA GROUNDWATER IRRIGATION PROJECT

2.1 Description of the project and a typical tubewell irrigation system

The aim of the Madura Groundwater Irrigation Project is to develop groundwater resources for irrigation in Madura which is an island off the north east coast of Java in Indonesia, (see Figure 1.1 in Paper 86/1d). Some 55 tubewell irrigation systems are already in use, and another 45 are to be constructed under the current phase of the project. This is being implemented by the Groundwater Irrigation Division (P2AT) within the Ministry of Public Works, with finance from the Government of Indonesia, the EEC and the UK. A typical well is 100m deep, with a turbine pump and diesel engine. It is designed to pump about 60 l/s from a dynamic water level of between 5m and 35m, depending on the site, to irrigate an area of some 40 ha, divided into seven blocks. The project includes the construction of canal systems over this area, to deliver water to outlets which each supply about 0.25 ha. The main crops are paddy rice and tobacco.

Before each tubewell is commissioned, the project appoints and trains an operator to run the pump and engine, and it also organises the formation of a water user association (called HIPPA) made up of the 100 to 160 farmers with land in the tubewell command area. They elect a chairman, secretary, treasurer, water bailiff and seven block leaders.

For the first two years after commissioning, the project pays the operator's salary and supplies diesel etc. for operation, but after that the tubewell is handed over to the HIPPA and the government provides only maintenance and repair services for the tubewell pump and engine.

2.2 The water management programme

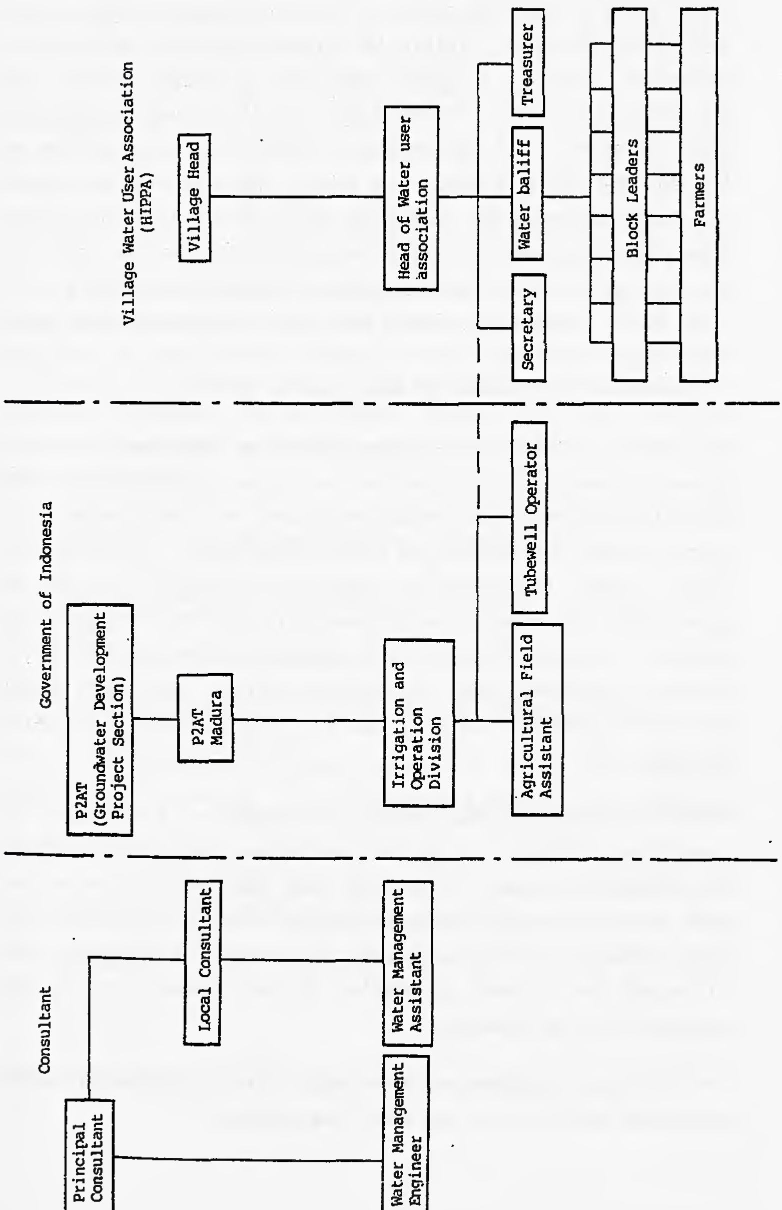
Since the project began in 1978, work on tubewell and irrigation operation and maintenance has been undertaken by staff in the P2AT Irrigation and Operation division, with some assistance from the consultant's agriculturalist and irrigation engineer. Consultancy inputs specifically for water management began in October 1984 with the arrival of an expatriate water management engineer at Madura, followed closely by a water management assistant from the local consultant. Together with the P2AT staff, they made an initial review of the situation on the operating tubewells and concluded that the most urgent need was to improve the performance of the water user associations (HIPPAs) who would eventually take over the running of the tubewell systems. Figure 2.1 shows the relevant parts of the project organisational structure. A decision was made to develop a training programme for the HIPPA officers of each tubewell system, following the methods used in the East Java Irrigation Project (EJIP) training programme, which provided a useful local model. For the wells which were already operating, this would also include briefing the villagers about the programme for intensifying the canalisation (quaternary development) and consulting them about the alignments of the quaternary canals.

It may be noted that a number of water management aspects had not been resolved at this stage, covering such important issues as operating responsibilities after handing over, and optimum schedules. Also no sociological studies had yet been carried out. It was decided to proceed regardless, to develop a training programme based on communication of simple principles and discussion with the HIPPA officers. The aim was to rouse the villagers' interest as soon as possible, and to refine and improve the programme content from the experience gained during its presentation.

Commentators such as Saldhana, in Network Paper 12b, stress the importance of thorough preparation for water management training

Figure 2.1

Madura Groundwater Irrigation Project Organisation Chart



programmes. In some cases however, the timing of various project activities may not always work out in an ideal way, so that compromises have to be made. This was the case in Madura, but in the event the training programme helped to resolve some of the outstanding issues. Firstly the training process helped water management staff to a better understanding of the situation on the tubewell systems. Secondly the activity helped to focus the minds of other staff and managers on the importance of some of the outstanding decisions. As a result, the technical content of the programme improved, as did the skill of the trainees, as the programme progressed. Nevertheless, technical content contributes only partially to the programme's impact. The training activity itself conveyed messages about the seriousness with which government viewed the tubewell system and the role of the HIPPA officers, and this seemed to have a major impact.

In parallel with the training programme described below, a tubewell manual was produced for each site, containing key data about that tubewell and irrigation system, and also standard sections on water management and HIPPA organisation. This was produced in the Indonesian and Madurese languages, for use by government and by the tubewell operators and HIPPA officers themselves. The manual acted as a summary of the content of the training programme, both for obtaining initial government approval of the standard content, and for giving to the HIPPA after the training.

Another byproduct of the training programme was a programme for consulting villagers during the planning and design period of the new tubewell systems. Using the same equipment and techniques used in the training programme, mobile teams visited the villagers scheduled for development, explained the programme and discussed the proposed boundaries of the command area and the proposed canal alignments.

The training programme was thus only part of the overall water management work carried out under the project.

2.3 The training programme for HIPPA officers

2.3.1 Training need

Investigations by the consultants' water management staff in late 1984 suggested that HIPPAs were in general poorly developed as organisations and not active. They did not seem at all ready to take on responsibility for managing the tubewell. In addition, there appeared to be a low standard of water management on many of the tubewell irrigation systems, with high losses resulting, for instance, from leaking channels and excessive irrigations on uneven fields. It was also clear that tubewells in some areas were not yet making an impact on the local agriculture. It should be noted however that there was considerable variation among the tubewells, in these as in other aspects.

Following this investigation it was decided to organise a training programme for the HIPPA officers, to cover all the operating tubewells as soon as possible, and to deal with the following topics:

- HIPPA organisation and officers' responsibilities
- financial aspects of managing the tubewell
- improving water management
- increasing the area irrigated and the cropping intensity

The HIPPA structure is shown in Figure 2.1. Its officers comprise the following, all of whom should ideally be trained:

- chairman
- water bailiff (known locally as ulu-ulu)
- secretary
- treasurer
- block leaders (approximately 7 per system)

2.4 Implementation

After deciding the training approach to be used, the next stage was preparation for the programme. This covered the following:

- design and construction of suitable demonstration quaternary canals
- planning and organising the programme in detail
- purchase of equipment
- preparation of material (OHP, slide, video)
- training of trainers

Four tubewell systems were selected for the construction of demonstration quaternaries. These were in different areas, so that all the operating tubewells were within reach of one of them. One demonstration quaternary canal with structures was designed and built on each of these four systems. These were the first quaternaries to be built by the project and thus they acted as prototypes for the major quaternary development programme which was about to start design work. The demonstration quaternaries were built by the HIPPA organisations, supervised and paid for by the project, which was the water management staff's preferred way of working. (However contractors will be used for the quaternary development programme in accordance with government rules.)

The detailed planning and organisation was done in parallel with the other work and gradually fell into place. Training would take place three days per week, at sites in the villages which the agricultural field assistants would agree with the village heads. Thus training would be carried out on six tubewell systems per month, and it would take about eight months to cover all the operating tubewells. The project staff would travel out each day from the project office at Pamekasan in central Madura, and two regular trainers and the local agricultural field

In addition the tubewell operator and the village head (kepala desa) need to be included, giving a total of about 13 participants per system. These people may be those with high standing within the village, but nevertheless they would have had little education. Some would be able to speak, read and write the Indonesian language, but others would only understand the local Madurese language.

Therefore in mid 1985, when the training programme was being prepared, the number of people to be trained amounted to some 700 villagers of the 55 existing systems, with another 600 on the 45 new systems to be trained later.

2.3.2 Planning, organisation and structure

The training programme for Madura was drawn up following the experience already gained on the East Java Irrigation Project. The principles adopted there for training low level government officials seemed to be generally valid for training villagers on the Madura tubewells. In particular it seemed that a course held at each tubewell would be best, so as to concentrate on the individual features and practical problems of that tubewell, and to avoid confusing the participants by unfamiliar surroundings. Therefore it was decided to set up a mobile team of trainers, who would carry out the training at one tubewell at a time, according to a programme which would enable all the Phase 1 systems to be covered by an early date.

The core members of this team who were involved in planning the programme from the beginning, were the P2AT Madura head of the agriculture section (in the Irrigation and Operation Division) and the local consultant's water management assistant. The former was Madurese and so he could communicate readily with the villagers, but the other was from west Java and could not speak the Madurese language. It was agreed that they would carry out the training programme, in accordance with guidelines and material developed with assistance from the principal consultant's water management engineer, who initiated the programme.

Each P2AT agricultural field assistant acted as a trainer at the tubewells for which he was normally responsible. Their usual job is to monitor operation, liaise with the villagers, and supervise agricultural demonstrations in these areas.

Two days were allocated per tubewell for the course, one day one week and one day the next week, to allow time for activities between the training days (eg. following up particular problems in the office). The main elements of the training at each tubewell were decided as follows:

- trainers to use an overhead projector with standard material prepared in advance on acetate rolls;
- trainers and participants together to inspect the participants' own tubewell system and discuss any problems there;
- trainers and participants together to inspect and discuss demonstration areas on other tubewells;
- trainers and participants to discuss and agree how to run the tubewell and its irrigation system.

This approach required that two vehicles should be available on one of the days, so as to visit the demonstration areas, and that a generator, overhead projector and flip chart should be taken to each day's training. Also meals would have to be provided for the trainers at least. In this way the approach led to high demands on the resources and organisational capabilities of the project.

Table 2.1 shows the course content which evolved.

The items in Table 2.1 include video, slide and film material. This represents an extension of the training equipment beyond the basic OHP and flip chart, taking advantage of the presence of the generator and the space in the vehicle, to take extra equipment and show audio-visual materials.

Table 2.1

HIPPA Training Programme, Madura Groundwater Irrigation Project

PROGRAMME	EQUIPMENT USED
<u>Day 1</u>	
The course programme for Day 1 is as follows:	
1. Introduction	OHP + flipchart
- HIPPA's report on problems	
- cropping pattern per kelompok	
- when irrigation can be useful	
2. Group photo	
3. Saving water	Video
4. Field inspection of irrigation system	
- HIPPA to show training staff the problems	
- training staff to point out need for maintenance etc.	
5. Quaternary development and programme	
- layout	OHP
- construction	Video
6. Land preparation for irrigated crops	Video
7. Lunch	
8. Programme for the second day's training	
9. Visit to other tubewells	
- demonstration quaternary	
- agriculture demonstration	
<u>Day 2</u>	
The course programme for Day 2 is as follows:	
1. Report back on problems raised on first day	flipchart
2. Quaternary layout	OHP
3. Field inspection (if necessary)	
4. Cost of operation	OHP
5. Payment of irrigation charges	OHP
6. Slides	slide projector
7. Operation of tubewell and irrigation system	
8. Rotation system	flipchart
9. Lunch	
10. HIPPA structure	OHP
11. HIPPA officers' responsibilities and tasks	OHP
12. Records	OHP
13. Summary of conclusions and agreements	
- copy of HIPPA	
- copy of P2AT	
14. Supper (staff only)	
15. Film	film projector

assistant would together do the training. Long wheel-base Land Rovers would be used to transport the trainers and equipment to the sites, and the participants to the demonstration. It was decided to pay an allowance to the participants, and also provide them and the trainers with a midday meal and refreshments, which the village head would be paid in advance to organise. The trainers would get an allowance, in recognition of the long hours they had to work, and they would also be provided with an evening meal when the film was shown. The tubewell operator and water bailiff at the demonstration quaternary would be paid a small allowance for being available at the time of the visit and discussing their system with the participants.

The sub-project manager visited the top local officials to explain the programme and request their support. A daily programme was prepared showing the sites to be visited, staff involved etc. Each month the local authorities were informed of the daily programme for the next month. They then informed the village heads and this ensured that the village heads would co-operate.

Equipment was purchased following the EJIP experience. The project already had an OHP, slide projector, film projector and TV monitor, but wooden boxes had to be made for transporting these safely.

OHP material was drafted in English, translated into Indonesian and written onto an acetate roll, using colour to emphasise some words, and for illustrations. The first translation was very literal, and it was revised and improved later, to make a more fluent Indonesian version. However the trainers usually explain the points in Madurese, using the OHP material as a prompt. Slide photographs were taken, and a video was prepared, to illustrate particular points. A suitable film drama about tertiary development was located and borrowed. More information on these aspects is given in Section 2.5 below.

The regular trainers were involved in the planning and organisation and in the preparation of the material. Thus they understood the training approach and did not need intensive instruction. One of the team had previously done a short government course on training and the use of training equipment. The training of trainers which was carried out consisted of a visit to see the EJIP work in progress, and discussions with the Senior Trainer there, and a dress rehearsal of the Madura training with the agricultural field assistants as participants. The foreign consultants took an active role in this, and then supervised the first month's training very closely, to guide the trainers.

The trainers could then continue with the rolling programme largely unsupervised, except for a weekly meeting to discuss the previous week's progress and the next week's programme and requirements.

2.5 Results

The training programme was carried out on the existing tubewells between July 1985 and February 1986, without any major problems. It was well received in the villages, and may (together with the concurrent increase in agricultural extension work) have contributed to the increase in tubewell utilisation which appears to have occurred.

The video and the film were the two parts of the programme which seemed most successful.

The video was made by a commercial agency in Surabaya, to illustrate the following:

- saving water by reducing losses from canals etc.

- constructing good quaternary canals.

The director already had some knowledge of irrigation, having produced sound/slide packages in the past. He prepared the scenario and script from the consultant's outline and illustrations of major points (the slides and cartoons already prepared). The consultant organised the locations for the filming. Local actors were used and two versions of each scene were filmed - first in the Indonesian language, then in Madurese. These were edited into two versions of the film - a Madurese version for training villagers, and an Indonesian version for general use with staff, contractors etc.

The film was obtained following the recommendation of one of the EJIP trainers. He had previous experience of using a movie film for water management training of Indonesian villagers and recommended this method for Madura, using the same Indonesian language film "Kadir Pendekar Air" (Skills for Water User Groups). It proved to be extremely popular, with crowds of typically 300 to 400 watching it, including large numbers of women and children (groups who otherwise were little involved in the training). The film is in the Indonesian language and tells the story of a village water bailiff on a surface irrigation system, who organises construction of tertiary and quaternary canals and cooperative action in the water user association etc. He is also involved in fights about water stealing, family illness, and romance with the daughter of the head of the water user association. Thus the film combines a good technical message with human interest. This seems a good medium for conveying a message to large numbers of villagers.

Follow up work is to be undertaken on these existing tubewells during mid 1986, and this will include procedures for the handing over of the tubewells to the HIPPAs. Later in 1986, the first of the new wells will be commissioned, and the training programme will then continue on these.

The total budget for the training is £20,000 for 100 tubewell systems, excluding consultant staff and vehicle costs and government salaries. This budget should prove adequate for the training programme, and also provide some funds for the associated follow up programme after the training, and consultation of new sites.

2.6 Conclusions

These two papers have briefly described the setting up and implementation of two successful training programmes. Their success has depended on many factors but some of the key points are considered to be:

- The training has been directed at the trainee's everyday work.

- The training has been practical and involved the trainees doing and thinking about their work.

- The emphasis of the training has been on discussion and exchange between trainee and trainer. This has encouraged the trainees to feel that their views and experiences are important and relevant.

- The training has been conducted in the trainees' own areas in familiar surroundings. The training has therefore been seen to be both very real and very relevant to the trainees.

- Suitably experienced and well-motivated trainers have instilled a significant degree of enthusiasm amongst the trainees, which in turn has provided satisfaction for the trainers in seeing that they are having an effect upon the trainees' work.

- Senior staff have taken a keen interest in the success of the training programme. This has enabled periodic organisational and budget allocation constraints to be resolved. It has also meant that action has been taken on feedback given to senior staff by the trainers, which has shown the training programme to be a very dynamic fact of life.

- The training programme has been quite tightly structured, using prepared material on the overhead projector for lectures and set routines and procedures for field visits. Established routines help build the trainers' confidence.

Measuring the worth and effect of training programmes is difficult, though this was measured to a degree in the EJIP programme using pre- and post-training tests, questionnaires and evaluations. What is central to irrigation management is the motivation of those involved, and this is not readily measured. It is believed from the trainees' reactions to the training course and the feedback during post-training monitoring and evaluation, that the motivation of the trainees to 'do a good job' has been increased.

In the MGIP training programme new lines of communciation have been opened up between the Project and the farmers, thus considerably improving each party's understanding and co-operative spirit.

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References

Burton, M.A. and Carruthers, I.D., 'Irrigation Management - A Training Programme Incorporating Simulations, Games and Role Playing Exercises', 12th ICID Congress, Fort Collins, 1984.

Burton, M.A. Darsun Kartodrejo, Arief Effandi, Tjahjo Santoso, Smout, I.K., 'Training in Water Management - A Practical

Approach for Managers and Operators in East Java, Indonesia.' Paper submitted to the forthcoming 13th ICID Congress, Rabat, 1987.

Saldhana, Cedric, 'Institution Development Issues in Rural Projects', Irrigation Management Network Paper No. 12b, ODI, London 1985.

Sir M MacDonald & Partners, Asia, 'O & M Staff Training Programme' East Java Irrigation Project, December 1983.

Sir M MacDonald & Partners, Asia, 'O & M Staff Training Programme - Interim Report', East Java Irrigation Project, August 1984.

Vivekanathan, M.N., 'Rehabilitation of irrigation systems in East Java, Indonesia.' Paper submitted to the forthcoming 13th ICID Congress, Rabat 1987.

Westfall, Dwayne G. (ed), 'Training Manual for Agricultural Management Specialists', Colorado State University Water Management Technical Report No. 60, 1980.

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IRRIGATION MANAGEMENT NETWORK

NEWSLETTER

ODI/IIMI Irrigation Management Network 86/2a August 1986

Agricultural Administration Unit, Overseas Development Institute, London

The Overseas Development Institute (ODI) is an independent, non-profit making research institute. Within it, the Agricultural Administration Unit (AAU) was established in 1975 with support from the British Aid programme. Its mandate is to widen the state of knowledge and flow of information concerning the administration of agriculture in developing countries. It does this through a programme of policy-oriented research and dissemination. Research findings and the results of practical experience are exchanged through four Networks on Agricultural Administration, Irrigation Management, Pastoral Development and Social Forestry. Membership is currently free of charge to professional people active in the appropriate area, but members are asked to provide their own publications in exchange, if possible. This creates the library which is central to information exchange.

The International Irrigation Management Institute, Kandy

The International Irrigation Management Institute (IIMI) is an autonomous, non-profit making international organization chartered in Sri Lanka in 1984 to conduct research, provide opportunities for professional development, and communicate information about irrigation management. Through collaboration, IIMI seeks ways to strengthen independent national capacity to improve the management and performance of irrigation systems in developing countries. Its multidisciplinary research programme is conducted on systems operated both by farmers and by government agencies in many co-operating countries. As an aspect of its dissemination programme it is joining ODI in the publication of the Irrigation Management Network papers, to enable these to appear more frequently to an enlarged membership. It has also provided equipment to link ODI's irrigation library into an international irrigation management database centred on IIMI.

NEWSLETTER

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86/2d Performance Measurement in Canal Water Management: A Discussion, by Charles Abernethy

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1. NETWORK PAPERS AND DISCUSSIONS

a. The Current Issue

Papers in the current issue deal with recurrent costs, performance indicators and the uses of micro-computers.

Mark Svendsen's paper No. 86/2b, on *Meeting Irrigation System Recurrent Cost Obligations* discusses a number of important issues relating to how public irrigation schemes can meet the costs of operation and maintenance. It takes up several points raised by Ian Carruthers' paper, No. 86/1c, *Irrigation Pricing and Management* in the last issue of the Irrigation Management Network. These relate in particular to the need to cover O&M charges at the very least from irrigation scheme farmers and to changing structures of financial management so that the water fees collected can be kept at scheme level, rather than disappearing into regional or national budgets. Svendsen's paper makes several very useful observations which should be kept in mind when assessing alternative policy changes. First, water is very rarely delivered and paid for on a true volumetric basis; hence, water charges provide no incentive to farmers to economise on water. Second, the provision of a larger O&M budget does not necessarily lead to better performance; more money may be spent on staff salaries rather than operational expenditures. Third, an increase in fees often leads to a decline in levels of payment; if this decline is coupled with rising costs of collection, the net revenue available for O&M may fall to negligible levels. In general, any attempt to improve O&M performance must probably involve the devolution of some power and control to farmers' associations. (This point is central also to a new report by Uphoff on increasing farmer participation in irrigation schemes, discussed in Section 5 of this Newsletter.) Svendsen presents several examples from the Philippines and Sri Lanka where major changes in irrigation management policy have taken place, such as agencies retaining water revenues at the scheme level and promoting active participation by farmers in scheme O&M, which it is hoped will lead to greater levels of fee collection and greater local accountability.

Paper 86/2d by Charles Abernethy discusses a way of assessing irrigation system performance. Both managers and researchers should find it useful to have a standard indicator against which the efficiency of system operation can be measured and compared with other systems and with the results of different management policies. The author defines the goal of water management to be the reliable delivery of the right quantity of water to the right place at the right time. This definition involves issues of equity, reliability and sustainability and it is on the first two of these that the subsequent discussion focuses. Several measures of distribution are investigated, such as the Gini coefficient, the coefficient of variation and the inter-quartile ratio to assess their worth as measures of effective water distribution. The author opts for a modified form of the last of these measures, given its relative ease of interpretation. Managers, in particular, should find Abernethy's discussion useful in its presentation of fairly simple ways of using data on main system water distribution to assess managerial efficiency. A special data collection exercise would probably be needed to measure water distribution efficiency at field or field channel level, but this would be worthwhile for a research or rehabilitation exercise.

People with a statistical background interested in this subject might like to know of 3 recent papers:

i. Leslie E Small and Chyong Ling Chen - *An Approach to Estimating the Potential Production Benefits from Improved Irrigation Water Management for Rice*, Irrigation and Drainage Systems, Vol. 1, No. 1, 1986, pp19-30.

ii. B D Dhawan *Output Impact According to Main Irrigation Source: Empirical Evidence from Four Selected States*, a paper presented at the INSA's National Seminar on Water Management, held in New Delhi, April 28-30, 1986.

iii. David Seckler, R K Sampath and S K Raheja *Quantitative Indicators of the Performance of Irrigation Management Systems* obtainable from Dr David Seckler, Director ISARD, Colorado State University, Fort Collins, Colorado 80523, USA.

Paper 86/2c contains 2 papers dealing with the use of computers in irrigation, the first as a management tool and the second for training purposes. Tom Sheng describes the application of microcomputers to monitoring and analysis of water supply and distribution in the Parakrama scheme, Sri Lanka. He notes the particular value of computers in providing a visual representation of water supply variation within the system and over time. Anyone interested in irrigation data management can contact Dr Sheng at Colorado State University, the full address for which is given in Paper 86/2c. Colorado State in association with the governments concerned and with the Consortium for International Development and USAID have run workshops on this subject this year in Karachi, Pakistan and Colombo, Sri Lanka. Laurence Smith's paper discusses the role that can be played by simulation exercises in getting across to students an understanding of the complex social, economic,and technical issues found in irrigation management. He describes 7 particular simulation exercises which illustrate a variety of different problems, some involving role-playing games and others simulating particular exercises, such as barrage control. He also provides the names and addresses of those from whom further information can be obtained.

b. Discussion on Previous Papers

i. Water Charging Systems

With reference to Ian Carruthers' points on the relationship between cost recovery and reliability of water supply (Paper 86/1c, pp 9-10), Chris Finney gives an illustration of a water charging system that attempts to cope with the situation. Incidentally, it also illustrates a way in which water charges can influence water economy, which is relevant to Mark Svendsen's discussion in Paper 86/2b. A study by Sir M MacDonald and Partners and Hunting Technical Services Ltd in 1985 of Government pump schemes in northern Sudan found the existing charging system to be based on a per hectare fee which varies according to crop grown. This therefore can reflect the amount of water used and thus influence cropping patterns in the direction of water economy. Since the pumping equipment is old and unreliable and there are frequent shortages of diesel, there is also provision for reducing the water charge by amending the recorded cropped area in line with the area effectively harvested. This reduces government revenue considerably at present, but farmers would resist any attempt to charge them for water not actually received. On the other hand, there is evidence that they would be willing to pay more if the supply was reliable. The report therefore recommends that the present system continue but with higher standard rates on schemes that have been rehabilitated than on those where this work has still to be carried out, with all rates to be increased annually in line with inflation.

ii. Markets for Groundwater.

James Copestake, Production Economist, Department of Agricultural Economics, Agricultural College and Research Institute, Madurai 625104, India, has completed research on *Finance for Wells in a Hard Rock Area of Southern Tamil Nadu*, in which he discusses the wasteful use of subsidised electricity by farmers with over-powered pumps. Farmers reduce the flow rates to an easily handled level by, for example, closing the gate valve. Shah in his Network Paper 11d noted that when electricity is charged at a fixed annual rate according to horsepower, rather than actual consumption, owners have an inducement to rent out their machinery to others. Copestake points out the disadvantages of non-economic use of electricity, especially when this restricts the supply of new connections. The report also discusses many other aspects of water utilisation.

iii. Intervening in Farmer Managed Systems.

John Gowing from the Department of Agricultural Engineering, University of Newcastle upon Tyne, NE1 7RU, UK, was formerly involved with an ODA supported programme (KHARDEP) for upgrading communal schemes in Nepal. Given their common experience with irrigation development in different parts of Nepal, he has written in to express both his high regard for the paper by Yoder and Martin (Network Paper 12c, November 1985) and his anxiety about some of its omissions.

> "Their paper stops short of a discussion of the problem of successful intervention. KHARDEP experience .... shows the extent of (this) problem."

Gowing describes his own "action-research" on this issue, by placing a Nepalese social scientist in one community where the programme was actively developing the irrigation system, to act as an intermediary between the project and the farmers. This produced promising results. (For other examples of success with such mediators see the Philippines experience reviewed by Bagadion and Korten, mentioned in Section 5. a. of this Newsletter, and the Gal Oya experiment described in Network Paper 10c.)

Gowing also notes Martin and Yoder are correct in saying that

> "wherever there is a reasonable potential for developing irrigation, the farmers have already made some effort to irrigate.... It follows that any external intervention is likely to be confronted with the most difficult schemes. If they were easy, the farmers would not need help. This was KHARDEP'S experience and the failure to recognise that fact earlier was a major factor in determining the poor success rate. There was a need to develop solutions to problems that could not be solved using the skills and resources available locally. However, any new solutions had to match local maintenance abilities. In the conditions of the Nepalese hills the option of engineering-out maintenance simply doesn't arise."

Further contributions to the learning process on intervening to upgrade farmer-operated systems will be welcome. See below for IIMI's research programme in this area.

2. REGISTER OF MEMBERS.

This issue of the Network is accompanied by an appendix to the Register of Members containing the list of our Indian membership. As Networkers will be aware, the updated register of members issued with the last issue of the Network, unfortunately left out members in India. This was particularly regrettable given the large number of members in this country and we apologise for this mistake.

Table 1 gives a breakdown of the Network's membership by continent and country. As can be seen, there has been substantial growth in numbers in almost all regions.

Thanks to those who have sent in completed membership forms. We are again enclosing a form with this issue and we hope to receive completed forms from those who have not yet returned them. As noted in the last newsletter, you will need to re-register if you wish to continue as a member of the Network. Further information about the form and the role of different kinds of information asked for was given in Section 3 of the last newsletter.

3. IIMI ACTIVITIES

a. Staff Changes

Dr Roberto Lenton joined IIMI on 18 August as Deputy Director General. F E Schulze arrives at the end of September as Director of International Programmes. Readers may have deduced from an advertisement in The Economist (9 August 1986) that Dr Tom Wickham will be coming to the end of his term of office as first Director General next year. Dean F. Peterson, Utah State University, Logan, UT, 84322-4105, USA, is chairing the search committee for his replacement and applications for the post must be made no later than 15 November 1986.

b. Publications

IIMI Research Paper No. 1 contains a paper by Leslie Small, *Research Priorities for Irrigation Management in Asia* dealing mainly with the conceptual and methodological problems leading to IIMI's choice of research areas. It is accompanied by a paper by Randolph Barker giving a brief summary of the status of irrigation research in several Asian

Table 1: BREAKDOWN BY REGION AND COUNTRY OF MEMBERS

Europe	1982	1985
Denmark	1	-
France	5	8
Italy	14	15
Luxembourg	-	3
Netherlands	18	29
Portugal	-	1
Sweden	4	3
Switzerland	1	2
W Germany	6	9
UK	144	213
	191	283

N Africa	1982	1985
Algeria	-	1
Morocco	-	1
		2

Middle East	1982	1985
Cyprus	3	3
Egypt	5	14
Israel	6	8
Jordan	1	2
Kuwait	2	2
Oman	1	-
Saudi Arabia	-	2
Turkey	5	8
Yemen Arab Republic	-	1
Yemen Peoples Republic	-	1
	23	43

N America	1982	1985
Canada	5	6
USA	94	93
	99	99

Central & Latin America	1982	1985
Argentina	1	1
Brazil	1	3
Chile	2	2
Ecuador	6	2
Guyana	2	-
Honduras	1	1
Jamaica	-	1
Mexico	4	5
Peru	2	3
Venezuela	1	-
	20	18

E & C Africa	1982	1985
Cameroon	-	1
Ethiopia	3	2
Kenya	15	29
Somalia	1	1
Sudan	4	16
	23	49

W Africa	1982	1985
Burkina Faso	3	3
Gambia	-	1
Ghana	4	5
Ivory Coast	-	2
Mali	-	2
Mauritania	1	-
Niger	-	1
Nigeria	14	30
Senegal	2	4
Sierra Leone	1	-
	25	48

Southern Africa	1982	1985
Botswana	1	-
Malawi	-	1
Mozambique	-	1
South Africa	2	3
Swaziland	-	1
Tanzania	1	7
Zambia	-	4
Zimbabwe	3	15
	7	32

South East and East Asia	1982	1985
Burma	2	4
China	2	5
Indonesia	28	38
Japan	3	2
Malaysia	7	10
Papua New Guinea	-	1
Philippines	14	14
South Korea	1	3
Taiwan	3	5
Thailand	19	20
	79	102

South Asia	1982	1985
Bangladesh	36	60
India	136	156
Nepal	5	17
Pakistan	15	33
Sri Lanka	18	81
	210	297

Australasia	1982	1985
Australia	3	4
New Zealand	2	3
	5	7

	1982	1985
TOTAL	682	978

countries. The papers derive from a workshop in January 1985 and resulted in the definition of research programme areas outlined by Cowell in Network Paper 86/1b.

IIMI Research Paper No. 2 provides summaries of papers and discussion at the *International Workshop on Selected Irrigation Management Issues*, held at IIMI, 15-19 July 1985. The topics discussed comprised rapid appraisal of canal irrigation performance by Robert Chambers and Ian Carruthers; management of rehabilitation by D Hammond Murray-Rust; managing main system water distribution by P S Rao and A Sundar; and institutional aspects of irrigation management by Bret Wallach, David Groenfeldt and Mick Moore.

Two further research papers are currently in press: J Wolf and B Merrey on *Irrigation Management in Pakistan* and Robert Chambers and Ian Carruthers on *Rapid Appraisal to Improve Canal Irrigation Performance*. Two management briefs have been prepared; No. 1 by P S Rao and A Sundar on *Managing Main System Water Distribution* and No. 2 by Robert Chambers and Ian Carruthers on *Rapid Rural Appraisal for Irrigation Systems*.

c. Research Programme

i. Sri Lanka

In early 1985, IIMI selected field sites in the North Central Province (NCP), incorporating three distinctly different types of irrigation commonly found in Sri Lanka's dry zone: relatively small and very old farmer-managed systems; the 35 year old 1,214 ha Dewahuwa System managed by the Irrigation Department; and the Kalunkuttiya Branch of the Mahaweli Authority's System H, (a 2,042 ha part of a ten-year old system which receives water from a modern complex of dams and reservoirs). Research began in April 1985 and focuses on understanding how farmers organise to share and distribute water in village "tank" schemes.

IIMI selected 140 farmers living in the Dewahuwa and System H systems, and, during the 1985 dry season, began documenting the amounts of water they used, the economics of producing rice and several other crops, their social and institutional environment, and water flow measurements at a number of locations. Researchers found that irrigation issues for two days in ten at Dewahuwa were not sufficient for rice, and yields were only 1.3 t/ha compared with 2.3 t/ha at System H where water was more plentiful. Water supplied to Dewahuwa during the 1985 dry season totalled 800 mm compared with 1,700 mm at System H. The mix of crops reflected this difference: 20 percent of Dewahuwa was planted to rice compared with 50 percent of System H.

Economic studies confirmed that chilies, soybeans, and green gram all returned greater net profits than rice. However, the diversified crops required considerably more labour than rice, especially labour to manage water. Rice is the favoured crop where the capacity to manage water is more limiting than the quantity of water supplied.

IIMI's research during 1985 and 1986 showed that year-to-year variation in rainfall is so pronounced that conclusions should not be drawn from a single year's data. During the pivotal dry-season month of June, 50 mm of rain fell at Dewahuwa in 1985 while in 1986, only 3 mm was recorded. These differences cause major adjustments in the management plans adopted by both farmers and agency staff.

From this research IIMI has identified three management practices that may affect diversified cropping: 1) night-time irrigation was found less well-adapted to diversified crops than to rice; 2) land shaping in parts of Dewahuwa clearly helps in managing water and increasing production of non-rice crops; and, 3) lack of effective control over structures along canals favours irrigation of rice over that of diversified crops. In 1987 IIMI will conduct field trials in which these three practices will be modified in different ways and then tested for their effects on irrigated diversified cropping.

ii. The Philippines

IIMI's research on irrigation management for diversified crops began at two sites in March 1985. As in Sri Lanka, the first objective was to document existing practices. Researchers found that rice and maize are often planted in the same field, and that non-rice crops are less profitable for farmers than rice. Soil saturation by excessive seepage from adjacent rice lands is one reason yields are low for non-rice crops. Results from the Philippines confirm that low prices discourage farmers from planting non-rice crops, and water issues above 15 mm/day reduce yields.

iii. Indonesia

In October 1985 IIMI began field research with partial support from ADB on selected sites in East, Central, and West Java. The research includes a study of irrigation management for crop diversification similar to that in Sri Lanka and the Philippines, and a study of the effects of Indonesian institutions on management and performance of irrigation systems.

iv. Nepal

IIMI posted Resident Scientist Dr Robert Yoder in October 1985 to assist the Water and Energy Secretariat conduct research on farmer-managed irrigation systems. The post is supported by the Ford Foundation and the International Fund for Agricultural Development (IFAD). Twenty-five percent of the Resident Scientist's time is allotted to developing a network for similar research in Thailand, India, Bhutan, Bangladesh, and Pakistan.

v. IIMI-Pakistan

As an Institute "branch", IIMI-Pakistan is organised as an international centre rather than a national project, and staff and budget are scaled to about half those of IIMI Headquarters. The Branch Director, Dr Jim Wolf, reports to IIMI's Governing Board through the Director General. IIMI-Pakistan provides an important linkage to irrigation systems in arid and semi-arid areas where water supplies are more limited than those in the humid tropics. In addition, it permits the Institute to gain research experience with larger systems than those in Sri Lanka, and with a full range of non-rice crops. Funding support comes from IIMI central support, bilateral programme support from interested donors, and from IFAD. The first staff take up their posts in August 1986 when the Memorandum of Understanding between IIMI and the Government of Pakistan will be signed.

vi. Irrigation Service Fees and Resource Mobilisation

The aim of this group of studies is to see how the arrangements for mobilising resources for O&M affect the quality of irrigation management. (For a more detailed discussion of some of the issues see the paper by Mark Svendsen, Paper 86/2b.) The first part of the research involved 5 national studies carried out jointly with the Asian Development Bank in Nepal, the Philippines, Indonesia, Korea and Thailand.

Researchers found that farmers do not pay the full costs of operating and maintaining irrigation systems in any of the countries studied. However, some countries have significant taxes and other financial devices which transfer resources from farmers to government. Therefore, irrigation service fee policy must be analyzed in the context of a country's overall economic policies. The study also found that those agencies which have relatively autonomous financial relationships with their governments are more accountable to farmers and take them more fully into account in decision making.

The study was completed in December 1985, and a comprehensive report given to ADB. As a result, the IIMI assisted the Bank in organising a seminar on *Irrigation Service Fees* in Manila in July 1986. The next phase involves detailed field studies into a number of issues and questions regarding resource mobilisation. They will begin in Korea in 1986, in collaboration with Professor Young Kun Shim of the Department of Agricultural Economics at Seoul National University. Arrangements are nearing completion for similar studies in Thailand in collaboration with Kasetsart University. IIMI staff will be directly involved with the Sri Lanka field studies.

d. Workshops

In May 1986, IIMI co-sponsored a national workshop on *Participatory Management in Sri Lanka's Irrigation Schemes*, a topic which forms part of IIMI's own research studies in North Central Province. The proceedings of this workshop are currently in press. *Public Intervention in Farmer-*

Managed Irrigation Systems provided the focus for discussion at a workshop co-sponsored by IIMI in Nepal, August 1986. It brought together more than 50 participants from 13 countries to discuss issues and plan a research network. It is hoped that such a network would enable researchers from many countries to maintain close communication regarding common research issues, the role of IIMI being to provide financial support, research interactions and help with dissemination of research results. The aim of research in this field is to find which forms of government intervention in farmer-managed irrigation systems are helpful in the long run and which are not; and to identify general principles of effective farmer management which could be adapted and applied to the tertiary management of government systems. Key countries which have expressed interest in this research are Bangladesh, India, Indonesia, Nepal, Pakistan, Philippines, Sri Lanka and Thailand. Proceedings from the workshop are currently in preparation for publication.

e. Professional Development Awards

IIMI is currently providing 4 post-doctoral, 8 doctoral and 3 masters fellowships for work on a wide variety of subjects ranging from the development of indices for irrigation performance assessment to resource mobilisation in hill irrigation systems of Nepal.

f. Collaborative Agreements

In April 1986, a Memorandum of Agreement was signed with the Agrarian Research and Training Institute, Sri Lanka, to conduct co-operative research, training and information activities. A draft Memorandum of Understanding with the International Commission on Irrigation and Drainage was submitted covering co-operation in database and library development and in information exchange.

4. NEWS FROM NETWORKERS

a. Changes in Management Strategies, Policy, Legal Issues and Related Research.

i Africa.

FAO Land and Water Division have produced a *Report on the Consultation on Irrigation in Africa, Lome, April 1986*. This summarises the discussions at the conference, which was attended by important officials of Ministries and irrigation project authorities from many African countries. Many policy issues were addressed. One feature was the strong emphasis on the social need for irrigation, which led to some queries as to the appropriateness of the internal rate of return to define project suitability and viability. However, insufficient time seems to have been paid to considering sources of funds for operation and maintenance without which social benefits cannot be maintained. FAO intend to publish the full conference proceedings, including the backgro-und papers, later this year (enquiries to Mr P Dieleman, FAO, Rome). The background papers provide Africa-wide data on many aspects of irrigation but without the country detail found in *Irrigation in Africa South of the Sahara*, FAO Investment Centre Technical Paper No. 5, 1986.

The Ford Foundation has provided a grant to enable groups of researchers and government policy makers in Kenya and Zimbabwe to exploit existing research reports and studies to develop material for formulating national irrigation policy, with supplementary research being undertaken as neces-sary. Country planning sessions have already been held. The first joint seminar in Nairobi later this year will review papers based on existing information. The co-ordinators are Dr George Ruigi, IDS, Nairobi, Profe-ssor Migot-Adholla, University of Nairobi and Dr Mandivamba Rukuni, Dept of Land Management, University of Zimbabwe.

In Zimbabwe, Simon Pazvakavambwa, Deputy Director (Irrigation Division) Ministry of Lands, Agriculture and Rural Resettlement, and other colleagues are examining how the government can carry out its intention to transfer small-scale schemes in communal lands from government to farmer management. They are working on the legal problems of constitut-ing the irrigators into corporate bodies, and also are devising suitable training programmes. Hydraulics Research, Wallingford, UK, have already begun a water measurement investigation on the largest scheme and Mary Tiffen recently visited Zimbabwe to design with Agritex a sample survey to elucidate, amongst other things, farmers' views on water management problems, on management by committee, the way farm income varies with size and location and their capacity to bear O&M costs.

A research project on land and water rights in irrigated areas of sub-Saharan Africa is being coordinated by Francoise Conac, Centre d'Etudes Juridiques Comparatives (Centre for Comparative Legal Studies), Universite de Paris I - Sorbonne, 14 rue Cujas, Paris 75231 Cedex 05, France. There are currently 9 research teams based in Nigeria, Kenya, Zambia, Senegal, Mali, Chad, Mauritania, Tanzania and Madagascar. The research involves case-studies organised by various African universities and research institutes. A seminar is to be held in Kisumu, Kenya in December 1986 in order to elaborate the main legal systems being studied and the links between legal and environmental and social systems in irrigated areas.

In a study of *Land Tenure Issues in River Basin Development in Sub-Saharan Africa*, Land Tenure Center Research Paper No. 90, University of Wisconsin-Madison, April 1986, Peter C Bloch and others survey land tenure systems on irrigation schemes in Kenya, Madagascar, Mali, Mauritania, Senegal, Sudan and Zimbabwe. Many governments have justified authoritarian methods and insecure tenancy for irrigation scheme farmers in order to get farmers to behave in the desired fashion. While a certain conflict of views is apparent amongst the writers over the way that tenure evolves under increasing population pressure, the writers do stress that increased security of tenure may be essential to raise investment and levels of productivity in the longer term. As far as size of holding is concerned, a flexible approach is advocated for new irrigation schemes whereby farmers are initially allocated a small plot. Evolution to a larger plot size is considered important if irrigation schemes are to generate a marketable crop surplus of any significance.

ii. Asia.

IFPRI has recently carried out two studies related to irrigation policy. One looks at the likely result in Bangladesh of re-allocating funds from their current use as fertilizer subsidies to the development of irrigation (likely to be beneficial). The other considers the likely effects of alternative, more equitable water distribution methods on income distribution on an irrigation system in the Philippines (where the system-wide benefits from such changes would probably be fairly small). Details from the International Food Policy Research Institute, 1776 Massachusetts Ave NW, Washington DC 20036, USA.

The difficulties of introducing the warabandi system of irrigation in Karnataka State, India is currently being studied by the Institute for Command Studies and Irrigation Management and by the Institute for Social and Economic Change, Bangalore. We hope to carry a report on their work soon.

Dr M I Haider, Water Management Synthesis Project, Colorado State University, Fort Collins, Colorado, USA, is co-ordinating arrangements for an international conference on rehabilitation policies in Washington, October 27-31. The focus will be on Asia, with case-studies of particular rehabilitation programmes and working group discussions on improving policies, planning and evaluation in this field. IIMI, USAID, ADB and World Bank are among the participants.

Tom Franks and Tim Harding, Project Planning Centre, Bradford University, UK, are testing the hypothesis that water practices adopted when a paddy system is originally commissioned profoundly affect the subsequent operation of the project and the rate at which benefits accrue. The work is based on Sri Lankan data from which it is hoped to formulate guidelines for operation during the commissioning period. ODA is funding this piece of research.

b. Recent Conferences on Water Resources.

The conferences noted in this section did not cover irrigation alone, but water resources more generally.

The International Federation of Automatic Control (IFAC) has a Committee on Development and a Committee on Systems Engineering. These had a joint workshop on *Systems Analysis applied to Water and Land Resources*, the proceedings of which are being published by the Pergamon Press. As a result of the workshop, a Working Group of 50 participants was formed to exchange information on Systems Analysis applied to Natural Resources.

For information apply to Luis Tavares, Cesur-1st, Av. Rovisco Pais, 1000 Lisbon, Portugal.

Amongst the irrigation papers at the World Water '86 Conference was a good summary of *New Developments in Surface Irrigation* by W R Rangeley and R Barnsley. A paper by J M Healey and J B Wilmshurst *Financing Development Projects* concluded that lack of, or imprecise financial targets set for water managers have contributed to the poor financial performance of irrigation and other water projects. If water users are to be subsidised, this should be in the form of a block grant to the agency concerned rather than through unconditional budgetary support. Papers from the conference will be published by the Institution of Civil Engineers early next year. Enquiries to the Institute of Civil Engineers, 1 Great George Street, London SW1, UK.

It was followed by a Conference on *Drought and Famine*. A paper by M A Chitale, Chairman of the Central Water Commission, New Delhi, summarises the ways in which water is managed in drought-prone areas of India. He notes a recent recommendation that dependability rates in irrigation systems be reduced from 75 percent to 50 percent, though water distribution systems will need more careful management to ensure that shortages are evenly spread over all farmers. Enquiries about obtaining papers should be addressed to the International Water Supply Association, 1 Queen Anne's Gate, London SW1H 9BT, UK, telephone London 222-8111.

c. Training Courses

The Colorado Institute for Irrigation Management has just been established at Colorado State University. It is designed to provide an integrated approach to irrigation management by drawing upon the experience of a wide range of staff at the university which has been one of the leading institutions in this field. The Institute will benefit in particular from a specialist in legal aspects of water policy, a subject which is often not paid due attention in questions relating to irrigation and water management. Details of training programmes can be obtained from CIIM, Colorado State University, Fort Collins, Colorado 80523, USA.

Colorado State University is also home to the International School for

Agricultural and Resource Development which runs a number of training programmes, including one on the design and management of irrigation systems. Further details from ISARD, Colorado State University at the above address, telephone (303) 491-6627, telex 9109309011 CSU CID FTCN.

CEFIGRE (International Training Centre for Water Resource Management) BP 13, Sophia Antipolis, 06561, Valbonne Cedex, France, is running its first training course in English on *Management of Irrigation Schemes* from 13 October to 7 November 1986. The organizer, Ian Fox, is arranging teaching inputs from consultants practising in this field.

Silsoe College, UK, is running a series of short courses, mostly 3 to 5 days in length on a series of topics related to irrigation. A detailed prospectus can be obtained from: The Short Course Executive, Silsoe College, Silsoe, Bedford, MK45 4DT, UK Telephone Silsoe (0525) 60428, telex: 825072 Citech G.

The Mananga Agricultural Management Centre, in association with Silsoe College, is organising a four week course in Swaziland for experienced irrigation managers from 23 March - 17 April 1987. Scholarships are available. Those interested should write to: The Principal, MAMC, PO Box 20, Mhlume, Swaziland. Telephone Swaziland 31133, Telex 2320 WD, Swaziland.

Wye College of the University of London has developed an innovatory external course for students wishing to work for the MSc. and Diploma in Agricultural Development. This post-graduate programme has the advantage of students being able to live in their own countries and to work at their own pace. The development and operation of water resources is one of the options for study. Books and study materials are being prepared for the course which will be by correspondence. Further details can be obtained from Henry Bernstein, Director of the External Programme, Department of Agricultural Economics, Wye College, University of London, Ashford, Kent, TN25 5AH, England, UK, telephone (0233) 812401, extension 291, telex 96118 ANZEEC G Wye College.

5. PUBLICATIONS

a. New Books.

Putting People First: Sociological Variables in Rural Development ed M N Cernea, a World Bank publication, is finally available in a UK edition from the Oxford University Press. It contains important articles by Coward on rules, roles and rehabilitation, developing lessons from a study of indigenous farmer operated schemes; by Freeman and Lowdermilk on the "precarious partnership" between farmers and bureaucracy in large systems and on the special features of tubewells in which they advocate the decentralization of control to farmers; a phased framework for settlement projects by Thayer Scudder; Uphoff on means of securing participation in a broader rural development framework and Chambers on rapid rural appraisal. One of the most interesting articles is by Bagadion and Korten on the way farmer participation is organised before rehabilitation of small schemes in the Philippines, thus ensuring that there is a functioning farmer organisation to take over O&M. (This follows on from their Network Paper 4c, December 1980.) Other countries might usefully study how this effective programme was carried out. It would have been useful to have some analysis of increased staffing costs resulting from the employment of community organisers and discussion of whether these costs were offset by savings on O&M. Unfortunately, one must always apply cost-benefit analysis in selecting working methods. However, this text on sociological variables in development will fill an important gap for many people.

Management of Water Projects: Decision Making and Investment Appraisal OECD, Paris 1985, is the work of national teams from a number of OECD countries. It deals with all kinds of water projects, including irrigation. Mary Tiffen recommends it strongly to all concerned with planning and appraisal whether in aid agencies, national governments or consultancy firms. Amongst the many issues it tackles are risk and uncertainty considerations in water resource planning. We all know that the outcome of an irrigation project ten or twenty years on will be very different from that planned; this book discusses ways of incorporating this fact into planning. We all talk about the need to consult local people; this book discusses techniques for doing so.

An interesting example of interdisciplinary research is *Paddy Farmers, Irrigation and Agricultural Services in Malaysia: A Case-Study of the Kemubu Scheme*, Department of Sociology paper 11, Agricultural University, Wageningen, the Netherlands, 1984.

Melvyn Kay from Silsoe College, U K has produced a new textbook for students of irrigation: *Surface Irrigation: Systems and Practice* which is published by Cranfield, Bedford, 1986, pp142. Extensive use is made of photographs and diagrams to illustrate the points made in the text. While this book is aimed mainly at the practical man in the field, it is also likely to be of great value to those involved in irrigation, whether as an engineer or project manager. Most of the chapters deal with technical issues, such as the main methods of irrigation, land preparation and water structures, but the author continually draws the reader's attention to socio-economic factors, such as labour availability or farmer skills which will help determine the choice and effectiveness of different irrigation regimes. The last three chapters cover operation and maintenance and health problems arising from irrigation schemes. The book might have benefitted from a short bibliography so that particular topics could be followed up in more detail.

Rainwater Harvesting: The Collection of Rainfall and Runoff in Rural Areas is written by Arnold Pacey with Adrian Cullis and published by the Intermediate Technology Development Group, London 1986. It considers techniques appropriate for domestic water supplies and crop cultivation, through use of water running off surfaces, but excluding flood or spate irrigation. There are successful examples of runoff farming in India, Israel and North Africa. The author, however, cautions against unqualified enthusiasm for construction of such systems as a way of solving food production problems in semi-arid Africa and emphasizes the need for much more research and data collection on existing schemes, both on techniques and on crucial social organisation and management issues. In contrast to irrigation schemes, the author suggests that the main role of rainwater harvesting projects will be to increase crop reliability and food security in marginal areas rather than substantially raising yields and marketable surplus.

b. Journals.

Vol. 1, No. 1, 1986 has now been published of *Irrigation and Drainage Systems*, editor in chief M G Bos, International Institute for Land Reclamation and Improvement, PO Box 45, 6700 AA, Wageningen, The Netherlands (publisher Martinus Nijhoff). A paper by Franks discusses methods of making significant improvements in systems such as the Rice Canal systems in Pakistan, without drastically dislocating existing procedures. Coward and Uphoff feature again on farmer responsibilities and Chambers on night irrigation. There are more technical papers of flow measurement structures by Bos, Clemmens and Repogle and by Schaack on canal lining experience in the USA (including pipes). So many critical factors are locally specific that Schaack recommends evaluating all the main options against local conditions - the perennial challenge of irrigation design.

c. Reports and papers.

Those unable to afford the books and journals mentioned above, but still interested in improving farmer organisations for water management, might write for *Getting the Process Right: Improving Irrigation Water Management with Farmer Organisation and Participation* by Norman Uphoff, (Working Paper for the Water Management Synthesis II Project, Cornell University 1986). Uphoff starts by looking at the variety of forms that farmer organisations can take and the objectives pursued, such as increased output, reduced conflict and sustained system performance. He goes on to assess how well they have worked in the past in different contexts and provides considerable detail of experiences with irrigator groups on schemes in different parts of the world. Uphoff advocates groups of water-users covering say 20-40 hectares, containing some 15-25 farmers, representatives from which would meet at a higher level with scheme management. There might well need to be retraining of irrigation agency staff in order to accept greater farmer participation. (The Philippines study in the collection edited by M N Cernea suggests one model.)

There continue to be many reports on African irrigation.

Opportunities for Irrigation Development in Tanzania by A Mascarenhas, J

Ngana and M Yoshida, JRP Series No. 52, Institute for Developing Economies, Tokyo, 1985, provides a useful summary of irrigation development in Tanzania. It notes the overwhelming importance of small-scale traditional irrigated crop production in the country in terms of total irrigated area. There is a case-study of a traditional system contrasted with a formal scheme built in 1957. The authors attribute the collapse of the latter to the lack of any kind of organisation for the management of O & M and the unfounded belief that the local people would abandon their established way of life in order to take up residence as farmers on the scheme. They conclude that future developments must learn from traditional schemes in which the institutional aspects tend to be well-developed though population growth and increased demand is now creating conflicts within these.

Gunnar Sorbo's latest book on settlers of the Kashm el Girba scheme in eastern Sudan *Tenants and Nomads in Eastern Sudan: A Study of Economic Adaptations in the New Halfa Scheme*, Scandinavian Institute of African Studies, Uppsala 1985, pp 159, describes the low commitment felt by tenants to the scheme, which parallels that found in many other parts of sub-Saharan Africa, where neither project planners nor scheme management have taken account of the wide range of incomes and high returns obtained from traditional activities of settler populations. Declining yields, increased production costs and poor water supply combine to produce yields that for many farmers are below those needed to make ends meet. Many tenants have fallen heavily into debt, a situation aggravated by the low prices and long period of several years for cotton payments to be received by farmers. The rise in cotton producer prices in 1981-2 and faster payment of producers has eased the position somewhat though Sorbo considers it too early to judge the overall effects of these changes. For many, it has only been by pursuing a wide range of activities to supplement returns from irrigated farming that settlers have been able to survive.

A recent paper by Andrew Shepherd *Water, Pastoralism and Irrigation Schemes in Eastern Sudan: Development of the Butana Prairie* Papers in the Administration of Development No. 22, from the Institute for Local Government Studies, Birmingham University, focuses on the need for integrated planning of water supply, pastoral development and irrigation schemes at the regional level. It provides a valuable picture of the interrelated activities and uses made of resources by pastoralists, mechanised farmers and irrigation scheme tenants, who often also have substantial animal holdings. Copies are obtainable from Geo Books, Regency House, 34 Duke Street, Norwich NR3 3AP, UK.

Watering the Shamba - Current Public and Private Sector Activities for Small Scale Irrigation Development by E W Coward et al, WMS Report No. 40, April 1986, describes the results of a two month mission to investigate past experience with small-scale irrigation in Kenya and to formulate guidelines for USAID in developing new schemes and rehabilitating old ones. While small schemes (defined as those under 100 hectares, run and maintained by farmers) currently occupy a very small area of land in Kenya, the government has recently established Provincial Irrigation Units whose task is to provide technical expertise and other assistance to local farmers in developing their own small-scale irrigated operations.

The Small-scale Irrigation Development Project, Ministry of Agriculture, Cathedral Road, PO Box 30028, Nairobi, Kenya, is providing a series of manuals for this purpose. Roger Bloemers at this address has drafted the ones on "structures" and would like to send them to networkers willing to comment before they are finalised.

R E A Day of Silsoe College, UK, points out the need for proper technical design even on tiny schemes. He reported for the FAO in Rome and the Freedom From Hunger Campaign in Kenya on 4 very small schemes in Kenya. Only 1 showed any success, the others suffering from faulty technical design and inadequate plot size. One had the feeling that local people would never have designed them thus if consulted.

WMS Report No. 41, October 1985, by T.F Weaver et al examines for USAID *Strategies for Irrigation Development* in Chad. Lake Chad and the Logone and Chari Rivers provide considerable potential for irrigated crop production using groundwater, flood recession farming and development of the flood plains. The survey of existing irrigation schemes demonstrates the very serious effects of recent drought on both traditional and new irrigation systems. This report also considers the potential for wadi irrigation using hand-dug wells and small basin plots, but the authors consider there to be severe constraints to its expansion, due to the limited availability and high cost of water supply, the hazard posed to crops from sand invasion and the fragility of the environments in which such cropping is proposed.

In a *Study of Present Status and Proposed Development Strategy of Wadi Agriculture on Northern Darfur Region, Sudan* the author, S A Widanapathirana (in a report for the Ministry of Agriculture and Natural Resources) considers the potential for future wadi development in this drought vulnerable area where, nevertheless, substantial volumes of water flow seasonally. Current use of wadis is limited to small vegetable plots and a few large commercial farms, growing vegetables, tobacco and grain. The author notes the need to establish an effective structure for the management of water and land resources in wadis. It is suggested that this role be played by traditional leaders. In addition, it is recognised, as in the ITDG book noted above, that a lot of work needs to be done on designing appropriate channels and dykes to divert and hold water. At present, farmers have neither the tools nor the technical knowledge to do this work themselves.

We have also been sent a description with diagrams of a self-help community action programme, assisted by the Swiss Development Co-operation, involving a water percolation tank, a small irrigation system and soil conservation in a drought-prone area of India. Details from Action for Food Production, C-17 Community Centre, Safdarjung Development Area, New Delhi, India.

6. ODI LUNCHTIME MEETINGS

On 26 June, Robert Hunt from the Department of Anthropology, Brandeis University, Waltham, USA, spoke on *Farmer Participation in Irrigation Systems: Positive Identification of a Social Constraint.*

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Camilla Toulmin

18 August 1986

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IRRIGATION MANAGEMENT NETWORK

MEETING IRRIGATION SYSTEM RECURRENT COST OBLIGATIONS

Mark Svendsen

ODI/IIMI Irrigation Management Network 86/2b August 1986

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Please send comments on this paper either to the author or to

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Comments received by the Editor may be used in future Newsletters or Papers.

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MEETING IRRIGATION SYSTEM RECURRENT COST OBLIGATIONS

Mark Svendsen

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MEETING IRRIGATION SYSTEM RECURRENT COST OBLIGATIONS

Mark Svendsen

INTRODUCTION

The economic and fiscal viability of public irrigation systems in developing countries is currently receiving intense scrutiny from a variety of observers, policy makers, and practitioners.[1] These topics have recently been the subject of a critical report by the U.S. General Accounting Office (GAO, 1983) and two subsequent studies on irrigation system O&M and associated recurrent costs commissioned by USAID (Carruthers, et al, 1985; Easter, 1985). Another major study on a similar set of topics has just been completed at the International Irrigation Management Institute (IIMI) with support from the Asian Development Bank (ADB, 1985). Recurrent costs have also been treated extensively in recent editions of this newsletter and in a number of other papers and reports (ODI, 1985; PRC/CHECCI, 1985; DAI, 1984; Prasad and Rao, 1985; Rao, 1985).

The purpose of this paper is to examine the means of meeting the recurring obligations entailed in operating and maintaining public irrigation systems. As used here, "cost recovery" refers only to the recurring costs of operating and maintaining existing systems and not to the original capital investment in them, as few countries outside East

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[1]The systems considered in this paper, as in most writing on the topic, are medium and large-scale government-owned systems where primary management responsibility rests with a government irrigation agency.

Asia make a serious attempt to recover the capital costs of large-scale public irrigation systems from the direct beneficiaries.[2]

FEES, FUNDING AND PERFORMANCE

Given that the performance of public irrigation systems is quite often disappointing, let us ask what impact irrigation fee policies can have in making improvements. To set the stage, it is useful to focus on two important connections that are often assumed in the traditional chain of argument that leads from irrigation fee assessment to effective O&M.

Irrigation Fees and Efficiency

The first of these is the connection between the level of irrigation fee charged to farmers and efficient resource (water) allocation. Nothing is closer to the heart of Western economic theory than the idea that prices mediate between supply and demand and, appropriately set, result in the efficient allocation of resources. We do economic theory grave' injustice, though, when we expect it to perform this minor miracle on commodities that are not paid for on a per unit basis.

All depends on a rational decision-maker choosing to buy (and apply) more or less of an item (input) based on its cost and his return. If the price paid is divorced from decisions about how much to buy, then "price" cannot perform a rational allocative function. In fact, the effect tends to be exactly the opposite of that intended. There is a good analogy with a 30-day rail or airline pass which allows unlimited travel within that period for a fixed payment.

To assess the role of pricing mechanisms in achieving efficient water use, it is necessary then to ask to what extent irrigation water is actually delivered and paid for on a per unit basis. There are a wide range of water pricing policies in operation in different countries and schemes, but virtually all of them are based on some measure of land area

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[2] A case in point is the new (1984) cost recovery policy in Sri Lanka which is presented explicitly as a charge to farmers to pay for proper operation and maintenance of their system (ECL and DPCL, 1985).

rather than on water actually used. Rates may be adjusted to take account of season, crop grown or the source of water used, but it is very rare to find true volumetric delivery of irrigation water by public agencies anywhere in the developing world. Moreover, the cost of implementing such a system for individual users is usually prohibitive.

One interesting aspect of such allocational and pricing arrangements is they assume that water will be allocated by administrative controls, such as the warabandi system in India, rather than by the price mechanism, since the price charged is irrelevant to the efficient operation of the controls.

The upshot of this is that it is virtually impossible to construct a plausible scenario whereby the price that is set for irrigation water has some incentive effect on water use decisions at the tertiary or "on-farm" level without postulating significant changes in the way that water is generally measured and delivered or in the way that farmers and the irrigation agency are organized and interact with each other[3].

O&M Budgets and Performance

The second connection commonly assumed is the one between the regular (non-developmental) budget provided to an irrigation agency and the agency's effectiveness in keeping the irrigation systems in its charge in good repair and highly productive. Unfortunately, this is another area where we have a dearth of empirical data.

In its absence, we can but speculate. However, given the great divergence between what irrigation agencies say (and perhaps think) they do to manage systems, and what empirical studies have shown to happen in practice, it is reasonable to assume that larger budgetary outlays to irrigation agencies from the central treasury would not result in commensurate improvements in system performance. It is likely, instead, that agencies would simply undertake "more of the same" and multiply

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[3]This, of course, assumes that farmers do feel some obligation to pay whatever fees are levied, which may be the case but often is not. If this obligation is not compelling, the entire discussion is moot.

actions that are often out of touch with field reality and demonstrably ineffective.

This is not to say that budgetary allocations are always adequate; in many cases they clearly are not and must be increased if system performance is to improve[4]. Rather, it is to argue that "structural" changes will usually be necessary if increased allocations are to be used effectively to improve system performance. These generally go beyond the commonplace remedy of more staff training and include (a) a clear-sighted look at how the systems are actually operating now, (b) a commitment to improved system performance and an incentive structure that supports that commitment, and (c) a recognition that agency control, in fact, often stops short of the nominal "transfer point" and that functional articulation with the farmer-managed end of the system is essential for effective overall management.

ALTERNATIVE POLICIES

Rather than concentrating on questions of how much higher we should raise irrigation fees and how we can get farmers to bear a larger share of the costs, it is time to take a more pragmatic and comprehensive approach to this issue. Such an approach has two fundamental thrusts, one of which involves devolution of certain responsibilities to farmers and the second a rethinking of our attempts to recover recurrent costs, including the reasons we do so and the methods we employ.

Devolve Responsibility[5]

In sharp contrast to this tendency toward increasing (nominal) central control, it seems far more sensible to explore the possibilities for a reduction in direct central authority. If one considers that the number

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[4] Mary Tiffen points out that while some countries make adequate budgetary allocations for O&M, the division among categories, eg. staff salaries, transport and communications, materials and equipment, is inappropriate, with the salary line typically being over-large. This is another productive area for exploration.

[5] This section draws heavily on Coward and Uphoff (1985), though ideas have been recast to some extent.

of control points in a large irrigation system increases in rough geometric fashion as one moves down through the system, it becomes quickly apparent that the costs involved in extending control downward will compound very rapidly. Conversely, the benefits of moving irrigation department control up by one level (e.g. from the "minor" to the "distributary"), in terms of cost savings to the irrigation agency, are equally substantial. It is worthwhile to remember that there are vastly more farmers practising irrigation management than there are civil servants in the irrigation scheme bureaucracy.

The first part of a sound solution strategy involves devolving responsibility <u>and control</u> to farmers, to the maximum extent possible. As put by Coward and Uphoff (1985) in their excellent discussion of this topic, this involves "reducing certain direct costs to government by collaborative arrangements with water users so that the latter mobilize more of their own resources to implement specified O&M activities."

That this is a reasonable objective is demonstrated by three separate bodies of evidence, they argue. First, there are many irrigation systems that farmers successfully manage and maintain with little or no government assistance. These are usually small systems but some cover thousands of hectares. Second, there are also examples of farmer groups assuming a substantial role in O&M activities within large government-administered irrigation systems. Third, there are several innovative programs underway in Asia which increase farmer involvement in O&M activities. Preliminary indications from several of these programs are extremely encouraging, although problems remain to be solved.

It is critically important to distinguish this recommended devolution from past programs where "responsibilities" have simply been assigned to farmers or farmers' groups, whether or not there were any farmers' groups and whether or not (usually not) there was any perceived advantage in the deal from the farmers' point of view. It is imperative, if devolution is to be successful, that the program be based on a balanced package of benefits that is attractive to both farmers and irrigation agency officials.

Equally important is the need to treat the question of which responsibilities should be turned over to farmers as an empirical one and not simply accept the traditional "above and below the turnout" demarcation. Evidence assembled by Chambers (1984) suggests that farmers have both strong interests and useful contributions to make above the turnout. This finding has major implications relating both to how attractive the devolution will be to farmers and to the level of cost savings to the irrigation agency that will result. Likewise, both maintenance and operations must be included in the farmers' sphere of responsibility if the arrangement is to be acceptable and effective.

One extremely attractive aspect of a genuine two-tiered approach to irrigation system management - one involving both the government irrigation agency and organized farmers - is that it would permit the employment of irrigation fees as a tool for achieving more efficient allocation of the water resource, an effect that is virtually impossible to realize under current organizational modes. It would do this by permitting the irrigators' group to act as a bulk purchaser of measured volumes of water from the irrigation agency, which it would then retail to its members. In doing this, it would function in a role similar to that of irrigation districts or ditch companies in the American West.

Rethink Cost Recovery

Chaudhry (1985) in his discussion of irrigation water pricing policy in Pakistan, identifies three major objectives that can be addressed through pricing decisions. He defines these as efficiency - allocation of irrigation water according to equi-marginal[6] principles, equity-reduction of the income distribution gap between different socio-economic groups, and financial - recovery of (capital and) operational costs of the irrigation system. In practice, he acknowledges, it is difficult to reach all three objectives at the same time.

Arguments made earlier demonstrate the irrelevance of pricing to this first objective under methods of water measurement and delivery

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[6] That is, allocation such that the cost of an additional unit of water is equal to the value of the extra output it produces.

prevailing throughout virtually all of the developing world. A rational and pragmatic approach to the recurrent cost question over the short run would thus abandon rhetoric that attributes significant "efficiency" benefits to pricing decisions. Doing this simplifies the task of developing appropriate cost recovery policies and clarifies our thinking on the problem.

Equity considerations are less easy to dismiss so summarily. On the one hand, there are conceivable ways to address them with pricing decisions. On the other, such measures have not proven particularly effective in the past. Differential pricing schemes for the head and tail of systems, for example, could have an impact on income distribution among farmers served by the system. Implementing such a scheme, however, would tend to legitimize and institutionalize a system of unequal access to water within the irrigation scheme, which is certainly not a desirable longer-range outcome.

Moreover, water pricing is not a particularly powerful tool for achieving equity ends - not nearly so effective as land or tenurial reform, for example. Thus, although some interesting experiments are underway, some involving the assignment of water shares on bases other than land ownership, these are probably not generally applicable measures for large public irrigation systems at the present time.

It is the third objective, the financial one, that seems to be the most powerful, the most timely, and the most promising one to pursue at the present time. This is true for several reasons.

A number of Asian countries, e.g. Thailand, the Philippines, Pakistan, Sri Lanka, Indonesia, are expressing serious concern about the recurrent cost burdens they currently bear and some have already taken steps to reduce these costs.

More intensive management regimes, needed to maintain present rates of growth in agricultural production as the land frontier closes, will push these burdens still higher.

> There are promising approaches available for addressing financial problems which have potential for gaining the favour of all three major participant groups - host country governments, farmers, and donor agencies.

> There are potentially strong indirect linkages between revenue generation measures on the one hand and improved system performance on the other.

The immediate objective under such a strategy involves bringing revenues and O&M expenditures more into line with one another. This can be done either by reducing the costs of O&M services - devolving responsibility for some O&M tasks to farmers and farmers' associations and rationalizing the tasks actually performed by irrigation agency personnel - or by increasing the budgets of the irrigation agencies. Pursuing both objectives simultaneously would probably be necessary in some cases and might result in a more effective program. An appropriate policy approach would involve a phased plan and a timetable for doing this.

But raising operating budgets is not an easy task. Accepting the strong recommendation in the Carruthers report (1985) that direct beneficiaries bear system O&M costs wherever possible, this task becomes, in part, one of increasing the revenues raised by the levy of irrigation fees.

It seems clear that in a great many cases, fees charged to farmers can and should be raised. It is equally clear, though, that simply raising fees is not the whole solution. A number of fundamental problems would remain to thwart most of the good that such a step could do.[7]

> First, fee levels are not revenue levels. It is total collections that actually pay for O&M services and changes in collection rates, often low anyway, are likely to be inversely related to changes in fee levels.

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[7]Many of these points were suggested by Carruthers (1985) and Easter (1985).

Second, revenue collected and paid to the national treasury has no particular affinity for the agency which "generated" it. It may find its way back to support O&M, but it may not.

Third, if the irrigation agency is the collection agent and revenue is retained by the national treasury, there is little incentive for aggressive collection efforts. Quite the contrary, collection responsibilities will be regarded by scheme staff as a burdensome diversion from "real" duties.

Fourth, costs of collection must be considered, since net, not gross, revenue is the legitimate yield of the process.

Fifth, the irrigation agency is still at the mercy of the political budget-setting process, in which O&M functions are often extremely vulnerable during any belt-tightening exercise.

Lastly, and perhaps most importantly, simply raising fees does not take advantage of the potential for linking users directly with the service-provider in a way that generates accountability - perhaps the most valuable attribute of an irrigation management system.

Some examples will help to illustrate each of these points.

Fees and revenues. (a) In the largest irrigation system in the Philippines, the Upper Pampanga River Integrated Irrigation System (UPRIIS), it was estimated in the late seventies that collection of 70% of the service fees due was necessary to cover O&M costs. Actual collections were only about half of that level. In part this resulted from a precipitous plunge in collection rates, from 64% to 27%, following a sharp increase in fee levels in 1975 (Cabanilla, 1984). (b) In Nepal, where water charge assessments are well below the level needed to cover adequate system O&M, actual collections are insignificant (Shrestha et al, 1984). (c) In Bihar in India, actual collection percentages have declined from around 28% in 1977-78 to only about 17% in 1981-82 (Prasad and Rao. 1985). (d) In Morocco, about 43% of amounts due are currently being collected (IBRD, 1986). Although there are exceptions to this pattern, it is a depressingly familiar one across much of the world.

Revenues and budgets. The interesting cases here are the exceptions to the general pattern of irrigation revenues disappearing into general national accounts. The Philippines offers an example. There the National Irrigation Administration (NIA) was constituted as a government-chartered corporation in 1964 and was charged with recovery of O&M costs and reimbursement of construction costs over a 25-year period. Revenues collected from farmers flow to a general account not specifically earmarked for O&M, but are retained within the agency. For major systems, no real attempt has been made to recover capital costs while the obligation to recover O&M costs has been taken seriously. While collection percentages are not always high, they do comprise perhaps the single most important measure of system performance in the eyes of NIA personnel - affecting performance evaluations of technicians, water delivery priorities to villages, and ratings received by entire districts and systems (Svendsen and Lopez, 1980).

In Sri Lanka, where fees have been low or non-existent, a dramatic shift in policy has recently taken place. In 1984, an annual fee (initially Rs. 100 per acre of paddy land) was imposed in major irrigation systems. The most interesting feature of this arrangement is that the amounts raised from farmers, as well as supplementary government contributions, are to remain with the scheme in which they are collected and are to be earmarked specifically for operation and maintenance of that scheme. Furthermore, farmers are to have a voice in deciding how these funds are spent.

This is an exciting and innovative approach which eliminates some of the fundamental liabilities of traditional systems of O&M cost recovery. It also capitalizes on an observation by Small (1982) that farmers are more likely to pay specific fees for specific purposes than general water fees. Early results are mixed and, while collections are significantly higher that the less-than-two-percent rate prevailing prior to 1984, only two districts had collection rates greater than 15% during the first year of the new approach (Easter, 1985), and it is too early to tell how effective the program ultimately will be.

Perhaps the most promising version of this approach is found when it is combined with a system of strong farmer water user organizations. The large Gal Oya system in the southeastern part of Sri Lanka has recently been the site of an innovative and highly successful program of farmer organization. Irrigator associations of 15-25 farmers each have been constituted and a four-tiered structure of farmer organizations set up covering over 25,000 acres. Uphoff (1985) reports that in the Gal Oya area, collections for the second year of operation under the new policy have now risen to 80% - the highest in the country. Moreover, budgets and plans for spending these receipts are reviewed by farmers' representatives. Unfortunately, current political turbulence in Sri Lanka may make it difficult to implement this innovative programme effectively. However, this combination of organized farmer groups and decentralized handling of funds earmarked specifically for O&M could provide an important and attractive model for application elsewhere.

Incentives for collection. This issue is really a corollary of the preceding one. Logic suggests it is unrealistic to expect irrigation department employees, whose primary responsibility is to operate and maintain irrigation systems, to be diligent in collecting money from farmers for the national treasury. Peabody (1985) has concluded, following his participation in the review of cost recovery programs led by Carruthers, that poor collection rates are more a function of irrigation departments' unwillingness to collect than of farmers' unwillingness to pay.

Costs of collection. Little data is available addressing this question, since the issue has not typically been framed in these terms. Scattered estimates of collection costs exist, however. Malhotra (1982) indicates that an unacceptable one-tenth of the total water revenue in agriculturally-rich Haryana state in India is being spent on the field establishment engaged in preparation of the water bill. This presumably does not include the actual costs of collection and accounting.

An even more striking picture is presented by Prasad and Rao (1985). Using figures for the Indian state of Bihar, they show that costs of collecting irrigation fees in that state, as a percentage of actual collections, increased from an already substantial 46% in 1977/78 to 84%

in 1981/82. The net contribution of irrigation revenues to meeting O&M costs is thus virtually nil.

Another case from the Philippines emphasizes the importance of this factor. In an attempt to increase collections, policy was modified in 1978 to stress collection of fees in kind. This in effect borrowed a page from the book of one of the most successful collection agents in the rural Philippines - the village money-lender - by allowing the collection of fees in palay (paddy) in farmers' fields immediately following the harvest. This measure, while contributing to significantly increased collections, was later de-emphasised because of the costs and problems associated with handling large quantities of grain. The practice of indexing the amount of fees paid in cash to measures of palay, in force since 1975, remains, however, and has provided an automatic and politically acceptable means of increasing fees over time.[8]

Budget cutting. It is almost axiomatic that funding for operations and maintenance are early casualties during times of financial stringency. This has happened recently in Peru and the Dominican Republic (Carruthers, et al., 1985).

A more extreme case is that of the National Irrigation Administration in the Philippines. While NIA has always had a mandate to recover costs from irrigators, in 1980, in the midst of serious national economic and financial problems, O&M subsidies from the national treasury were stopped altogether. The fact that around 90% of the total O&M cost is now made up of salaries and wages indicates that negligible amounts are being spent on equipment operation, essential for effective O&M (Sison and Guino, 1983). In the case of the Philippines, however, the results of the withdrawal of subsidies have not been entirely negative, as described below.

Accountability. Because NIA has been concerned with cost recovery since its inception and has experimented with a variety of methods for

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[8]Although the real retail price of rice has declined by more than 40% since 1973 (Ferguson, 1986), irrigation fees, in nominal terms have increased.

increasing its collections, it was in a position to respond in some positive ways to the financial stringency forced upon it. This response has followed the two fundamental approaches advocated in this paper-reducing costs (in part by devolving responsibility to farmers' associations) and increasing fee collections.

In attempting to reduce operating costs, NIA's strategy has included transferring complete responsibility for some of the smaller nationally-owned systems (those under 1000 hectares) to farmers, handing over responsibility for tertiary-level O&M to Farmers' Irrigator Associations (FIAs), and contracting out maintenance responsibilities to FIAs on a fee basis (Carruthers et al., 1985). All of this has allowed NIA to reduce field staff levels.

Other cost cutting measures have also been undertaken. In one system in Laguna province visited by the author in 1984, pumps purchased under an ADB credit and installed to augment water already delivered to the system by gravity flow have been idle since their installation several years ago. NIA engineers indicate that operating the pumps would increase the average cost of water delivered in the system to a level well beyond what could be recovered from the users. They indicated also that staff members have been transferred out of their system to bring operating costs into line with revenues.

These measures have had a demonstrable effect. On a nation-wide basis, operating expenditures, which had risen from 107 M pesos in 1978 to 245 M pesos in 1981, had fallen back to 182 M pesos by 1983 (Carruthers et al., 1985).

The second thrust, that of increasing revenues from irrigation fee collections, has also relied heavily on the FIAs - in this case to serve as collection agents. Systems of collection incentives have been established to return a portion of the fees collected to the collecting FIA, with the fraction of the rebate increasing as the FIA's collection efficiency increases.

NIA also recognizes connections between collections and the quality of irrigation service provided to farmers, the physical condition of its systems, and the level of contact and amiability of the relationships between its personnel and farmers. Implications of this recognition are a stress on system rehabilitation, a concern with farmer satisfaction, and an emphasis on more extensive contact between system officials and farmers. The impact of these measures on collection percentages is not clear at this time, although individual components of the approach have been shown to be effective in other situations.

Given the central role of the FIAs in both thrusts, it is important to realize that programs have been underway in the Philippines since 1975, aimed at learning to organize farmers into viable and self-reliant irrigator associations. Early efforts were carried out in small community-owned schemes and this work is among the most successful attempted anywhere in Asia. Efforts were later extended to larger national schemes with some modifications and with more mixed results. Work on both programs continues.

It would be a mistake to expect immediate results from a program such as this. In the Philippines, important elements have come together in a timely and fortuitous way, some of which began many years before the country's current financial difficulties arose. Over the middle-range future, the prospect of establishing O&M on a self-sustaining basis is promising. It is an experience that bears close monitoring as it unfolds, both for its own sake and for the lessons it may have to offer other countries in the region and beyond.

CONCLUSION

In the traditional chain of assumptions connecting increased irrigation fees to improved system performance, one prominent link appears to be broken and another unreliable. The first is the linkage between fee levels and their incentive effect on efficient use of irrigation water by farmers. Given current patterns and practices of water delivery throughout the developing world, a convincing case for such a linkage simply cannot be made.

The second link is the one relating increased funding for a government irrigation agency and improved O&M (and improved system performance).

There is reason to doubt the effectiveness of this relationship in many cases, and it is, at best, an unproven one. The implication is that while augmenting revenue flows to an irrigation organization, we must, at the same time, also analyze its functions and roles with respect to their effectiveness in increasing system output and extending its lifetime.

This leads to the proposition that the fee paying relationship established between farmers and the irrigation agency is the critical factor in improving system performance rather than the level of the charge assessed. The essence of this relationship is a mutual dependency - the irrigation agency being dependent on fee payments for its operating budget and farmers relying on the agency for reliable water deliveries to their tertiary units.

There are two fundamental approaches to the problem of imbalance between irrigation agency revenues and the costs of adequate O&M. These are (a) to reduce costs and (b) to raise revenues. For greatest effect, both should be undertaken together.

To accomplish the first of these, some form of farmer organization will be necessary in most cases. In the case of the second, simply increasing fees is not enough. It is necessary also to consider collection efficiencies and costs, the path that revenues take in reaching the irrigation agency, the presence or absence of supplemental subsidies from the national treasury, and a number of other factors.

If there is a simple vision of an ideal case, it might look a bit like a public utility for irrigation water. It would see itself as providing an irrigation service, would generate most of the revenue it needs directly from its users (in this case, probably user groups) and bear some accountability to the public in general and to its user groups in particular. We may be a long way from such a vision in most cases. However, in one country, the Philippines, a promising start had been made down just such a road before the recent economic and political difficulties. It will be interesting to see if that journey is now resumed.

REFERENCES

Asian Development Bank. 1985. Technical assistance for a regional study on irrigation service fees. ADB, Manila.

Cabanilla, Liborio S. 1984. Study of operation and maintenance problems in irrigation: the Philippine case. Case study prepared for the Office of Technical Resources, Bureau for Asia and Near East, USAID, Washington, DC 20523.

Carruthers, Ian D., et al. 1985. Irrigation pricing and management. U. S. Agency for International Development, Washington, DC, 20523.

Chambers, Robert. 1984. Farmers above the outlet: irrigators and canal management in South Asia. Draft Paper. Institute of Development Studies, Sussex.

Chaudhry, M. Aslam. 1985. An evaluation of existing irrigation water pricing policy in Pakistan. PRC Engineering/Checchi, Islamabad.

Coward, E. Walter Jr. and Norman Uphoff. 1985. O&M costs in irrigation: reappraising government and farmer responsibilities and rights. Paper prepared for the USAID/Asia Bureau Regional Conference for Agricultural and Rural Development Officers, 22-26 April, Los Banos, Philippines.

Easter, K. William. 1985. Recurring cost of irrigation in Asia: operation and maintenance. Bureau for Asia and Near East, U. S. Agency for International Development, Washington, DC, 20523.

Engineering Consultants Ltd. and Development Planning Consultants Ltd. 1985. Study of recurrent cost problems in irrigation systems: Sri Lanka. Case study prepared for the Office of Technical Resources, Bureau for Asia and Near East, USAID, Washington, DC 20523.

Ferguson, Carol. 1986. Intensification of Philippine gravity irrigation: infrastructure costs and facilities in government systems, and modeling NIA water allocation and distribution. Paper presented at the Forum on Irrigation Systems Research and Applications, Cornell University, Ithaca, NY 14853. 13-15 May.

IBRD. 1986. Report and recommendation of the president of the International Bank for Reconstruction and Development to the executive directors on a proposed loan in an amount equivalent to US$46.0 million to the Kingdom of Morocco for a large scale irrigation improvement project. IBRD, Washington.

Malhotra, S. P. 1982. The warabandi system and its infrastructure. Central Board of Irrigation and Power publication no. 157. New Delhi.

Overseas Development Inst. 1985. Irrigation management network paper 11e. Agric. Admin. Unit, ODI, London.

Peabody, N. S. P. 1985. Debriefing at AID/Washington on Irrigation Pricing and Management study conducted by Devres, Inc. 22 October.

Prasad, Kamala and P. K. Rao. 1985. On irrigation pricing in India. Mimeo. Harvard University, Cambridge, MA.

Rao, P. K. 1984. On cost recovery and irrigation water pricing. Irrigation management network paper 10f. Agric. Admin. Unit, ODI, London.

Shrestha, T. B; S. K. Shkya, and M. M. Shrestha. 1984. Study of operation and maintenance problems in Nepalese irrigation projects. Case study prepared for the Office of Technical Resources, Bureau for Asia and Near East, USAID, Washington, DC 20523.

Sison, J. and R. Guino. 1983. An assessment of costs and performance of various types of irrigation systems in the Philippines. Paper prepared for IFPRI. Quoted in Cabanilla, 1984.

Small, L. E. 1982. Investment decisions for the development and utilization of irrigation resources in Southeast Asia, Report No. 26. A/D/C, New York. Quoted in Prasad and Rao, 1985.

Svendsen, M. and E. Lopez. 1980. Six rotational areas in the Penaranda River Irrigation System. Technical Report no. 2 on the determinants of developing country irrigation project problems. Cornell University, Ithaca, NY.

U.S. General Accounting Office. 1983. Irrigation assistance to developing countries should require stronger commitments to operation and maintenance. GAO, Washington, DC.

Uphoff, Norman. 1985. Executive summary for trip report on farmer organization program in Gal Oya, Sri Lanka: July-August 1985. Rural Development Committee, Cornell Univ., Ithaca, NY. Mimeo.

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IRRIGATION MANAGEMENT NETWORK

COMPUTERS IN IRRIGATION MANAGEMENT:

A. AN APPLICATION OF LOTUS 1-2-3 SOFTWARE TO IRRIGATION DATA MANAGEMENT

Tom S Sheng

B. THE ROLE OF SIMULATION EXERCISES IN TRAINING IRRIGATION MANAGERS

Laurence E D Smith

ODI/IIMI Irrigation Management Network 86/2c August 1986

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COMPUTERS IN IRRIGATION MANAGEMENT

A. AN APPLICATION OF LOTUS 1-2-3 SOFTWARE TO IRRIGATION DATA MANAGEMENT

Tom S Sheng

B. THE ROLE OF SIMULATION EXERCISES IN TRAINING IRRIGATION MANAGERS

Laurence E D Smith

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A. AN APPLICATION OF LOTUS 1-2-3 SOFTWARE TO IRRIGATION DATA MANAGEMENT

Tom S Sheng

Methodology

With increasing frequency, developing countries are turning to microcomputer technology for a wide range of applications. Today, more than 30 countries are using microcomputers in irrigated agricultural development projects to increase the capabilities of their project management. Microcomputers are becoming an integral tool of irrigation system management, especially for data processing and analysis.

During a recent short-term technical assignment to Sri Lanka, I assisted the project staff, who are conducting a two-year diagnostic analysis of an irrigation system, in designing worksheet models using Lotus 1-2-3 software to much more rapidly analyse water supply and distribution in the Parakrama Samudra Scheme in Polonnaruwa. Part of the engineering data collected during the 1985 _yala_ (dry season) consists of approximately 3,000 staff gauge readings from 31 selected gauging stations on thee system. Three worksheet models were built to accelerate the calculations for the water supply and distribution analysis. With the graph capability of the Lotus software, the data also could be easily presented in a visual format.

The first model, flow rate, was designed to accept the staff gauge readings from the monitoring stations and calculate the corresponding flow rates. Once the staff readings are entered, the worksheet automatically computes the flow rates (in cusecs and cumecs), average flow, and standard deviation for each gauging station over the study period. An example of the flow rate model is presented in Table 1.

Table 2 shows the model for calculating water duties for each channel based on the design, estimated and actual measured command areas. Average water duty and standard deviation are also calculated for each canal over the study period. All these calculations are done automatically by the worksheet using the information calculated from the flow rate worksheet.

The third worksheet, water supply, was formulated to compute the daily water supply (in/ac/day) and cumulative water supply (in/ac) for each studied channel. Water supply rate and average water supply over the study period for each channel are also calculated. This worksheet, as shown in Table 3, performs the calculations based on the results provided by the two previous worksheets.

The most important feature of the Lotus 1-2-3 software is the graph option which allows the creation of visual presentations of data. In this case, Lotus 1-2-3 was used to turn flow rates over time into inflow hydrographs (Figure 1). In additions, several other graphs regarding water supply, cumulative supply, and water duty can be generated to clarify relationships among channels and water distribution trends that might not be seen. Examples of average and cumulative supply graphs are shown in Figures 2 and 3.

Within 16 days, my Sri Lankan counterpart and I were able to complete the preliminary engineering analysis. Without the Lotus worksheet model, it would have been very difficult to analyse the large data set in such a short time. In conclusion, worksheets on microcomputers provide a rapid and reliable data analysis tool in water management with responsive results.

<u>Note</u>

Dr K Sanmuganathan of Hydraulics Research, points out the usual need for accuracy in the data fed into such programmes. This is a good point since the ease with which graphs can be produced can lead people to forget the old computer warning "garbage in - garbage out".

On the other hand, if staff know their data is going to be utilised, they are more motivated to collect it carefully. A tool which provides the means for quick analysis is also an aid for monitoring; it should be easier to detect gauging stations which are throwing up readings at variance with others in the system, and to investigate the cause.

Mary Tiffen

Table 1. An Example of the Flow Rate Model

Diagnostic Analysis
Cultivation Season: Yala 1985
Tank Name: Parakrama Samudra

	D1 Main Canal		
Date	H (ft)	Q (cfs)	Q (cms)
Jun 3	3.800	345.000	9.769
Jun 4	3.800	345.000	9.769
Jun 5	3.900	370.000	10.477
Jun 6	3.900	370.000	10.477
Jun 7	3.800	345.000	9.769
Jun 8	3.800	345.000	9.769
Jun 9	3.800	345.000	9.769
Jun 10	3.800	345.000	9.769
Jun 11	3.800	345.000	9.769
Jun 12	3.800	345.000	9.769
Jun 13	3.800	345.000	9.769
Jun 14	3.800	345.000	9.769
Jun 15	2.000	110.000	3.115
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
Aug 24	4.000	390.000	11.044
Aug 25	4.000	390.000	11.044
Aug 26	3.900	370.000	10.477
Aug 27	3.500	280.000	7.929
Aug 28	3.400	260.000	7.362
Aug 29	3.300	242.000	6.853
Aug 30	3.300	242.000	6.853
AVE.	3.727	342.693	9.704
STD.	0.537	80.765	2.287

Table 2. An Example of the Water Duty Model

Diagnostic Analysis
Cultivation Season: *Yala* 1985
Tank Name: Parakrama Samudra

	D1 Main Canal		
Command Area (acres):			
a. Design			16000.000
b. Estimated			20000.000
c. Actual Measured			Not Available
Date	qa (cfs/ac)	qb (cfs/ac)	qc (cfs/ac)
Jun 3	0.022	0.017	
Jun 4	0.022	0.017	
Jun 5	0.023	0.019	
Jun 6	0.023	0.019	
Jun 7	0.022	0.017	
Jun 8	0.022	0.017	
Jun 9	0.022	0.017	
Jun 10	0.022	0.017	
Jun 11	0.022	0.017	
Jun 12	0.022	0.017	
.	.	.	
.	.	.	
.	.	.	
.	.	.	
.	.	.	
Aug 24	0.024	0.020	
Aug 25	0.024	0.020	
Aug 26	0.023	0.019	
Aug 27	0.018	0.014	
Aug 28	0.016	0.013	
Aug 29	0.015	0.012	
Aug 30	0.015	0.012	
AVE.	0.021	0.017	
STD.	0.005	0.004	
AVE-ac/cfs	46.689	58.361	

Table 3. An Example of the Water Supply Model

Diagnostic Analysis
Cultivation Season: Yala 1985
Tank Name: Parakrama Samudra

D1 Main Canal			
Command Area (acres)			
a. Design			16000.000
b. Estimated			20000.000
c. Actual measured			Not Available
Date	qb (cfs/ac)	db (in/ac)	Cum. db (in/ac)
Jun 3	0.017	0.411	0.411
Jun 4	0.017	0.411	0.821
Jun 5	0.017	0.411	1.232
Jun 6	0.019	0.440	1.672
Jun 7	0.019	0.440	2.112
Jun 8	0.017	0.411	2.523
Jun 9	0.017	0.411	2.933
Jun 10	0.017	0.411	3.344
Jun 11	0.017	0.411	3.754
Jun 12	0.017	0.411	4.165
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
Aug 26	0.019	0.440	34.668
Aug 27	0.014	0.333	35.001
Aug 28	0.013	0.309	35.311
Aug 29	0.012	0.288	35.599
Aug 30	0.012	0.288	35.887
AVE.	0.017	0.408	
STD.	0.004	0.096	
AVE-ac/cfs	58.361		
Rate (in/ac/day)			0.403

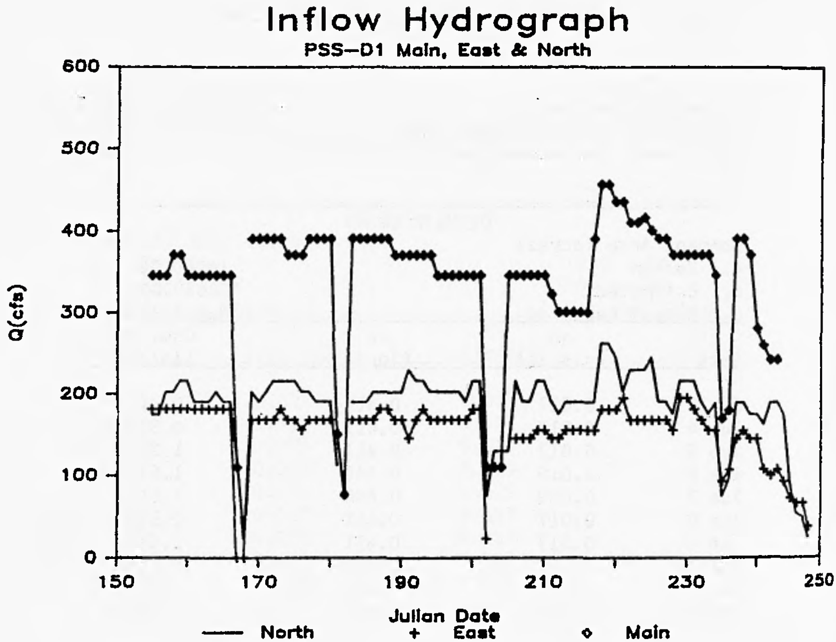

Figure 1. An Example of 1985 Inflow Hydrograph for D1 Main, East and North Canals of Parakrama Samudra Scheme.

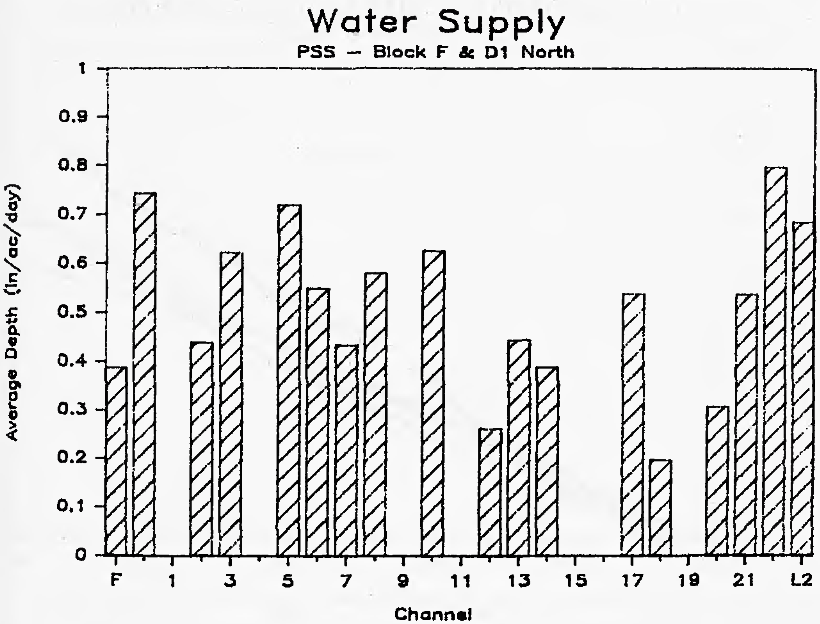

Figure 2. An Example of Average Water Depth Supplied per Acre over 1985 Dry Season for Block F and Each Distributary Channel Along D1 Main Canal of Parakrama Samudra Scheme.

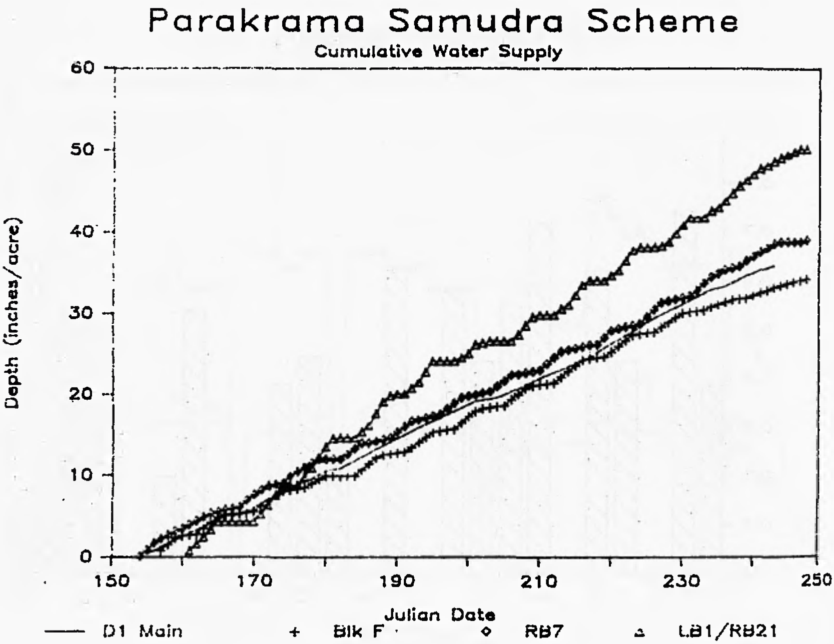

Figure 3. An Example of Cumulative Water Supply Over 1985 Dry Season for Several Selected Channels of Parakrama Samudra Scheme.

B. THE ROLE OF SIMULATION EXERCISES IN TRAINING IRRIGATION MANAGERS

Laurence E D Smith

1. Introduction and Definitions

It is necessary to define the terms simulation and games in the context of training exercises for irrigation managers. The distinction between the two in this text are based on the definitions below. When such exercises are being considered in a broader context the term "simulation exercises" is intended to include both simulations and games.

Simulation: A simulation attempts to describe or imitate a real situation as accurately as possible. Generally it will have a technical or procedural core which is specified in detail. The objective of a simulation is to improve understanding of the reality being described and to develop technical and managerial skills.

Game: A game may be an abstraction from reality. Generally involving role-playing, participants in the game attempt to achieve an internal objective. The game will have one or more external objectives: eg. to provide illustrations of the real situation that help teach a lesson, or to develop other skills eg. team work, presentation, confidence etc. A game may, if desired, incorporate the social context to the situation.

There are deficiencies in management science in relation to the complex area of rural development in the less developed world. No single management theory has universal applicability because of cultural and economic differences. Management games can focus the mind on the complex inter-relationships and facilitate the weighting of priorities. Such exercises enable the simulation of, for example, time pressure on decision making, interview situations, team work, presentation techniques and working with inadequate data sets, issues that are essential for good training of managers but which are rarely covered in formal courses. Games and simulations can provoke questioning attitudes and debate, particularly through role-playing. This is extremely valuable in cultures where such attitudes are not usually openly expressed or where dealing with sensitive issues, for example corruption, farmers' incomes or their asset/liability position.

The River Wadu Irrigation Project Planning Exercise, I D Carruthers(1), incorporates these factors and is found to be particularly useful in drawing together the theoretical and applied elements of a course in project identification, planning and appraisal methodology. Students realise, often for the first time, how the various components of the course and techniques which they have learnt will fit together in a professional working situation.

Simulation exercises therefore have tremendous potential which are reinforced by the advent of new educational media such as micro-computers and associated software, and video cameras which assist in self assessment of performance by participants.

There are however limitations. Simulations provide a powerful technique as students will often remember events from the exercise long after a training course has finished. It is however impossible to fully simulate reality and there is a danger that the game situation can replace reality in the mind. Lessons can therefore be learnt from simulations exercises but this should not be done in isolation from the broader context.

2. Issues in the Design of Simulation Exercises for Irrigation Management

The main justification for simulation exercises is their use as a teaching aid. They allow realism to be promoted in a particular training course and can simulate situations which can otherwise not be adequately described or explained.

There are a number of problems in applying these techniques to irrigation. First and foremost any simulation needs to be underlain by the correct principles and procedures by which the situation being described is usually operated or would be operated in ideal conditions. For irrigation and irrigation management, in particular, this framework does not exist as there is no universally applicable set of standards, principles or even guidelines from which to work. Even the criteria by which the success of an irrigation scheme is measured will vary between cultures, and between situations with different social, economic and political circumstances and constraints.

Existing studies generally identify the reasons why schemes have failed to work satisfactorily rather than specifying the way things should be done. Two main problem areas have been identified: firstly, deficiencies in everyday operation and maintenance often giving rise to the need for costly rehabilitation; secondly, deficiencies of the irrigation management bureaucracy. The first of these is mainly technical but includes interaction between farmers and the scheme. The second requires analysis of the organisation but also has many political implications. Few solutions have been identified in these problem areas, while those that have are rarely implemented. As a result it is necessary to make a number of assumptions in order to design a simulation exercise for irrigation management, both to simplify the complexities of reality and to achieve a wider applicability.

3. Examples of Irrigation Management Simulation Exercises

The Irrigation Game, J Youngman(2), is designed to illustrate some of the problems experienced by both managers and farmers in the operation of an irrigation scheme. Players as individuals or in groups assume two separate roles concurrently and take different sets of decisions for both activities. Each player or team manages an irrigation scheme for another player to farm on and at the same time farm a scheme which is managed by someone else.

The internal objectives of the game are to maximise farmers' incomes and the value of the scheme's assets, ie. structures, through efficient management of the scheme and the completion of rehabilitation works. These objectives are concurrent because a scheme's income is gained from a proportional tax on farmers' incomes. This allows a competitive element to be introduced between players as their cumulative position can be recorded. The objective of the game as a training exercise is to illustrate how a water distribution system works and the demands that it faces.

The Irrigation Management Game, M Burton(3), also takes the form of a role playing management game. The main activities in this game are for Village Water Managers to calculate crop water requirements for the crops grown in a village on the basis of their yield response to water, the methodology being based on FAO Irrigation and Drainage Papers 24 and 33, and to make water requests to the Water Bailiffs of the scheme who then determine the allocation of water.

The game's objectives are to teach managers about crop water requirements and the problems of allocation between the head, middle and tail sections of a scheme. In particular it was intended to teach engineers about some of the agricultural constraints of an irrigation scheme. The game has been successful with regard to these objectives and is now in frequent use in Universities and training programmes.

The Juba Sugar Estate Game, M Pole, A Kenyon and R Carter(4), centres on the logistic and priority issues of resource allocation. As a secondary aim, it encourages management teamwork and joint decision making. Players must allocate scarce resources of water, labour, fertilizer and fuel to achieve a continuous and even flow of good quality cane to the factory thereby optimising financial returns. Although well illustrating the problems of resource scarcity, and the desirability of task allocation and rapid decision making within teams, this games does not incorporate social aspects and is complex in operation. Further refinement is proceeding to simplify presentation and ease monitoring of the game by the controller.

The Sarala Simulation, T Franks(5), is a modified version of The Irrigation Management Game by M Burton, developed for conditions in Sri Lanka. The modifications made were based on three requirements: simplicity, speed (duration one half day) and realism. Although simple, it has been found to bring out several useful lessons. It promotes communications as participants have to talk together in order to play. The difficulties of the job of project manager in Sri Lanka are illustrated quite forcefully. The use of this game has shown that people do learn from simulation, as it generates enthusiasm and attention.

The Sukkur Barrage computer model, Sir M MacDonald and Partners(6), is closer to a simulation than a game, involving individual interaction with a micro-computer programme rather than role playing. The player has to maintain flows and levels against changes in river flow and demand. Real barrage operating criteria must be met to ensure its proper operation and safety. The model is used as a discussion tool to fully understand the barrage operating criteria and as a training tool to demonstrate the complexity of the decisions involved to engineers not normally concerned with barrage operations.

The graphic representation of the barrage and the ease with which the simulation can be operated are very impressive. Persons with little or no knowledge of barrage control may immediately be able to appreciate the key factors involved and through using the model begin learning about how they inter-relate.

CAMSIS - Computer Aided Management and Simulation of Irrigation Systems, M Burton(7), allows a particular irrigation system and set of data constraints to be defined as a computer model. The allocation of water through the system can then be simulated in detail and displayed graphically showing operators the consequences of decisions made. In presentation this simulation makes use of two computer monitors. Although obviously an extra cost this has the advantage that for example both tables of figures and corresponding diagrams or graphs can be viewed together. Similarly help menus can be viewed alongside the problems they refer to. It may be possible to achieve the same result with one screen through the use of "windows" or divisions of the display.

It should be noted that graphics presented on colour monitors are far more readily understood with the information more easily absorbed than is the case using monochrome screens.

4. Summary and Conclusions

Simulation exercises provide a framework for learning the unteachable, allowing a mix of social, economic and technical factors to be experienced. For example, farmer participation is a key issue in irrigation management but how can this message be otherwise presented and how can its effects be demonstrated? Such exercises can promote understanding. They are not intended to be management tools or means for making predictions. It is also necessary for the trainer to see students do not learn the wrong lessons from the exercise, for example, unrealistic quantitative relationships.

The distinction between simulations and games is necessary and, as both have application in the training of irrigation managers, a balance between the two is required. There is a danger in the use of analogue models if participants come to believe that the model considers all of the influencing factors and available options. Role playing games are more open-ended and flexible in this respect, allowing a manager's motives and priorities to be explained and the key actions and decisions required to manage a project to be reassigned their correct weighting.

Simulations can show an individual manager the consequences of his actions. In a real situation a manager may be unable to see any visible benefits from any increased or improved efforts on his part. Simulations provide a means to do this and can give managers confidence in their actions.

In practice, managers rarely have either enough time or all the information they need to make a fully-informed decision. Simulation exercises are useful in demonstrating such constraints as managerial performance and should provide a stimulus to improving data collection systems.

Efforts should be made to co-ordinate future development of simulation techniques and to spread their use(8). Working groups are planned to develop particular aspects, and to organise future meetings. Attempts will be made to hold similar workshops to the one at Wye in international fora such as the 1987 ICID congress in Morocco.

Appendix

Simulation Exercises described and contact addresses for further information.

(1) River Wadu Irrigation Project Planning Exercise
Developed by I D Carruthers
For a full description see: Chapter 14, "A role playing game for training river basin planning" I D Carruthers, in River Basin Planning: Theory and Practice, (eds) S K Saha and C J Barrow, John Wiley, 1981.
Contact: L E D Smith, Wye College, Wye, Ashford, Kent, TN25 5AH, UK.

(2) The Irrigation Game
Developed by James Youngman in conjunction with Wye College, with support from Sir M MacDonald and Partners Ltd and the Science and Engineering Research Council.
Contact: L E D Smith, Wye College, Wye, Ashford, Kent, TN25 5AH, UK.

(3) The Irrigation Management Game
Developed by M A Burton, Sir M MacDonald & Partners, Cambridge and I D Carruthers, Wye College (University of London).
For a full account of the game and its use see: The Proceedings of the 12th ICID Congress, 1984.
Contact: M A Burton, Institute of Irrigation Studies, The University, Southampton, SO9 5NH, UK.

(4) The Juba Sugar Estate Game
Developed by M Pole, A Kenyon and R Carter.
Contact: R Carter, Lecturer in Water Management, Silsoe College, Silsoe, Bedford, MK45 4DT, UK.

(5) The Sarala Simulation
Developed by T Franks
Contact: T Franks, Project Planning Centre for Developing Countries, University of Bradford, Bradford, BD7 1DP, UK.

(6) Computer Applications for Training on Water Resource Projects. Sukkur Barrage Programme.
Sir M MacDonald and Partners Ltd, Cambridge.
Two other programmes being developed are: Indus Allocations-allocation of water supplies between barrages and offtaking canals; Kotri Right bank Canals - operation of a typical canal command area to meet demands of irrigation, storage in a reservoir and a water supply intake.
Contact: S Gunn, Sir M MacDonald and Partners Ltd, Demeter House, Station Road, Cambridge, CB1 2RS, UK.

(7) CAMSIS - Computer Aided Management and Simulation of Irrigation Systems.
Developed by M A Burton
Contact: M A Burton, Institute of Irrigation Studies, The University, Southampton, SO9 5NH, UK.

(8) The author would be pleased to receive comments with regard to the use of exercises described here, or others in use of under development, and to coordinate exchange of views and information between interested parties.

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IRRIGATION MANAGEMENT NETWORK

PERFORMANCE MEASUREMENT IN CANAL WATER MANAGEMENT: A DISCUSSION

Charles L Abernethy

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PERFORMANCE MEASUREMENT IN CANAL WATER MANAGEMENT
A DISCUSSION

Charles L Abernethy

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PERFORMANCE MEASUREMENT IN CANAL WATER MANAGEMENT
A DISCUSSION

Charles L Abernethy

This paper opens up an area important to managers, planners and researchers involved in irrigation. What do we mean by a successful scheme? If we can agree on using the same indicators of good performance, and the same methods of measuring whether objectives have been achieved, both research and management will be more effective. The original version of this paper was written in 1984. Dr Tom Wickham of IIMI invited Charles Abernethy to do some further work on it for dissemination to the Network. Responses of readers as to whether the criteria suggested here are generally acceptable are invited, together with any clarifications or alternatives which they wish to put forward. The Editor has taken the opportunity of adding a few comments and hopes this will stimulate others to send in their reactions. We would then hope to follow this paper with a second quoting from and summarising the points made.

1. INTRODUCTION

This paper addresses the question, how should we measure the performance of an irrigation system? What do we mean when we speak of a particular system as "successful" or "deteriorating"? Can we put such qualitative descriptions into numbers?

The need for an agreed set of parameters that will represent irrigation performance is urgent. Lenton (1985) has put it succinctly: "one of the extraordinary characteristics of irrigation systems management is that, despite the fact that large irrigation projects generate revenues far in excess of the largest business corporations, there is virtually no information on the extent to which these irrigation systems are achieving performance objectives". If we can agree a set of indicators of performance, then it begins to be possible to measure the effect of changes of management technique. Targets can be set, staff incentives can be based upon achievement of these targets, and managers can maintain a clearer sense of priorities and goals.

We need performance indicators equally urgently in research. Research workers make case studies of individual irrigation systems, but their results are reported in a wide variety of terms. This makes it difficult, or impossible, to compare the projects studied. Without agreed standards of performance, there is no basis for saying whether one system is performing better or worse than another.

We also need such indicators for the proper evaluation of policy alternatives. For example, at present, in some countries quite major reforms are in train or are actively contemplated, in the general direction of increasing the role of farmers in management; yet the impact of these changes on system performance is unclear. Different advocates of these reforms have different expectations as to which aspects of performance the changes are supposed to influence. Questions of this kind can be answered on a sound basis only if we have some general agreement as to what good performance is and how it may be measured.

As we so often find in studying irrigation management, the diversity of circumstances that can occur in the real world makes it difficult to develop generalised methodologies. These are always open to the objection that, in certain circumstances, they can be shown to be inappropriate. So it should be said at the beginning that the ideas developed here are intended, primarily, to refer to canal-fed surface irrigation systems in situations that are, at least seasonally, water-deficient (that is, where there is effective demand for alternative use of any water that can be saved by good management techniques); in other words, areas where water is a scarce resource. Such conditions apply to many of the principal irrigation countries, for example, Sudan, Egypt, Iraq, Pakistan, India and northern Sri Lanka. So the range is not unduly restrictive, but the ideas offered here probably require some adaptation for application in other circumstances.

2. CHARACTERISTICS OF GOOD PERFORMANCE

First, let us consider what seem to be the desirable features of a good, successful irrigation system. Then let us consider separately a set of parameters in which each of these desirable attributes can be quantified.

Production

Presumably the list of desirable features will always be headed by output of some agricultural product. The primary purpose of an irrigation project is to enhance production of food or fibre. That is why it is built and it is on the basis of its agricultural output that it ought, first and foremost, to be assessed.

There are indeed cases where this statement may need to be diluted: mainly, these are the cases of what may be called "welfare" irrigation, where the motivation for the project derives from a need to provide an improved quality of life for some less fortunate region or social group, rather than to make any significant contribution to national agricultural production. But even in those cases, the project cannot make much sense unless it delivers a healthy agricultural output.

However, production can be influenced by a very wide range of factors, and by no means all of them have anything to do with the quality of the irrigation. Consider one striking recent example: the improvement in cotton production in the Sudan Gezira after 1981. Various sources (see, for instance, Faki, El Bedawi, and Bailey, 1984) show that in the two crop years 1981-83 the yields were greater by 71% than in the preceding two years. It is generally agreed that the factors which caused this dramatic improvement, after over a decade of persistent decline in yields, were a change in the accounting system of the parastatal body that manages and purchases the cotton crop and a price rise. This gave greater rewards to the farmers from cotton production. It is not suggested that any change in water management or water control practices played a significant role in instigating this improvement in yields.

The Gezira case is instructive, because it shows us how carefully we must think about our definition of the term "management". In this case, an improvement was made and it was of a scale and rapidity that were greater than most practitioners would deem possible from water management alone. This may tempt us to say that financial arrangements, prices, markets, and so forth, are supreme in determining output; and all of these things can be regarded as aspects of management. On the other hand, the great improvement resulted from the reversal of a bad policy environment, which is not the same thing as good project management.

If we are not to become very confused, it seems essential to introduce some restrictive definition of irrigation management, before continuing the analysis. The link between output and rewards, just demonstrated so vividly in the Gezira, could happen in any sort of agricultural development project. It does not help us towards a deeper understanding of the management problems that are peculiar to irrigation. But it does demonstrate the difficulty of adopting production as a main indicator of performance, if what we are interested in is the management of the water system.

Classification of Management Activities

If we want to analyse irrigation performance, it seems desirable to focus our attention primarily on those aspects in which irrigation differs from rainfed agriculture. Firstly, irrigation is, by definition, a system for artificial provision of water at times and places where crops can utilise it. So one clear yardstick for the evaluation of its management must be whether it fulfills these functions well. This area of management we can categorise as water management: the delivery of water where and when it is wanted, reliably and in the right quantities. Because water is artificially provided, and is not what economists call a free good, we have to consider whether this factor of production is in scarce supply.

As already stated, this article is concerned with those cases where it is, and therefore, we should be as much, if not more, interested in maximising production per cubic meter of water supplied (m^3) as per hectare of irrigated land.

Linked to the artificial provision of water are shared facilities for the joint benefit of a large number of farmers. These facilities will not be durable without a significant, continual maintenance effort, so it is inherent that irrigation farmers need an organisation for operation and maintenance. Cost-effective criteria applied to the management of other types of public plant such as roads, railways, etc can be used to assess this aspect of irrigation management.

Agricultural management comprises decisions on land tenure, crop choices, planting dates, marketing, etc. In most countries the irrigating farmers are the agricultural managers as they are in rainfed agriculture but in some cases, particularly in Africa, the authority managing the plant also directs agricultural activities. It is this set of decisions which can be most affected by the economic environment created by national policy decisions.

In the present paper, the discussion is confined to water management. It seems right to deal with this first, for if the water management is unsuccessful it will not be possible for the agricultural management to succeed.

In the context of this analysis of management types, we see the relevance of the Gezira events. They show us that, although we must inevitably treat output (per m^3) as highly important, it cannot be used as evidence of good water management, since it has been demonstrated that it can experience dramatic changes without any change in water management practices.

For a choice of parameters to define good water management, therefore, we may return to the definition of the purposes of water management: delivery of water where and when it can be utilised for crop production, reliably and in appropriate amounts.

Equity

Equity, or spatial uniformity, of water distribution, ought to be one of the principal aims of the managers of any irrigation system that supplies multiple users[1]. Inequity, often referred to as "tail-end" problems, is well known to exist in many systems. Yet there is remarkably little published, quantitative information that helps us to assess the extent of inequity, nor whether it has, in any particular circumstances, been overcome by either improved management or by engineering interventions.

Inequity has a direct influence upon productivity because, whereas the parts of a system that receive less than their agronomic requirement of water will produce less than their potential, the areas which receive more water than they need do not show improvement in yield: the excess water is not serving a productive purpose.[2]

Putting this in another way, inequity - regardless of its social undesirability, which may be a matter of political attitudes - is undesirable because it implies poor utilisation of some water, and therefore reduced productivity of the available water.

Regularity and reliability

Regularity of water distribution is another necessary objective. Poor regularity is likely to be correlated with poor output and equity. The link with equity comes because it is likely that areas with poor average

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[1] *Equity of water distribution, which is what is being discussed here, has to be distinguished from equity of income distribution. It could be hypothesised that in systems with inequitable water distribution, land at the top end of the system will have a higher price, and all things being equal, farmers are likely to be smaller there than in tail end areas where farmers may be able to buy or rent land more cheaply. We cannot assume that farmers at the top-end enjoy higher incomes per family unit than those at the lower end till we have also looked at farm size and land values, opportunities for exploiting grazing land, etc. Mary Tiffen*

[2] *However, if top-enders receive only just enough for maximum yields per ha, a move to more equitable water distribution may lead to some reduction in top-end production, which should be out-balanced by higher yields per ha elsewhere in the system, leading to an increased yield per m^3 of water in the system as a whole. Mary Tiffen*

supplies will also be most subject to erratic deliveries. It therefore deserves to be monitored as a management parameter.

By regularity we do not mean uniformity in time, but supply according to some time schedule that matches the water needs of the crops and ensures that the necessary water is always accessible in the root zone.

Like inequity, irregularity of delivery implies waste of water since, unless the average delivery is much below requirements, it means that at times deliveries are larger than needed. So again there is a direct link with the primary objective of productivity: irregularity implies necessarily a reduction of potential productivity.

Along with regularity we should consider other aspects of the time-distribution of water flows, especially reliability. Farmers' behaviour and attitude to water are likely to be influenced by this. If they feel sure that deliveries will occur according to some schedule, they will plan their agricultural activities accordingly. But if experience teaches them that the arrival of water is unreliable, then (according to various case studies) we can anticipate at least two reactions that, however logical they may appear to the individual farmer, are undesirable for the system's overall health. First, the farmer who is well placed (meaning either possessing an upstream outlet, or having influence with the system's managers) is likely to take more water than he needs in case the next delivery is delayed. This increases inequity. Second, farmers will feel obliged to use drought-resistant varieties, which probably means that output will decrease below potential.

Durability

Durability, or sustainability, of the system is a more difficult factor to encompass. This refers most often to the issue of leaching, drainage and salinisation: if these are not attended to, then we know that the system's life will be rather brief (at least for those in arid climates and with high water-tables). This means that after a few years we expect to see a deterioration of output. But lack of durability can come from various other causes: reduction of soil fertility, for example, because of incorrect agricultural practices; or low-grade maintenance, which usually results in loss of channel capacity and therefore aggravates tail-end inequity problems. The increasing frequency with which whole systems need to be rehabilitated in recent times is a symptom of this last problem.

Cost

Last, we should consider whether the cost of managing the system is to be regarded as a performance characteristic. Cost and durability are linked, as other discussions in the Network have shown, since maintenance is a call on recurrent revenues. In a number of countries recently, public-sector irrigation projects have encountered growing budgetary difficulties that are forcing quite drastic structural reappraisals and reorganisations. But we cannot put low-cost management as a goal in its own right, because, if we do so, it seems highly unlikely that we shall achieve either output, equity or regularity. Increased management cost is acceptable, if we have reason to think it is counterbalanced by increases in the major aims. The first requirement is to develop a system of measurement so that we shall really know how well we are achieving our primary water management goals; armed with that information, we can then proceed to find out what will happen to performance if we increase or reduce management expenditure. Thus, we shall have a means to judge cost-effectiveness.

Summary

In summary, we should regard the following as the vital characteristics of successful water management: equity, regularity, reliability, and durability. In the following sections we consider further the first two of these, and define practical numerical parameters which can be used to express each.

3. EQUITY

Types of Inequity

Inequity of distribution occurs at various levels in an irrigation system. First, we may have non-uniformity of distribution within a field; second, we may have inequity between the users of a common field channel; third, we may have inequity between the flows issued from the main system to distributaries or to field channels. Broadly speaking, the first derives from inadequacy of land levelling and grading (or from non-uniformity of emitter and sprinkler outputs, in mechanised systems); the second often reflects the quality of inter-farmer cooperation and their management capacity; the third depends on the efficiency of the system management bureaucracy.

The measurement of inequity at each of these levels requires different data collection methods. The first, for example, might require neutron probe measurements of soil moisture at scattered points in numerous fields. It would necessitate a relatively expensive research programme, which might well be justified if a major rehabilitation, in which levelling was likely to be a component, was being contemplated. The second also requires data collection at numerous points along many field channels, but would be worth undertaking in some systems as a research study that will provide us with data on the quality of farmer-managed water distribution at this level, leading to decisions on whether to devolve further management responsibilities to the farmers. It might also lead us to develop devices that allow farmers to monitor the quantity of water passing along the different segments of the field channel, and therefore, to make their management decisions on the basis of better information. The third requires data collection at relatively few points, at the off-takes from the major canals, where measurement devices are already installed in many systems. It is, therefore, an immediately practical tool by which managers can monitor their systems.

Measures of Inequity

The next issue is which measures of inequity we should use. Amongst engineers, Christianson (1942) proposed a co-efficient which was ratified, so to speak, by the ASCE On-farm Irrigation Committee (1978); Till and Bos (1985) have used the standard deviation; Abernethy (1984) suggested the inter-quartile ratio(I_1). Other possibilities drawn from other disciplines in which inequity is of interest, include the Gini coefficient, used by economists (the writer is indebted to Dr J Moris for suggesting its use here), and the Shannon-Wiener index, used by ecologists to measure the diversity of species. In addition, we can consider a modified variant of the inter-quartile ratio(I_2).

Figure 1 illustrates the difference between I_1 and I_2. The inter-quartile ratio I_1 is defined as h75/h25, h25 being the depth of water such that one quarter of all the land receives less than this, and h75 is the lower limit of the most favoured quarter. However, when we have a relatively small set of available values of h (which is usually the case) then h25 and h75 are not sharply defined, and I_1 becomes rather volatile. For this reason, I prefer to take the average depth of water received by all land in the best quarter, divided by the average depth received in the poorest quarter, (ie. the average for the shaded area in Figure 1), which I have termed I_2.

All of these measures of inequity are reasonably easy to calculate, provided the data is available. The choice between them therefore has to be made on the basis of ease of interpretation, reliability, and utility as a research tool. Since they are generally unfamiliar as yet, even among irrigation specialists, it may be useful to give some sample data from real situations in developing countries.[3]

Examples of the Use of Inequity Measures

First, we consider data from Pakistan presented by Trout and others (1977), and adapted in Table 1. This refers to an area of 148 ha, served by a single watercourse, in a typical Punjabi warabandi (time-sharing) system. Under this each farmer is entitled, once a week, to exclusive use of the watercourse's flow, for a fraction of the week that is equal to his fraction of the total land served. There were 20 holdings. The researchers measured the flows actually delivered at each holding, for one week. Their purpose was to demonstrate that the system, though apparently equitable, becomes significantly inequitable in older or ill-maintained channels, because seepage losses along the canal greatly reduce the amount of water actually received by tail-end users.

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[3]Abernethy has provided an Appendix giving further information on each of the statistical measures discussed. Readers wanting this are invited to write to the ODI-IIMI Network Secretary at ODI.

FIGURE 1

DEFINITION OF INTER-QUARTILE RATIOS

$$I_1 = h_{75} / h_{25}$$

$$I_2 = \text{upper} / \text{lower shaded areas}$$

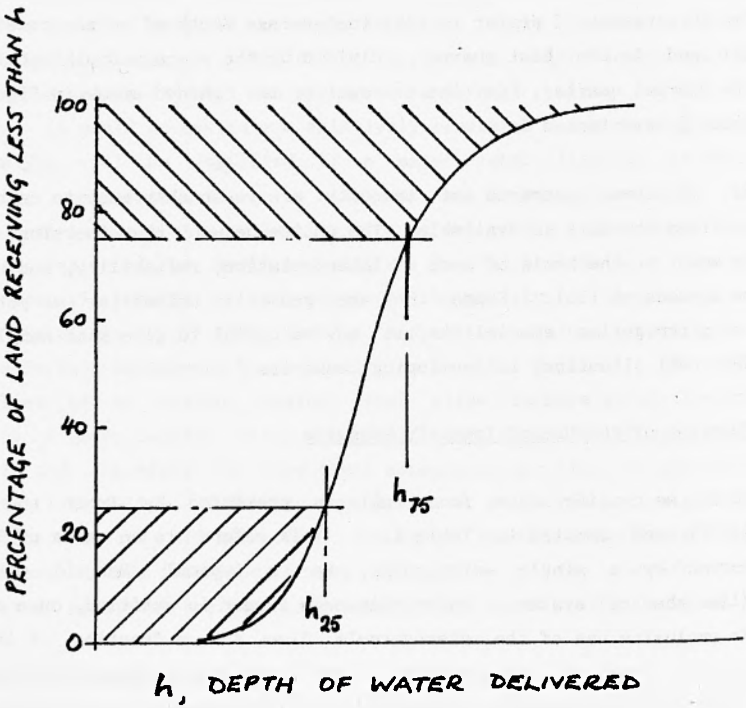


Table 1: Water distribution at tubewell 81-R, Mona, Pakistan

Holding number	Area A (ha)	Water received h (mm)
1	4.29	7.3
2	4.33	7.3
3	4.33	7.3
4	2.67	8.6
5	18.67	11.6
6	5.39	12.9
7	7.49	13.3
8	1.46	15.0
9	5.87	15.0
10	4.07	16.1
11	8.46	16.3
12	17.25	18.9
13	6.24	19.3
14	6.24	19.3
15	2.59	21.1
16	5.43	21.9
17	10.33	21.9
18	8.30	27.5
19	7.81	29.2
20	16.76	29.2

Total area = 148.0 ha

Weighted mean water supply received = 18.44 mm

Data adapted from T Trout, S A Bowers, Mohsin Wahha, Hayat Ullah Khan, Mohamed Yasin and M Iqbal: Operational conveyance losses on tubewell 81-R watercourse. Mona Reclamation Experimental Station, publication no.76, July 1977.

Table 2 shows the values of the various inequity parameters for these data. These numbers demonstrate they have very different values as communicators. A Gini coefficient of 0.225, or a Christianson coefficient of 0.329, convey little meaning except to the initiated specialist; but an I_2 of 3.08 shows that the fortunate quarter of farmers in the head-reach got *just over three times as much water as the opposite* quarter at the tails. This latter statistic has immediate impact and clear significance.

The primary data tell us how much water each holding received, and how big each holding was. So we can calculate the inequity coefficients either on the basis of holdings or of hectares. Coefficients in Table 2 are calculated by each of these methods. It is often said that the distribution of power and influence within an irrigation community will mean that the largest farmers will secure more than their proper share of water. *If that is so, we should find that the inequity coefficients* would be greater when calculated on a holdings basis. Table 2 shows that in this case all the coefficients do indeed show this tendency, but only very weakly. Of course, this deduction, from one week's data on one small area, is not presented as having any important meaning, but rather as an indication of the kind of quantification that we can begin to apply to social influences. Sociological results presented in this way become much more convincing to researchers from other disciplines.

Data presented previously by the writer (Abernethy, 1985), on the Kaudulla irrigation system in Sri Lanka, *illustrates some other* points about the inequity parameters. This study was of a rice irrigation system of about 2400 ha, whose main canal feeds 10 distinct sub-systems. Over the years 1978-83, ten growing seasons in all, the flows to each of these subsystems were monitored. The data is not reproduced here for space reasons, but Table 3 shows the values of the inequity coefficients between sub-system for each of the ten seasons, and these are plotted in Figure 2. (In Sri Lankan terminology, Maha is the major growing season, October to March at this site, and Yala the secondary season, April to September.)

These data show several things. The parameters themselves behave in general consistently; on the whole, they all rise or fall together.

Table 2: Inequity parameters for the data of Table 1

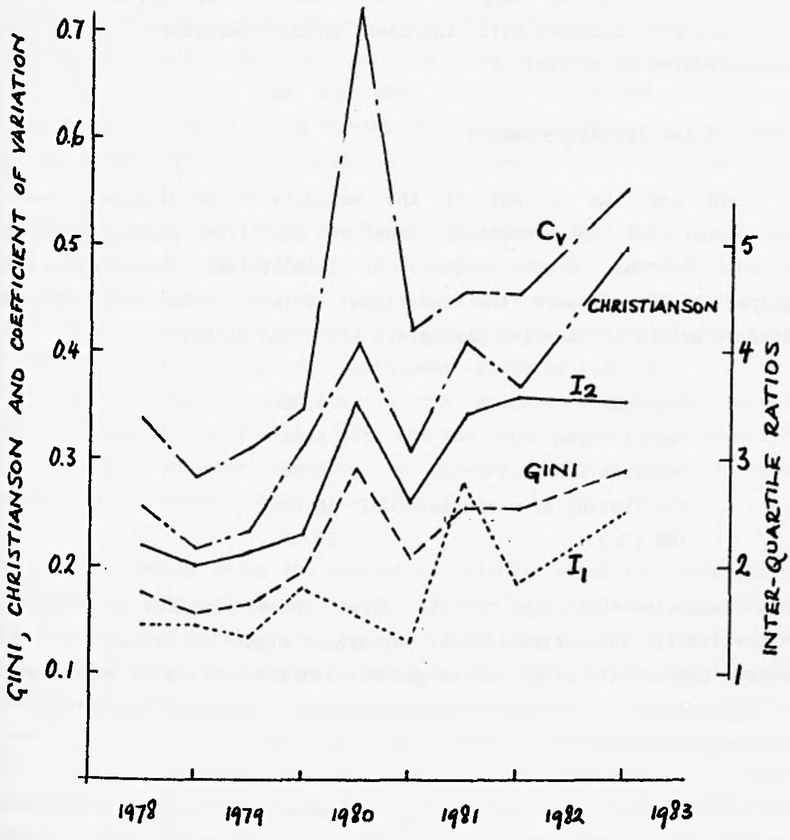
Unit of analysis:	Holdings	Hectares
Inequity parameter:		
Coefficient of variation	0.407	0.373
Christianson	0.329	0.307
Inter-quartile ratio, I_1	1.79	1.79
Modified IQR, I_2	3.08	2.81
Gini	0.225	0.211

Table 3: Inequity parameters at Kaudulla (Sri Lanka) over five years

	Cv	C	I_1	I_2	G
Yala 78	0.337	0.258	1.46	2.20	0.177
Maha 78/79	0.283	0.220	1.46	2.01	0.156
Yala 79	0.311	0.232	1.36	2.14	0.166
Maha 79/80	0.348	0.313	1.80	2.31	0.197
Yala 80	0.721	0.409	1.55	3.55	0.293
Maha 80/81	0.422	0.309	1.31	2.61	0.209
Yala 81	0.457	0.408	2.80	3.39	0.257
Maha 81/82	0.454	0.369	1.86	3.59	0.255
Yala 82	n o d a t a				
Maha 82/83	0.555	0.495	2.50	3.53	0.290
Mean	0.432	0.355	1.79	2.81	0.222

FIGURE 2

BEHAVIOUR OF INEQUITY COEFFICIENTS
OVER 5 YEARS AT KAUDULLA, SRI LANKA



However, the coefficient of variation shows a greater sensitivity than the others: this is because it alone uses the squares of deviations, and it therefore reacts more to any extreme values present.

Figure 2 also shows that, over the period of data collection, inequity worsened. This seems to have coincided, more or less, with management efforts to reduce the gross amounts of water used in the system. It may be surmised that, as supplies are reduced, competition for water increases, and inequity will increase, unless management can introduce new procedures to control it.

Choice of the Inequity Measure

We might say, as a test of the validity of the different inequity parameters, that the normalised mean of all five represents a fair estimate of the "true" inequity of this system. This gives a basis against which to compare the individual values. On this basis the standard errors of the five parameters are found to be:

Gini (G)	4.0%
Christianson (C)	5.6%
Modified IQR (I_2)	6.6%
Coefficient of variation (Cv)	15.6%
IQR (I_1)	19.1%

This suggests that any of the first three measures is acceptable. Theoretically, the coefficient of variation might be thought the most useful, because its wider use in general statistical theory opens the way to other forms of analysis, but this diagram illustrates the difficulties in interpretation.

The writer has a preference for the modified inter-quartile ratio I_2 because of its clear meaning to the layman. If we are going to attack inequity successfully, an important element in that attack will certainly be communication, between farmers and technical officials of various disciplines. That process is bound to be improved if we adopt readily understandable terms.

4. REGULARITY

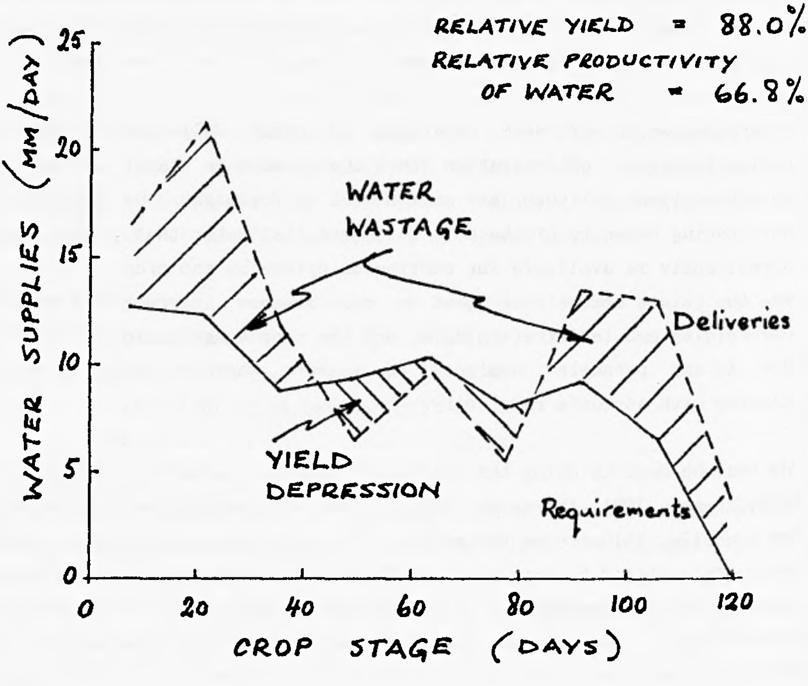
It might be supposed that, since uniformity in space and uniformity in time are evidently analogous, we could develop a similar set of parameters for regularity as for equity. Indeed this has been proposed, at least in the case of the Christianson coefficient. However, this is not sufficient, because in this case the order of the events has to be reflected in the parameter. It is not just a question of counting up the deviations from the requirements (the Christianson method), since a continuation of water shortages over say three or four weeks is much more harmful to crop yield than the same set of shortages occurring at occasions widely distributed through the crop life. Moreover, shortages have a greater effect on yield at certain stages of crop development.

Furthermore, we do not seek constancy of water deliveries. In the rotational systems of irrigation that are common in canal systems, we plan intermittent delivery, say once a week or fortnight. We rely on the water-storing capacity of the soil to ensure that water that is delivered intermittently is available for continuous uptake by the crop.
These two points demonstrate that we must somehow incorporate the soil water-holding and infiltration data, and the crop's agronomic response to water, in any parameter designed to measure whether water is being delivered with adequate regularity.

This can be done by using the concept of relative potential yield (Davey and Rydzewski, 1981; Abernethy, 1984). Figure 3, using some observations from Kaudulla, illustrates the process. First, we develop a water demand curve. This should be done on a daily basis, using data from climatic observations, to construct an evapotranspiration curve, say through the Penman formula. Next, we use some form of soil storage and percolation model, from which we can calculate a pattern of intermittent water inputs that will maintain in the root zone sufficient water to satisfy crop needs, downward percolation and direct evaporation to atmosphere. (Holmes, 1983, describes these steps for the case of a rice system.) Then we compare the actual history of water issue to the field with this ideal requirement. Using crop-water response tables such as those of Doorenbos and Kassam (1979), we can calculate how much yield is lost due to the occasions when water deliveries fall below requirement. The

FIGURE 3

EFFECT OF IRREGULAR WATER DELIVERY UPON CROP YIELD AND WATER PRODUCTIVITY



excess supply of water at other periods implies a waste of water, and, therefore, a reduction of the productivity of the water used. Taking all these things together, we can calculate that (for the particular patterns of crop demand and water delivery shown in Figure 3) the relative yield Yr (that is, yield relative to what would be achieved if the delivery and demand curves matched precisely) is 88.0%, and the relative productivity of water, Pr, similarly defined, is 66.8%.

That means (without any consideration of how the farmer uses the water in his field) the system is supplying water to him in such a way that the best productivity he can achieve will be 33.2% less than it could be under a water delivery system that accurately matched crop requirements. This seems to be a meaningful way of quantifying the effect of a delivery schedule. It enables us to interpret scheduling in output terms, but without the distortion of extraneous factors (fertilisers, pests, prices, etc) that make it unsafe to use actual production as the measure.

This method also enables us to understand clearly the different implications of the productivity of water and the yield (which is the productivity of land). The farmer at the head of an inequitable system, experiencing plentiful water, and for whom the marginal cost of taking excess water is usually zero, will probably be mainly concerned with yield per hectare. Farmers elsewhere in the system, experiencing a scarcity of water, may adopt strategies to maximise output per m^3 of water. Currently, systems managers often feel themselves judged by the criteria of high yield/ha, whereas, if they are managing systems where water is short relatively to demand, they should be judged by output/m^3, and concerned to have high Pr as an indicator of performance.

It is possible to extend the approach described above, and combine the influences of inequity and irregularity. Relative yield and relative productivity can be calculated for all parts of a system for which we have a season's data. We can then calculate the inequity parameters (Gini coefficient, modified inter-quartile ratio, or whichever we prefer) on the basis of yield, or water productivity, instead of water supply.

5. CONCLUSION

The principal characteristics of good water management in canal irrigation systems should be equity, regularity, reliability and durability. Equity can be measured by various parameters. The modified inter-quartile ratio I_2 is recommended because it has an obvious meaning and is therefore useful for communicating with a lay audience. he effect of irregularity in the time-distribution of water is best measured in terms of relative yield and relative productivity of water.

REFERENCES

C L Abernethy: Methodology for studies of irrigation water management. Hydraulics Research, Wallingford, England, report OD/TN 9, October 1984.

C L Abernethy: Irrigation water management at Kaudulla, Sri Lanka. Hydraulics Research, Wallingford, England, report OD 70, July 1985.

ASCE On-farm Irrigation Committee: Describing irrigation efficiency and uniformity. Journal, American Society of Civil Engineers, v.104, IR1, March 1978.

J E Christianson: Irrigation by sprinkling. California Agricultural Experimental Station, Bulletin 670, 1942.

C J N Davey and J R Rydzewski: Evaluation of water management on irrigation projects. 12th Congress ICID, Special Session, paper R1, Grenoble, 1981.

J Doorenbos and A H Kassam: Yield response to water. FAO Irrigation and Drainage Paper 33, Rome, 1979.

Hamid Faki, Ahmed El Bedawi and C R Bailey: The effect of farm location on cotton yields and income in the Gezira-Managil. In "Water distribution in Sudanese agriculture: productivity and equity," ed. O A Fadl and C R Bailey, University of Gezira, 1984.

D W Holmes: Irrigated rice land, a program to compute water requirements. Hydraulics Research, Wallingford, England, report OD 53, March 1983.

R Lenton: On the development and use of improved methodologies for irrigation management. In "Current issues in and approaches to irrigation management in developing countries." Westview Press, 1985.

M R Till and M G Bos: The influence of uniformity and leaching on the field application efficiency. ICID Bulletin, v. 34, no. 1, January 1985.

T Trout, S A Bowers, Mohsin Wahha, Hayat Ullah Khan, Mohamed Yasin and M Iqbal: Operational conveyance losses on tubewell 81-R watercourse. Mona Reclamation Experimental Station, publication no.76, July 1977.

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odi-IIMI

IRRIGATION MANAGEMENT NETWORK

NEWSLETTER

ODI/IIMI Irigation Management Network 86/3a November 1986

Agricultural Administration Unit, Overseas Development Institute, London

The Overseas Development Institute (ODI) is an independent, non-profit making research institute. Within it, the Agricultural Administration Unit (AAU) was established in 1975 with support from the British Aid programme. Its mandate is to widen the state of knowledge and flow of information concerning the administration of agriculture in developing countries. It does this through a programme of policy-oriented research and dissemination. Research findings and the results of practical experience are exchanged through four Networks on Agricultural Administration, Irrigation Management, Pastoral Development and Social Forestry. Membership is currently free of charge to professional people active in the appropriate area, but members are asked to provide their own publications in exchange, if possible. This creates the library which is central to information exchange.

The International Irrigation Management Institute, Kandy

The International Irrigation Management Institute (IIMI) is an autonomous, non-profit making international organization chartered in Sri Lanka in 1984 to conduct research, provide opportunities for professional development, and communicate information about irrigation management. Through collaboration, IIMI seeks ways to strengthen independent national capacity to improve the management and performance of irrigation systems in developing countries. Its multidisciplinary research programme is conducted on systems operated both by farmers and by government agencies in many co-operating countries. As an aspect of its dissemination programme it is joining ODI in the publication of the Irrigation Management Network papers, to enable these to appear more frequently to an enlarged membership. It has also provided equipment to link ODI's irrigation library into an international irrigation management database centred on IIMI.

NEWSLETTER

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NEWSLETTER

This Newsletter contains information on proposed new research networks or requests for exchanges of information, on farmer-managed systems, water user associations and irrigation bureaucracies, groundwater licensing, water harvesting, flooding of reservoirs and night irrigation. Those interested in any of these topics may wish to turn at once to Section 2 page 7.

1. NETWORK PAPERS AND DISCUSSION

a. The Current Issue

The current issue contains three papers, dealing with government intervention in farmer-managed systems, the principles behind the Chinese system of cost recovery, and a system of combining training with the identification of priority maintenance needs and better financial planning. These papers are linked not only to past Network discussions but also to three important recent conferences. They are also relevant to the issue of sustainability, which we hope to consider further in future issues.

The Irrigation Water Charge in China (86/3b)

FAO and USAID jointly sponsored an important conference in Rome in September on *Irrigation Development and Water Charges*. The conference considered general topics such as the effect of water charges on irrigation system efficiency, with papers by Small, based on his recent research work for IIMI and the Asian Development Bank, and by Le Baron and Keller of Utah State University. Another useful paper was by Sagardoy, analysing operation and maintenance costs. If we expect farmers to pay for the service it is important that costs are kept down to what is essential for good operation, without extravagant use of manpower. One of the most interesting country studies was that on China, by Professor Xu Gouhua, a revised version of which appears as Network Paper 86/3b. The Chinese expect farmers to pay O & M costs and additionally, to contribute both to construction and to repay a proportion of other capital costs. Charges vary according to the amount of water requested and delivered to a village, and to costs in that particular system. The village is responsible for O & M from its turnout to the farmers, and for cost collection from the beneficiary farmers.

The general opinion expressed at the end of the conference was that water charges contribute to system efficiency best when they are retained within the system, as in China, with the managers having budgetting powers. This creates incentives for good delivery of services and it may also provide resources for improving services. Coward and Martin were able to show that when farmers manage systems themselves, their payments in cash and kind to their own organising body are often higher than national charges for water, illustrating the value placed on water when it is delivered in accordance with community wishes. Charges contribute most to water saving on the part of farmers where charges are based on volume, which is often difficult, and where they represent a fairly high proportion of production costs, as in countries like Cyprus, where water for agriculture is a scarce and valued resource.

FAO is publishing the conference proceedings. Those interested in seeing these valuable papers should write to J. Sagardoy, Land and Water Division, FAO, Via delle Terme di Caracalla, Rome 00100, Italy.

Farmer-managed Irrigation: Research Issues (1986/3c)

This paper, by Martin, Yoder and Groenfeldt, concerns the large area in many countries which is irrigated by systems managed by farmers. There is a trend for government to intervene in these systems, but such intervention may not produce desirable results if the management system and its relationship to the physical structures are not understood. The paper describes two approaches which have been found helpful in analysing these systems. It also notes that government organisations may well have to adopt new attitudes if they are successfully to carry out repairs or improvements, as has happened in the Philippines. However, there is a lot more to be learnt both in understanding farmer managed systems and in understanding if and how to intervene. The authors invite interested researchers to join in a new research network for which IIMI is providing some resources (details at the end of Paper 86/3c and in section 2 below). This Farmer-Managed Systems Network (FMIS) was launched at the IIMI-Government of Nepal workshop on Farmer Managed Irrigation Systems in August 1986, as described in Newsletter 86/2a.

Some of the problems to which this paper refers are illustrated in the *SSIS Newsletter*, July 1986, from the Water Resources and Environment Institute, Faculty of Engineering, Khon Kaen University, Thailand. Various articles describe difficulties with government programmes for provision or upgrading of small systems, because requests for help have not been properly vetted. There are planning deficiencies in the local government system, and under-utilisation of the structures provided. However, the Khon Kaen University-New Zealand small scale water resources project, described by Evan Mayson in ODI Irrigation Management Network Paper 9e, has just been evaluated and has confirmed many of the points made in this paper. Between 1979 and 1985 small diversion weirs have been built in co-operation with villagers. The usual design has a fixed crest of about 1 metre, and a variable crest of stop-logs, of 1 to 1.5 metres. The weir is sized according to the size of the stream. This paper is still available from ODI on application to the Irrigation Management Network Secretary, but requests for the *SSIS Newsletter* should be addressed to Khon Kaen University.

Operations and Maintenance Learning Process (86/3d)

An International Conference on *Irrigation System Rehabilitation and Betterment* was held at Washington D.C. October 27-31, 1986. It was sponsored by the Water Management Synthesis Project of USAID. A stimulating paper by Gilbert Levine suggested that irrigation systems would need regular remodelling because higher levels of water efficiency performance would be expected of them over time. The amount and type of maintenance required should take account of this necessary upgrading. The general feeling, however, was that regular maintenance was economically justified and beneficial to farmers who would otherwise receive declining or erratic water supplies. An interesting paper by Skogerboe, circulated during the conference, suggests a method of combining the identification and costing of maintenance needs, with setting of maintenance priorities, which is also good training for the engineers involved. The method has been tried out in Thailand, where it has been found feasible and beneficial for engineers with a few years experience.

The conference was also concerned with cost reduction, the recovery of O & M costs from rehabilitated systems, better planning to take user needs into account, staff re-orientation to enable them to work better with users, in addition to monitoring and evaluation. There were also several useful case-studies presented. The proceedings are to be published. For details write to Dr. Mohammed Haider, Water Management Synthesis Project, Colorado State University, Fort Collins, CO 80523, United States.

b. Discussion on Previous Papers

i. Performance Measurement in Canal Water Management

We have so far only received one comment on Charles Abernethy's paper on this subject, published with the August issue of the Network. As it is a matter on which further comment is likely, we will hold over discussion to the next Newsletter.

ii. System Design and Water Use Efficiency

Issues brought up by Horst's paper for the Network, *Irrigation Systems-Alternative Design Concepts*, No. 7c, April 1983, continue to excite interest and comment. The Director of WALMI, Canal Colony, Okhla, New Delhi, India has written to us to outline the practical difficulties faced in achieving water use efficiencies that remotely approach those planned when a project was designed. There are severe social, political, economic and technical constraints acting on water use efficiencies in the large canal systems of Uttar Pradesh, from which the Director takes his evidence. Control systems need to be very simple, relying on gauges and flumes and he advises against trying to increase irrigation efficiencies through introducing more sophisticated scheduling and water measurement devices. Instead, he argues that the only means for farmers to get greater security in water supply is through conjunctive use of both surface and groundwater.

iii. Groundwater

Prof Xu notes in his paper that China does not have an effective groundwater licensing and charging system. We have circulated to a few members comments which have arisen during the discussion of Tushaar Shah's paper 11d. If anyone would like to contribute papers or information on licensing systems that are effective in situations where groundwater is a scarce resource, could they write to Camilla Toulmin at ODI.

2. RESEARCH NETWORKS

a. Farmer Managed Irrigation Systems (FMIS Network)

The background to this Network is described in Paper 1986/3b. The objectives of the Network are: (1) To provide a link between researchers who have already produced results and have gained valuable experience in farmer-managed systems, and other researchers interested in pursuing similar issues; (2) To promote widespread interest among policy makers and implementing agencies about alternative approaches to assisting farmer-managed irrigation systems; (3) To promote interaction and collaboration between research organizations and implementing agencies; and (4) To develop practical methods for diagnosing existing problems in farmer-managed irrigation systems which can be used by agency staff who are not professional researchers.

The primary function of the FMIS Network is to facilitate exchange and dissemination of information; this will be done by setting up a newsletter to be published by IIMI, in addition to publications, seminars and visits. At a later stage and contingent upon funding, it is hoped that the Network will also provide limited direct research support. The research topics which the network will seek to promote include: 1) inventories of farmer-managed systems, 2) studies of failed systems, 3) changing property rights when traditional legal frameworks are superceded by national legal systems, 4) the viability of farmer-managed systems under changing socio-economic conditions, 5) public administration studies of government's role in farmer-managed systems, 6) the influence of donor policies on farmer-managed systems, 7) evaluating the indirect costs and benefits of intervening in farmer-managed irrigation systems, 8) understanding the reasons underlying farmers' requests for outside assistance in managing their irrigation systems, 9) determining the optimal division of management responsibility between farmers and an irrigation agency, 10) case studies of successful intervention by outside agencies to identify the reasons for success, and 11) evaluating the technical needs of farmer-managed systems.

For more information write to the FMIS Network Coordinator, IIMI, Digana Village, via Kandy, Sri Lanka.

b. Working Group on Irrigation Institutions Research

IIMI has begun field research in Sri Lanka and Indonesia aimed at gaining a better understanding of irrigation institutions, including both farmers' associations and the bureaucracy of agencies managing large governmental systems. It is hoped that research in other countries will follow similar lines.

IIMI would like to identify other researchers who are studying Water Users' Associations (WUAs), irrigation agency operations, and/or the interactions between agencies and WUAs. The objective is to create a small working group or sub-network and to facilitate the interchange of information on the methodologies being used and the research findings. If there is sufficient interest IIMI might develop a more formal arrangement for supporting further research, seminars and workshops, consulting services, etc.

Those interested are invited to write to Doug Merrey, IIMI, Digana, via Kandy, Sri Lanka. Please provide basic information on the country, agency and project where you are working, the objectives of the research, methodologies being used, and time frame for the work. Merrey would also like to receive copies of any reports already available. Suggestions on how such a working group might operate will be welcome.

Michael Cernea, Sociological Adviser, World Bank, 1818 H Street NW, Washington DC 20433, USA, is interested in ways to build WUAs into the design of projects, and would like to have information on experience with this.

c. Rainwater Harvesting

In the August Newsletter, we reviewed a book by Pacey and Cullis on rainwater harvesting techniques. There is currently considerable interest amongst donor agencies in the role that water harvesting could play in providing more secure food production in semi-arid parts of Africa. For example, a variety of projects have been set up in the Turkana District of north west Kenya and in Burkina Faso. However, there is remarkably little data on the costs and returns of alternative methods of rainwater collection and use. Researchers at the Intermediate Technology Development Group, which commissioned and published the book by Pacey and Cullis, are interested in promoting greater interest and exchange of information in the field of rainwater harvesting (defined fairly widely to include use of water for domestic purposes, livestock and crops). Given the growth of interest, it would be valuable to pool the experience of different practitioners in this field. ITDG would be interested in participating within or helping to run a network linking people working on rainwater harvesting; those who would like to contribute their ideas as to how such a network could develop should write to: Patrick Mulvany, ITDG, Myson House, Railway Terrace, Rugby CV21 3HT, UK (telephone 0788 60631, telex 317466 ITDG G).

d. Secondary Consequences of Creating Reservoirs for Irrigation

Michael Cernea, Sociological Adviser, World Bank, 1818 H Street NW, Washington DC 20433, USA, has been involved in a study on this subject. Although the report is now finished, he would be interested in hearing from other people with concerns or interests in this field, since further work is planned.

e. Canal Irrigation at Night

Robert Chambers, Institute of Development Studies, University of Sussex, Brighton BN1 9RE, UK, continues to be interested in this subject. Please write to him if you have information, particularly examples of successful or unsuccessful steps taken by managers to start or improve canal irrigation at night.

3. IIMI ACTIVITIES

a. Publications

The following publications are now available or in press (in addition to those noted in previous Newsletters):

Chambers, Robert and Ian Carruthers. 1986. *Rapid Appraisal to Improve Canal Irrigation Performance: Experience and options.* Digana Village, Sri Lanka: International Irrigation Management Institute Research Paper No. 3 (November).

International Irrigation Management Institute and Joint WHO/FAO/UNEP Panel of Experts on Environmental Management for Vector Control (PEEM). 1986. *Proceedings of the Workshop on Irrigation and Vector-Borne Disease Transmission.* Digana Village, Sri Lanka, 13-17 October.

International Irrigation Management Institute. 1986. *Annual Report for 1984-85.* Digana Village, Sri Lanka: IIMI Pub.

International Irrigation Management Institute and Ministry of Lands and Land Development of the Government of Sri Lanka. 1986. *Proceedings of a Workshop on Participatory Management in Sri Lanka's Irrigation Schemes.* Digana Village, Sri Lanka, 15-17 May.

Cowell, Robert L. 1986. *Communication audit: A field method for assessing communication in organizations.* Digana Village, Sri Lanka: International Irrigation Management Institute Management Brief No. 3.

Wolf, James M. and Douglas J. Merrey. 1986. *Irrigation Management in Pakistan: Four papers.* Digana Village, Sri Lanka: International Irrigation Management Institute Research Paper No. 4.

Martin, Edward and Robert Yoder. 1986. *Institutions for Irrigation Management in Farmer-managed Systems: Examples from the hills of Nepal.* Digana Village, Sri Lanka: International Irrigation Management Institute Research Paper No. 5.

The following should be available from January/February 1987:

International Irrigation Management Institute and Water and Energy Commission Secretariat (WECS) of the Ministry of Water Resources, Government of Nepal. 1986. *Proceedings of a Workshop on Public Intervention in Farmer-managed Irrigation Systems.* Kathmandu, Nepal, 4-6 July.

International Irrigation Management Institute. 1986. *Proceedings of the Workshop on Irrigation Management for Crop Diversification.* Digana Village, Sri Lanka, 24-27 November.

Bautista, Honorio B. 1986. *Experience with Organizing Irrigators' Associations: A case study of the Magat River Irrigation Project in the Philippines.* Digana Village, Sri Lanka: International Irrigation Management Institute Case Study/Country Paper No. 1 (December). A brief description of this appears on page 13.

IIMI publication's are mailed free (surface mail) on request. Please address requests to: Communication and Publication Office, IIMI, Digana Village via Kandy, Sri Lanka. You can be placed on IIMI's mailing list by completing a card which will be sent to you on request.

b. Pakistan

IIMI's branch in Pakistan became fully operational with the formal signing of a Memorandum of Agreement between the Government of Pakistan and IIMI in October 1986. Pakistan offers opportunities to study irrigation management issues on large-scale systems under arid and semi-arid conditions, and with highly diversified cropping patterns. The Director is Dr. James Wolf and there will be four to six internationally-recruited staff, in addition to nationally recruited support staff. The major field sites will be in Punjab and Sind provinces, and the office address is ATl-B Danepur Road, GOR 1, Lahore, Pakistan. The operating budget at full development is projected to be US$1.75 million per year.

c. Workshops.

The *Workshop on Irrigation Management for Diversified Cropping* was held at IIMI from 24 -27 November 1986, its main objective being to identify the constraints to diversified cropping under irrigation conditions, and to seek ways of relaxing such constraints. A number of countries in the humid tropical regions of Asia are now approaching self-sufficiency in rice production, which in turn has lead to declining real prices of rice. Many farmers are seeking ways to diversify their production and income sources, but they face obstacles in growing non-rice crops on land irrigated by systems designed and operated only for rice. IIMI's research programme in this area in collaboration with national institutions in Sri Lanka, the Philippines and Indonesia was described in the last Newsletter. Several other countries have also expressed interest in collaborating in a research network on management of irrigation systems for production of non-rice crops in the drier part of the year. A total of 55 participants are expected at the Workshop, including those from Bangladesh, India, Korea, Indonesia, Madagascar, Malaysia, Nepal, Philippines, Taiwan, and Thailand, as well as the World Bank, USAID, and eight Sri Lankan national agencies, including the Irrigation Department, the Agricultural Department, the Mahaweli Authority, the University of Peradeniya, and the Agrarian Research and Training Institute and IIMI Resident Scientists from Indonesia and the Philippines. Proceedings of the Workshop should be available from IIMI Publications Office by early 1987.

d. IIMI's 1987 Budget

IIMI's 1986 budget approved by the Board of Governors totalled US$2.86 million. Of this, approximately US$1.5 million is central (unrestricted and restricted core) support. The 1987 central (core) budget endorsed by the Board totals US$2.9 million, with an additional US$1.27 million of special project support. Research accounts for 67 percent of the total program costs, compared with 21 percent for professional development and 12 percent for the information program. This budget, like that of 1986, reflects very limited capital expenditure, thanks largely to the Government of Sri Lanka for providing office and residential accommodation in Digana Village.

e. Professional Development Awards.

The Fellowship and Special Awards Programs at IIMI, described by Cowell (ODI/IIMI Network Paper 86/1b), are designed to provide training and research opportunities for irrigation management researchers and professionals from developing countries. The first appointment under IIMI's *Special Awards Program* is Honorio B. Bautista from the Philippines. This program is aimed at professionals from national agriculture or irrigation agencies who are responsible for managing irrigated agriculture and is intended to last from two to four months. Dr. Bautista's work focuses on the organization of irrigator associations on the Magat River project in the Philippines. In 1976 the Agricultural Development Division started organizing Rotational Unit Groups and Irrigator Groups at the turnout to ensure farmers' participa-tion in the equitable distribution of water and maintenance of irrigation facilities. In 1980, 23 Irrigator Associations (IAs) were organized in the sub-lateral and lateral canals to see if formal farmer groups could assist in the cleaning and minor maintenance work of larger irrigation canals and in collection of irrigation service fees. What happened in the succeeding years went far beyond expectations. The number of IAs grew from 23 in 1980 to 240 in 1986 with a total of 20,198 members cultivating 40,766 ha of rice land. Nearly 60% of these IAs now maintain about 600 km of irrigation canals and assist the National Irrigation Administration officials in the collection of irrigation service fees. Publication details are on page 11.

Candidates interested in IIMI's Fellowship and Special Awards Programs should write to: The Director-General, IIMI, Digana Village via Kandy, Sri Lanka, and enclose bio-data, a brief description of current course-/research/ professional work, a two-page summary of research and professional accomplishments during the past few years, and a proposal of the work they intend to pursue at IIMI.

4. FORTHCOMING CONFERENCES

An International Conference on *Water Resources, Needs and Planning in Drought Prone Areas*, is taking place from December 6th-12th, 1986, in Khartoum, Sudan. It has been sponsored and organised by the Sudan Engineering Society, the International Association for Hydraulic Research and UNDP/UNESCO. The conference has five main topics: data collection and utilisation; hydraulic engineering; water control structures; groundwater exploration and engineering; and case studies demonstrating the problems typical of water resource development in drought-prone areas. Enquiries about papers and the publication of proceedings should be addressed to Dr. Isam Mohmed Abdel-Magid, Faculty of Engineering and Architecture, Civil Engineering Department, P.O.Box 321, University of Khartoum, Khartoum, Sudan.

An International Symposium on *Conjunctive Use of Surface and Groundwater for Agriculture* is to be held at the Centre of Excellence in Water Resources Engineering, University of Engineering and Technology, Lahore, Pakistan in March 1987. While each country has its own experience and problems in this field, there are a number of common issues which it is hoped will be tackled at this symposium. Both international agencies (such as UNESCO, FAO, ICID, World Bank and USAID) and local development and research bodies have been approached for their collaboration. The focus of the symposium will include such topics as strategies for the development and use of conjunctive water resources, identification of factors limiting conjunctive water use and organizational structures for effective project operation and maintenance. Papers should have been received by November 30th, 1986 but people who have something original or of practical importance to offer should write to Dr N.M.Awan, Director, Centre of Excellence in Water Resources Engineering, University of Engineering and Technology, Lahore-31, Pakistan.

The 13th WEDC conference will be held in Malawi in April 1987, on rural development in Africa. Small-scale irrigation will be one of the topics. Persons wishing to submit papers should send a brief outline to Prof. John Pickford, WEDC, University of Technology, Loughborough LE11 3TU, UK.

5. TRAINING.

Irrigation Water Management Training Manuals

The Land and Water Development Division of the FAO has recently published the first two in its series of training manuals on irrigation water management: *Introduction to Irrigation* and *Elements of Topographic Surveying*. Keith Weatherhead of Silsoe College reviews them as follows: The manuals are intended for use by assistants in agricultural extension services and irrigation technicians. *Introduction to Irrigation* introduces the basic concepts, terms, methods and calculations needed. After a perhaps overlong chapter on calculating areas, etc., fundamental concepts are covered in soil and water, topography, rainfall and evaporation, irrigation systems, drainage and saline soils. *Elements of Topographic Surveying* describes elementary surveying equipment and provides examples of their application. Topics include setting out straight lines, right angles, perpendicular and horizontal lines, slopes and contour lines and measuring distances and differences in elevation. This is all achieved with the simplest of equipment; indeed, surveying levels and theodolites are mentioned only in passing. Both texts use plenty of drawings and diagrams to simplify the explanation. Three-dimensional perspective drawings replace many of the standard two-dimensional cross-sections used elsewhere. Generally, the text is simple and clear. The present editions are marked provisional and definitive versions are to be issued after a trial period and field testing. Nevertheless, they are well produced and printed and make a solid basis for training courses at this level. For further information write to: The Inter-national Support Programme for Irrigation Water Management, Land and Water Development Division, FAO, Via delle Terme di Caracalla, 00100 Rome, Italy. Pieter Dieleman tells us that these publications seem to have found a gap in training provision, and there have already been many requests for them. A third one on crop water requirements and scheduling has now been produced.

The Project Planning Centre for Developing Countries, University of Bradford is running a course on *The Planning, Appraisal and Implementation of Water Supply and Sanitation Projects and Programmes*, from April 27th to July 17th, 1987. The course is directed at staff who have had some years' experience of pre-investment planning, construction and operation in the water and sanitation sector, such as civil engineers, public health administrators and primary health care specialists. While the course is not explicitly concerned with irrigation systems, several elements in the course are likely to be of value to those from an irrigation background, such as the financial and budgetary control of projects, planning maintenance and rehabilitation, evaluation procedures and the design of pricing policies. Further details may be obtained by writing to the Course Director, Water Supply and Sanitation Projects Course, Project Planning Centre for Developing Countries, University of Bradford, Bradford, West Yorkshire BD7 1DP, UK (telex 51309 UNIBFD G).

An International course on *Applied Microcomputer Use in Irrigation and Drainage* is being held at the International Irrigation Center, Utah State University, USA from January 11th to February 21st, 1987. The course is designed for agricultural and civil engineers, agronomists and soil scientists working in the planning, design, operation and management of irrigation projects. The aim is to provide students with a thorough understanding of the principles, processes and practices of irrigation and drainage engineering and to enable them to develop the skills needed to simulate such principles using their own data. The cost of the course (excluding food, lodging etc.) is US$3,425. Requests for information and registration should be made to : Admission Committee, International Irrigation Center, Utah State University, Logan, UT 84322-8305, USA (telephone (801)750-2800, telex 3789426 UTAHSTATE LOGN). The deadline for registrations received by telex or telephone is Monday, 5 January 1987.

The Centre de Formation Internationale à la Gestion des Ressources en Eau (CEFIGRE) is running a number of courses in both French and English on Irrigation and Drainage. The three courses in French are: applied rural hydrology, the use of satellite imagery in irrigation development, and small scale irrigation covering flood retreat techniques, rainwater harvesting and use of swampland. The four English courses planned are: rainwater harvesting, the management of irrigation schemes, soil conservation for small catchment zones, and use of scarce resources in agricultural development. Details of the cost, venue and scheduling of different courses are obtainable by writing to: CEFIGRE, Sophia Antipolis, B.P.13, 06561 Valbonne Cedex, France (telephone 93 74 3100, telex 461311F).

6. NEWS FROM NETWORKERS ON AFRICAN PROGRAMMES

As part of its expanded programme for irrigation and water management in Africa, in 1987 USAID will fund an $8 million Research and Co-ordination Project in Niger, to develop and institutionalise a system of applied research. Under its Water Management Synthesis II programme, it will carry out three field studies focussing on improving existing irrigation and on encouraging the development of locally managed irrigation systems in Zimbabwe, Rwanda and Niger. A fourth study in Kenya is in the planning stage. The studies are of varying length and intensity. They will provide the basis for a workshop for participants from selected African countries on irrigation development and improvement in Africa. This is planned for November 1987, at a time and place to be decided. Further information is available from Worth Fitzgerald, WMS Project Manager, Office of Agriculture, Bureau for Science and Technology, USAID, Washington, DC 20523.

USAID is also financing rehabilitation and improvement in the Shalambood area of Somalia.

The World Bank has carried out studies on options and investment priorities in several African countries. The first phase, now completed, included Morocco, Mali and Sudan with co-financing from UNDP and the Government of France. The methodology has now been refined, and is being applied to Botswana, Zambia, Zimbabwe and Kenya with co-financing from the Government of the Netherlands. We hope to carry more information in a future issue. The person responsible at the Bank is Jose Olivares, Senior Agricultural Economist, Economics and Policy Division, Agriculture and Rural Development Department.

The country studies of water law and land tenure issues co-ordinated by Francoise Conac and referred to in the last issue continue and so do policy studies by Zimbabwean and Kenyan scholars and administrators.

FAO is revising its follow-up programme to the Lome meeting due to unexpected budgetary constraints.

7. PUBLICATIONS

Several publications have already been mentioned in connection with topics discussed earlier in the Newsletter. This section reviews some important papers covering a range of topics.

The most recent issue of *Land Use Policy* (Vol. 3, No. 4, October 1986) focuses on land use in Africa and contains a number of interesting papers and book reviews. Biswas provides a useful survey of irrigation development and potential in Africa, of variations in economic performance between schemes and of the main constraints to successful irrigation development in the African context. He notes in particular the inadequate attention paid to operation and maintenance on many schemes and the consequent need for expensive rehabilitation programmes. Sibanda describes the impact of two small scale rural projects on communities in the Zambezi Valley, Zimbabwe. While neither project is explicitly concerned with irrigation, Sibanda's paper highlights a number of crucial issues of general importance concerned with the need to involve recipient communities in project planning and implementation. The role of dambos (seasonally water-logged land, known also as fadama, bolis or vleis) in

African agricultural systems is described by Turner. Not only do they allow dry season crops to be grown using traditional irrigation techniques but they may also provide valuable dry season grazing for livestock. The future productivity of dambos is threatened in many places by erosion and degradation, due to overuse of water and soils. However, in some parts of Africa, such problems are avoided and careful management of this resource can be an ideal means of small scale development.

In many African countries better exploitation of water-retentive soils may be more suited to their conditions and much less costly than full irrigation systems. A workshop on these areas, known as dambos in Zimbabwe, was held at the University of Harare in August, 1986. A paper by Patricia Hotchkiss shows how important vegetable gardens are in these areas are as a source of income and food. For details write to Alan Windram, University of Harare.

Methodologies to evaluate the performance of irrigation systems is the report of a Regional workshop held in Dhaka, Bangladesh, from June 25-27th 1985, and is jointly published by the Bangladesh Agricultural Research Council and Winrock Inter-national Institute for Agricultural Development. It contains 16 papers on the monitoring and evaluation of irrigation systems, with particular reference to India and Bangladesh. The participants emphasize the need to establish clearly beforehand the objectives of monitoring and evaluation programmes and to plan different kinds of monitoring depending on the stage reached in the project and the questions to be answered. Bottrall's paper notes the tendency for bias in evaluating system performance, with more attention paid to water management at the farm level rather than main system management. Bellekens describes the experience of the Asian Development Bank in financing irrigation schemes and their subsequent performance. In general, schemes have not met expectations, due to time and cost overruns, slow take up of the technology by farmers, heavy maintenance costs and low water use efficiency. In addition, the area actually irrigated is frequently considerably less than planned as a result of inadequate assessment of soils, water availability and the distributional capacity of the system. He notes that performance can be greatly improved where both institutional and physical structures receive attention. Biswas reiterates the need for continuous monitoring and evaluation so that project management can take timely corrective action. Murray-Rust, Tabbal, Galang and Sumayao examine three systems in the Philippines to assess their performance and recent attempts at rehabilitation. They note in particular the lack of flexibility built into most irrigation systems. Design often fails to take operational and maintenance requirements into account. Modifications to operational practice are almost always necessary to adapt to changes in water availability, due to highly optimistic assumptions about conveyance capacities, and to desired changes in cropping patterns and calendars. Gisselquist and Alam discuss the importance of assessing the distributional effects of irrigation development. They note that the equity effects of irrigation are often very poor, in part due to the lack of explicit attention paid to equity in scheme design and in part to the poor definition of rights over water which allows some people to misappropriate water at the expense of others. The Ford Foundation have made a certain number of copies of the Workshop proceedings available for distribution through ODI. Please write to the Irrigation Management Network Secretary at ODI.

The *ICID Bulletin* for January 1986 (Vol. 35 No. 1) contains several valuable articles. Le Moigne from the World Bank describes the Bank's experience with financing irrigation development. Overall, irrigation comprises around 10% of all loans and some 35% of loans to the agricultural sector. The main problems encountered during project planning and implementation include insufficient technical preparation, unrealistic implementation schedules and inadequate counterpart funding. Once projects have been established, the issues of cost recovery and finance of maintenance expenditures arise frequently. Rehabilitation and modernisation of irrigation projects are now taking up a large proportion of Bank resources and there is increased recognition that such rehabilitation must include both physical and institutional modifications. Le Moigne contrasts traditional large scale schemes on which a rigid cropping system is practised with the requirements of future schemes in which flexibility and ability to respond to changes in crops, water supply and management will be given much greater prominence. Hlavek discusses selection criteria for choice of irrigation technique in relation to several economic factors and institutional and technical constraints. Delavalle's two articles discuss irrigation water management and choice of irrigation methods. He also stresses Le Moigne's point that management systems must be able to adapt to variable demands. Pozzi describes alternative methods for controlling water-associated diseases and the ways in which environmental management, rather than chemical methods, can be used to reduce disease problems.

The autumn issue of the *ADA Gazette* (the magazine of the Association and Drainage Authorities, UK) has a short piece on the use of fish to control weeds in water and drainage systems. Trials using grass carp have been undertaken for 3 years, the fish being released in May in a drainage catchment at a stocking rate of around 200kgs/ha. The carp controlled most submerged weeds and produced a substantial cost saving, when the cost of keeping the drain stocked with fish is compared with the cost of weed-cutting operations. It would be interesting to know of successful examples of weed control using fish elsewhere, with an assessment of the costs and benefits. The proceedings of the 7th International Symposium on Aquatic Weeds, held at Loughborough University of Technology, UK, September 1986 are now available as European Weed Research Society Symposia Proceedings, Post Box 14, NL-6700, Wageningen, The Netherlands. Although most of the papers describe research and management methods in Europe, there are a few on Egypt, Malaysia, China and India.

The Water Management Synthesis Project has published several new papers. *Improving policies and programs for farmer organization in irrigation water management* (Cornell University, WMS Professional Paper no.1, 1985, 41p) by Norman Uphoff, Ruth Meizen-Dick and Nancy St-Julien, is a shortened version of Uphoff's paper - *Getting the process right: Improving irrigation water management with farmer organization and participation* (Cornell University, WMS Working Paper) - reviewed in the IMN Newsletter last August. It provides a useful summary of results, methods of analysis and recommendations from the longer paper.

WMS Report 45, *Post 1987 Strategy for Irrigation*, USAID Pakistan, has been prepared by Dean F. Petersen, Utah State University, Logan, Utah 84322-4105, USA. Mike Powell comments that it is a good survey of the problems in Pakistan, where total water supplies are very restricted, and where local jealousies, poor organisation and insufficient staff with understanding of the principles and practice of irrigation agronomy complicate the development of more intensive agricultural production on the farm. However, there is now clear recognition in Pakistan of its water scarcity and the consequent need to improve water use efficiency. USAID's objective is to continue to assist in the improvement and distribution of irrigation water through the financing of infrastructural rehabilitation and through technical assistance for institutional improvements including effective water users' associations. Both the World Bank and Asian Development Bank are also assisting On Farm Water Management Projects in Pakistan with the aim of improving water use efficiency. The ADB programme, begun in 1981, has achieved considerable success in water course reconstruction and land development and an active project training programme has advanced thinking, but limitations in the provision of water management extension staff, equipment and supporting budgets have seriously reduced the effectiveness of the project. The current World Bank OFWM II project has increased the number of water management extension staff in each field team. It will be interesting to see how this programme develops. Powell thinks an integrated approach is necessary.

> "Sustained increases in production can only occur when large numbers of individual farmers have confidence in a reliable water supply, understand the implications of improved water use, and are prepared to work co-operatively to maintain both infrastructure and land developments. Increased inputs will then be justified and crop intensity and yields will increase".

Irrigation Rehab: User's Manual (Cornell University, September 1986, WMS Report no.46) by Robert L. Oaks and others is a computer-based game, aimed at simulating tasks and problems likely to be encountered in planning for and implementing the rehabilitation of an existing irrigation system. It is hoped to be of value to a variety of different professionals, such as irrigation engineers, government officials, consultants and project managers. Its starting point is that rehabilitation offers an important opportunity for reconsideration of fundamental aspects of irrigation system design and operation, given the likelihood that there have been substantial changes in key parameters (water supply conditions, social, economic and agronomic variables) since the scheme was originally designed. Consequently, rehabilitation should be thought of as a means to incorporate accumulated experience from years of operating a scheme in order to better match the physical and human resources available. The game is based on conditions in many large or small scale gravity-flow irrigation systems that grow rice, in the humid/sub-humid monsoon regions of Asia. It can be played by one or more teams or by a single individual. REHAB is meant to be a non-competitive activity, in which participants first seek to discover as many problems as possible that exist in a hypothetical irrigation system. Each group or player then formulates solutions to the identified or anticipated problems before meeting farmers to discuss system rehabilitation. The disk at the back of the manual is for use on an IBM-PC, XT or AT computer, though the authors note that it should also perform on any fully IBM-compatible system.

Use of computer models to aid water management seems to be growing fast. In the last issue of the Network, we published two short papers by Tom Sheng and Laurence Smith describing how computers can be used as a management tool and for training purposes. In the Spring issue of *Water Management Review* (Vol. 1 No. 2), the newsletter from the WMS Project at Colorado State University, two further articles outline how computer models can be of value. Gary P. Merkley from Utah State University describes 2 models, one on hydrodynamics and the other on water allocation systems, developed to achieve more efficient main system management aimed at providing optimal water delivery given various constraints. The models can be applied to a variety of situations, to simulate for example, the consequences of poor maintenance for main system management. Glenn Dearth shows how the use of microcomputers has greatly improved system operation in the Gal Oya Water Management Project. Here, 3 models have been developed, covering irrigation water requirements, system operation and record-keeping, the aim being to improve canal operating schedules, using the minimum amount of data collection. There are 3 phases to the modelling exercise: first, pre-season planning of irrigable area given water supply availability, second, weekly planning of delivery schedules to reflect the actual area planted, soil characteristics, stage of crop growth and climatic variations and third, post-season record-keeping to compare planned with actual operation to allow for improvements in model specification.

The Wheat Trap by Gunilla Andrae and Bjorn Beckman (London, Zed Books Ltd in association with the Scandinavian Institute of African Studies, 1985) describes the role of large scale irrigation schemes in Nigeria's agricultural development strategy, and in achieving greater self-sufficiency in food production. Alan Bird who worked on the Bakolori Irrigation Project in the north of Nigeria, after Sir M MacDonald Ltd took over management from an Italian firm in the early 1980s, gives his assessment of the book:

"At first glance, this book would seem to be of considerable interest to those concerned with agricultural development in northern Nigeria. In particular, the focus in Part 2 on the 3 large irrigation schemes there (Bakolori, South Chad and Kano River) led me to hope, at long last, that a useful analysis of these projects was now available in book form. From my point of view, however, it turns out to have been a disappointment and a chance missed. The book comes across as an awkward amalgamation of two different, though connected studies, the first on the white bread industry in Nigeria and the second on large scale irrigation development. Beckman's view is that irrigation schemes were promoted primarily as a way of attaining self-sufficiency in wheat production, given Nigeria's very heavy import dependence. This is not a helpful way of understanding the rationale behind irrigation development; rather, these large irrigation schemes must be seen in the light of preliminary studies carried out in the 1960s and early 70s, by the FAO and others, which recommended large scale water resource development as a strategy for increasing crop production in this semi-arid region. Wheat was never planned to take up more than 11.5% of crop area in the Bakolori Project while the South Chad project had rice as its main crop. Beckman's numerous small factual errors detract from the often justified arguments brought against these schemes. It is a pity that his detailed site knowledge is so limited and that he did not contact many of those who could have provided him with more information. He lacks an understanding of how consultancy contracts work and thus misses a valuable opportunity to analyse how the interests of different parties involved in project design and development are crucial determinants of how and why these projects developed as they did. I would like to see a review of these irrigations schemes, based on detailed field work, to investigate how they have performed over the last five years and whether their effects have been as damaging as many predicted."

(What is clear from Beckman's work, however, is the danger of jumping from preliminary identification of a possible role for irrigation in dealing with food needs to the commissioning of large-scale schemes. They were not based on thorough understanding either of the farming systems that they were disrupting, or of the hydrological regime. Nor was there any modest pilot scheme to try out the proposed cropping regime - Ed).

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18 November 1986

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IRRIGATION MANAGEMENT NETWORK

THE IRRIGATION WATER CHARGE IN CHINA

Xu Guohua

ODI/IIMI Irrigation Management Network Paper 86/3b November 1986

Papers in this set

83/3a: Newsletter
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ERRATA

Page 6, para 3, line 4: Should read "7.5 days' labour for annual repairs", not half a day.

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THE IRRIGATION WATER CHARGE IN CHINA

Xu Guohua

1. IRRIGATION IN CHINA

China has a very long history of irrigation. The famous Dujiangyan irrigation works, for example, has been operating continuously for more than 22.3 centuries and is still efficiently irrigating 587,000 ha of land. China's irrigated area is also very large. Official statistics show that there are 44.45 million ha under irrigation, equal to 45 per cent of the total cultivated land area. The main irrigated crops are rice, wheat, maize and cotton. Rice is the dominant crop in southern China where the climate is warm and humid. Wheat, maize and cotton are the main crops in north China where the climate is semi-arid to semi-humid, and water resources are not abundant. Irrigation in north China under normal conditions can increase crop yields substantially and may double the yields in dry years, while in wet years it has few benefits. In north-east China where the winter is quite cold and the summer is warm, the returns from growing paddy rice is substantially higher than other crops, so rice has become the dominant crop in the irrigated sector. However, only 15% of total cultivated area is actually under irrigation in this region, the main dryland crops being wheat, maize and soybean. The north-west part of China is quite arid, and in some parts practically no cropping is possible without irrigation.

Chinese irrigation facilities, aside from very small ponds, dikes and simple wells possessed by individuals, all belong to the public sector. All big and medium irrigation works are national properties, and managed by government water conservancy organisations, while the small ones are generally owned by local collective organisations of farmers. In the construction of a national project, as a rule for the last 3 decades, the government water conservancy unit constructs the main canals and structures with the farmers contributing most of the labour needed; farmers also construct the tertiary canals and on-farm works with building materials (steel, cement and wood, etc.) provided by the government. Farmers receive only a small allowance for their work in scheme construction. If account is taken of the difference between the normal wage the farmers could earn and this allowance, farmers' share of the irrigation investment is roughly equal to the share of the government in most cases. Small irrigation projects have to be approved by the government water conservancy organisation first; the owner can then generally get a loan to construct the project, and sometimes the water conservancy organisation may provide the owner with subsidised building materials.

Once a scheme has started to operate, 3 levels of management organisation are established. At the top level is scheme organisation, run by government. While it is responsible for the whole system, only the headworks and main canals are under its direct management. Next, there are many 2nd level organisations which take care of medium level canals, each with a coverage of several thousand hectares or more. These organisations are semi-governmental, permanent in nature and their personnel are professionals. The 3rd level organisations are small, temporary groups of 3-5 persons. They are responsible for O&M, for canals at the lowest level as well as irrigation practices within lands of certain villages. Farmers make up these groups and are responsible for work only at irrigation time and winter repair time, totalling perhaps 20-30 days per year, the rest of their time being spent farming. Water charges are used to finance the two higher level organisations. Expenditures at the third level are not financed by water charges but are paid for by local farmers. However, these expenditures are quite limited and correspond to only a small proportion of total water charges.

Actual water use by different farmers is not measured; instead, it is assumed that each irrigation concerns Xm^3 of water. However, the water delivered by the main canals is actually measured with a device and the total amount of water allocated to a village is estimated by persons rich in experience. As far as the total sum of water volumes is concerned, all use by villagers must meet the amount measured at the upper level (discounted by the appropriate coefficient to allow for water losses during conveyance). This means that although the amount of water is not actually measured at field level, the amount of water for a village is measured with reasonable accuracy so that any errors in measurement occur within the confines of the village boundary. It is very simple to record the number of irrigations received by a farmer. Far more difficult is the actual collection of water charges. In most cases this is done by village groups, but in some cases by scheme personnel.

Many water conservancy projects are multipurpose. In addition to the irrigation function, they may also be used for flood control, hydro-electric power generation, fisheries, etc.. In such cases, the irrigation water charge is not the sole source of scheme income.

2. WATER CHARGING POLICY UP TO 1979

The forms and rates of water charges vary with different projects under different conditions. The irrigation water charge per ha in the rice growing Dujiangyan scheme, for example, ranged from 37.5 to 75 kilograms of husked rice plus half a day of labour for annual repairs through the 1940s to the beginning of 1980s, the rate varying for land of differing quality. The cotton dominant irrigation area of Jin-wei canal, Shaanxi province, used to charge farmers from 3.75 to 18.75 kilograms of lint per ha during 1930s and 1940s. In 1956, it was changed to 10.5 yuan[1] per ha of irrigation land as the basic charge which had to be paid no matter whether it was actually irrigated or not, plus 7.5 yuan per ha for each actual irrigation. That means, if a hectare of cotton land is irrigated twice in that year, as is normal practice, the water charge will be 10.5 + 2(7.5) = 25.5 yuan. The method of payment switched in 1956 from assessment in kind to a cash charge per hectare. Levies in kind had been

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[1] The Chinese unit of currency is 1 yuan divided into a hundred cents. In 1985 1 yuan = $2.9367.

practiced before because of the very high levels of inflation which eroded the real value of cash-based charges. Following the establishment of a new government in 1949, currency inflation was brought under control so that charges could be reliably assessed and collected in cash.

In general, these water charges are approximately equal to between 1 and 3 per cent of the normal yield or gross income from that crop. It is obvious that these irrigation water charges do not cover investment costs and take care of only O&M expenditures under normal conditions, with some money to be used for overhaul. Although the Dujiangyan works, the Jinwei canal and some other irrigation systems have maintained normal operation with such irrigation water charges, there are quite a number of irrigation works in poor financial state, due to the fact that water charges have been too low and to low collection rates. The result is that the facilities have not been well maintained and operated, with some so poor that they had to ask the government to provide a subsidy.

Tables 1 and 2 present data on water costs and charges. From these can be seen the wide variation in costs of supply between provinces and schemes. Topographical differences have an important effect on both construction and O&M costs while other factors include differences in water supply available and willingness as well as ability to subsidise irrigated agriculture. In the case of Jiangsu Province, for example, the land is flat and there is plenty of water. Not only are construction and O&M expenses low, but also it is rather a rich province, with the ability to subsidise its farmers, if needed.

3. THE BASIS OF REFORMS IN WATER CHARGE POLICY SINCE 1979

In 1979 China started her great economic reforms and in 1981, the basis for water charges was changed. At the beginning of that year, the former Ministry of Water Conservancy (now Ministry of Water Conservation and Hydro-Electric Power, (MWCHP)) conducted a nation-wide investigation of water charges. From the end of 1981 till the summer of 1985, MWCHP held many special conferences to discuss and study the water charge issue and finally, in July 1985, the State Council issued "The principles of determination, calculation, collection and use of water charge of water conservancy works". This document marks the beginning of a new period in

TABLE 1. IRRIGATION WATER CHARGE OF 19 PROVINCES CITIES AND AUTONOMOUS REGIONS

Province City or Autonomous Regions	Irrigation Water Charge					Water Charge for Other Uses	
	Basic Charge yuan/ha	Varying Charge				Industrial use cent/m^3	Domestic use cent/m^3
		for Cereal Crops		for Cash Crops			
		based on the amount of water used cent/m^3	based on the area irrigated yuan/ha	based on the amount of water used cent/m^3	based on the area irrigated yuan/ha		
Guangzhou		0.5-0.8	30-75	30% higher than that of cereal crops		2.0-3.0	2.0-2.5
Guangdong		0.5-0.7	52.5-75				
Guangxi	7.5	0.6-0.7		1.3-1.5		2-3, 4-6	5-6
Guizhou		0.5	37.5-52.5	0.8	45-60	2-4	2-10
Sichuan	9.0-15.0	0.3-0.8	22.5-52.5			0.4-1.0,2-5	0.5-2.0
Zhejiang		0.8-1.2	45-75	1.2-1.6	60-90	2-6	1.6-4.8
Anhui	7.5-15.0	0.4-0.6				2	1
Jiangsu		0.1-0.15	15-22.5			0.13,0.7	0.2
Shandong		0.8-1.2	45-75	1.0-2.0		1.5-3.0,4-7	
Henan	3.0-7.5	0.2-0.5	45-105			0.1-0.2,0.7-1.0	0.4-0.6
Shaanxi		1.0-1.5	30-60		60-90	1-2,5-8	2-4
Hebei	4.5-7.5	0.5-0.8				0.8-1.0,4-5	0.8-1.0
Beijing		0.6				1.5-4.0	0.5
Shanxi		0.8-1.5				6-10	6-10
Liaoning		0.8				3-5	0.5-1.5
Inner Mongolia		0.5-0.6	30-36	0.6-0.7	37.5-45	2-4	4-8
Gansu		0.6	37.5	0.7		2	3

TABLE 2. WATER COSTS AND RELATIVE PROPORTIONS OF THEIR COMPONENTS (SELECTED WATER SUPPLY WORKS)

Name of Province Autonomous Regions or Cities	Name of Water supplying works	Cost of water supplied cent/m³	Relative proportions of different parts of cost				Rate of amortizations	
			amortization for investment recovery %	amortization for system rehabilitation %	O&M expenditures % ±	Total %	for investment recovery %	for system rehabilitation %
Guangdong	Longjing	0.447	33.0	7.4	59.6	100	2.0	0.5
Guangxi	Jiangkou	0.470	32.5	12.1	55.4	100	3.7	1.4
Guangxi	Dajiang*	2.005	35.7	10.0	54.3	100	5.0	1.4
Hunan	Red Flag	4.202	68.6	25.4	6.0	100	3.8	1.4
Jiangxi	Bingyuan	0.498	62.7	17.5	19.8	100	5.0	1.4
Sichuan	Quanmin	3.470	57.1	40.0	20.9	100	2.0	1.4
Henan	Zhifang	7.476	55.1	27.7	17.2	100	2.3	1.2
Shanxi	9 Stations*	6.369	52.1	10.9	37.0	100	6.7	1.4
Ningxia	Tongxin*	9.100	24.1	6.1	69.8	100	2.0	0.5
Gansu	Jintaichuan*	7.500	50.2	13.2	36.6	100	5.3	1.4

* pumped water

± figures in this column are calculated based on the actual expenditures in 1981

NOTE: This is a simplified version of the author's original table which contains data from a much larger number of Provinces and water supply works. Copies of this more detailed table can be obtained by writing to Fiona Harris, The Irrigation Management Network at ODI, London.

the course of water charge reforms.

A fundamental element in reforming irrigation water charges is the need to change traditional attitudes. For thousands of years, the Chinese people have considered water conservancy works as works of public welfare and they did not have any idea of recovering the investment. Now, the construction of irrigation projects is to be considered in the same way as economic enterprises like factories or mines. Scientific appraisal is needed to test that such projects are economic, feasible, and that the investment can be recovered within a reasonable period. It is a principle that all economic enterprises should be able to recover their investment, since only then can the extent of economic construction be greater, and can the people reap larger benefits. If an enterprise cannot get back its investment within a reasonable number of years, how can we develop the next enterprise? If water conservancy projects can not recover their investment, how can further projects be constructed? For these reasons, State Council policy is that all water supplied by water conservancy organisations should be paid for and the rate of water charge should be determined on the basis of calculated cost. Since farmers have contributed their labour without receiving any pay in constructing the water conservancy projects, the rate of irrigation water charge should be lower than those of other users; farmers' labour investment should be deducted when calculating the cost of irrigation water and determining the rate of charge, while the whole investment cost should be included in calculating the cost of water for other water users.

The reform of water charges should also promote the economic utilisation of water resources. With the growth of national population and economic activity, shortage of water, especially in northern China, has become serious. The old system of low water charges and the method of fixing the rate of water charge only on irrigated area leads to waste and increasing water shortage. Thus, the State Council has announced that:

1. In general, the water charge should be based on the amount of water used
2. For agricultural use, a combined system should be used to assess the water charge - part of it based on the area of irrigated land (the

basic charge) and the other part on the amount of water used.

Furthermore, it is recommended that different water prices be calculated for different seasons.

4. EXAMPLES OF THE NEW CHARGING SYSTEM

The Jin-wei Canal has used the following system for collecting irrigation water charges since 1980: the basic charge is 6 yuan per ha, with a variable fee for the amount of water used depending on season: 9 cents/m^3 for winter water, 10.5 cents/m^3 for spring and 12 cents/m^3 for summer. The new policy also allows the use of a punitive rate for water use in excess of a given level in areas short of water.

Nineteen provinces, cities and autonomous regions have erected new systems of collecting water charges since 1982 (see Table 1). The situation is better than before, but there are still many problems to be solved.

Shanxi, a province in North-China, in 1981 had a total amount of water supplied by the provincial water conservancy organisations of 5,400 million m^3, of which 93 per cent was for irrigation. The price of water supplied for different uses was: 0.3-0.5 cents/m^3 for irrigation and 2.0-3.0 cents/m^3 for industrial and domestic uses of cities and towns. However, the costs of supplying water were 3.4-4.1 cents/m^3, which meant that there was a deficit of 1.0-2.0 cents for every m^3 of water supplied for industrial or domestic uses, and of 3.0-3.7 cents per m^3 of water supplied for irrigation use. The difference between the water cost and the water price, which was paid by the government water conservancy organisation, was in effect a subsidy to water-using farmers, factories and urban dwellers. Then in 1982, water prices were changed to: 6-10 cents/m^3 for industrial and domestic use, 0.8-1.5 cents/m^3 for gravitational irrigation and 2-8 cents/m^3 for pumped water irrigation with a lift of 50-300 m. The total income of water charges collected according to this new system is 2.5 times that of the old system. Yet the 0.8 cents/m^3 irrigation water charge is still only enough for O&M, while 1.5 cents/m^3 still would not cover investment recovery, although it might help to pay for repairs or overhauls. The price of water for gravity irrigation of 0.8-1.5 cents/m^3 equals approximately 38-71 yuan/ha, or about 2.0-4.0 per cent of gross value of crops produced per ha irrigated under normal conditions. We feel around 2.0 per cent of the gross value of the local main crop is the optimum level for a water charge, and a range of 3.5-5.0 per cent acceptable. This is felt to represent a reasonable charge on farmers, given levels of farm income. To achieve full investment recovery would demand a water charge estimated at from 6-15% of total gross output value.

5. ADDITIONAL STEPS NEEDED FOR FULL COST RECOVERY

The above example shows clearly that although the water conservancy organisation of Shanxi Province has raised their income from water charges by 2.5 times, in practice they are still unable to recover investment costs. That is only one among many examples. There is a very wide range in costs of water supply (see Column 3 of Table 2) between schemes and provinces. The new irrigation charges in Table 1 are, in many cases, still too low to cover the costs of water supply.

a. Education

A number of steps must be taken to improve the situation. First, the principle of cost recovery needs explaining. It is very difficult to change traditional ideas held for thousands of years. The cadres of China have, since 1949, devoted their efforts to bringing benefits to people. However, many rural people are still poor and need help. Furthermore, most irrigation works were built using unpaid farmers' labour. This makes the situation more complicated.

b. Reduction of Costs and Increase in Subsidiary Income

Secondly, we could try to lower the water cost. The greater the fall in costs, the easier the recovery of the investment. There are many things we can do. The number of staff members working in management offices and administrative expenditures can be cut. To take all possible steps to reduce the loss of water in conveyance and application is also an important task in all irrigation areas. It is now proposed that all water conservancy organisations develop diversified businesses to earn extra money in order to increase the total income available for O&M expenditures and investment recovery. There are still other choices and possibilities.

c. Examination of Special Cases

Thirdly, in some cases, there may be special reasons why the cost of water is too high to be fully charged to water users. For example, gravity irrigation systems in mountainous areas not only have very high investment costs per unit of irrigated land, but also have high O&M expenditures, because they have to build and maintain many complicated structures to keep the water running. There are also some areas irrigated with water pumped up hundreds of feet. In such cases, the power cost may represent several tenths of gross value of crops produced on that field, although the price of electricity for agricultural use is far lower than those for other uses. For these and other reasons, the question must be asked "are these irrigation projects really worthwhile to construct and maintain?" Generally, this question should be answered independently by examining the economic benefit from these projects, but in some special cases this question should be answered by looking at the overall benefits from these projects. If projects are to be constructed in the latter case, it may be necessary to subsidise them, but it would be better that these subsidies take an open form rather than that of a low water charge.

Besides the questions mentioned above, another question remains: should water users pay a "resource fee" for water used in water short regions? In China, only users who divert or pump water from reservoirs or "reservoir-regulating" rivers have to pay such a fee. Many people agree that persons who pump water from underground in regions not rich in water resources should pay such a fee too, but no action has yet been taken. One reason for this is that while all surface water is under the control of the Ministry of Water Conservation and Hydro Power, groundwater management is the responsibility of three different ministries. It is becoming clear that if water users were asked to pay a fee for the water they use, they would have a strong incentive to improve their efficiency of water use.

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IRRIGATION MANAGEMENT NETWORK

FARMER-MANAGED IRRIGATION: RESEARCH ISSUES

Edward Martin, Robert Yoder, and David Groenfeldt

ODI/IIMI Irrigation Management Network Paper 86/3c November 1986

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FARMER-MANAGED IRRIGATION: RESEARCH ISSUES

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FARMER-MANAGED IRRIGATION: RESEARCH ISSUES

Edward Martin, Robert Yoder, and David Groenfeldt

This is a revised version of a paper which was sent to the participants of a conference on *Public Intervention in Farmer-Managed Irrigation Systems*. The conference, sponsored by the International Irrigation Management Institute with the Water and Energy Commission Secretariat of the Ministry of Water Resources, His Majesty's Government of Nepal, and held in Kathmandu in August 1986, had as its objective to identify and discuss research issues related to farmer-managed irrigation systems. The purpose of the paper was to provide participants with some background material about research on farmer-managed systems and public intervention in these systems. The authors hope now to establish a research network on these issues. Interested researchers and practitioners will find details at the end of the paper.

1. INTRODUCTION

1.1 The importance of small scale irrigation

There is growing recognition among development planners, irrigation agency officials, and agricultural research scientists of the importance of small-scale irrigation systems which are managed by farmers, or have the potential for being farmer-managed.[1] Unlike large-scale irrigation projects which typically involve large sums of technical and financial assistance, improvements to farmer-managed irrigation systems can generally be carried out at lower cost, with greater budgetary flexibility, and primarily through local expertise.[2]

Most farmer-managed systems are relatively small in scale, often irrigating less than 100 ha, but farmer-managed systems as large as 10,000 ha can be found in Nepal (Water and Energy Commission, 1981). There are several other examples of systems over 1,000 ha in Asia, and in the USA they may be over 100,000 ha.[3] Study of large farmer-managed irrigation systems may indicate that farmers' management responsibilities need not be limited to small-scale systems or the tertiary level of large-scale systems and may suggest how farmer organizations could take over the management of major portions of large-scale systems or possibly even manage the whole system.

Even though most farmer-managed systems are small, their large number results in a total area irrigated which rivals that of large-scale agency-managed systems in many countries. In the case of Nepal it is estimated that 400,000 ha, or nearly 80 percent of the irrigated area, is under the command of farmer-managed irrigation systems, while in the Philippines farmer-managed systems account for approximately 60 percent (850,000 ha) of the irrigated area (Bagadion, 1986). In Sri Lanka village tank and diversion systems managed by farmers account for an estimated 243,000 ha of irrigated area (Gunadasa et al., 1981), while in Bangladesh farmers manage most of the groundwater irrigation systems.

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[1]The term "farmer-managed" is used to refer to irrigation systems where groups of farmers collectively manage the system from the water source to the fields. Irrigation systems of this type are often referred to as "communals" or "community-managed" systems. The term "farmer-managed" avoids the ambiguities of the term "community."

[2]While this is often one of the arguments for investing in assistance to farmer-managed systems, the approach taken by some agencies results in higher costs per hectare in these projects than for large-scale projects.

[3] See the chart compiled by Robert Hunt, Appendix to ODI Irrigation Management Newsletter 9a, April 1984.

While irrigation in Africa is not nearly as extensive as in Asia, much of the irrigation is small-scale and, in many cases, farmer-managed. An estimated 2.6 million of a total of 5.3 million hectares of irrigation in sub-Saharan Africa are classified as small-scale or traditional, indicating individual or small group management (FAO, 1986).

1.2 The trend towards intervention in farmer-managed systems

For a variety of reasons government irrigation agencies, international donors, and private voluntary organizations are becoming more interested in farmer-managed and small-scale irrigation systems. In many countries the best locations for large-scale irrigation have already been utilized. In other cases donor agencies, disappointed with the results of investing in large-scale irrigation systems, view small-scale irrigation systems as an opportunity for rapid project implementation with the potential to realize benefits more quickly than large-scale projects. Because of the traditional technologies used in farmer-managed systems, the assumption is often made that with minimal physical improvements to structures, significant gains in production and high economic returns on investment can be achieved. At the same time, farmers and local politicians are making more requests of irrigation agencies to improve their irrigation system and, in some cases, asking the government to take over the management of the system. However, we know little about the results. Except in the Philippines there has been little documentation of significant production gains through outside agency intervention.

The ease with which improvements can be made by developing new small systems or improving old ones can be over-estimated. In some areas, like the hill regions of Nepal, most locations with high irrigation potential have been developed already to some extent by farmers. This has three implications for government irrigation development efforts. First, investment in desirable sites will nearly always involve intervention in farmer-managed irrigation systems or impinge on the water rights of neighboring systems. Second, if improvement were technically easy, farmers might carry it out themselves. They are most likely to request help in technically difficult situations (Gowing, 1986). Third, the remaining areas without any irrigation development are often those in which irrigation construction is technically more difficult and more expensive. Social and cultural differences may also account for the fact that farmers have not developed irrigation systems and make the intervention by an outside agency more difficult.

The nature of agency involvement in farmer-managed irrigation systems varies considerably. Two opposing trends can be observed, one toward increasing agency involvement in the management of systems and the other toward reduction in agency responsibilities. In Himachal Pradesh, the Public Works Department provides assistance to farmer-managed irrigation systems only after the existing farmer organization turns over management of the system to the agency. A contrasting situation exists in the Philippines where, after construction or rehabilitation by the National Irrigation Administration, the whole system including the dam is turned over to a legally registered water user organization. "Signed documents clearly establish the organization's legal ownership of the facilities--and leave no question regarding its full responsibility and authority for operation and maintenance" (Korten, 1986).[4]

The results of intervention are mixed. In the Philippines farmer organizations have been strengthened and the technical inputs have resulted in more productive irrigation systems (de los Reyes and Jopillo, 1986). There have been other cases, in Nepal for example, where the farmers have ceased to consider the system their own and have balked at mobilizing the resources needed to operate and maintain it themselves following intervention.[5] A dependency relationship has developed between farmers and the intervening agency, and this is undesirable for several reasons.

(1) It is costly for an irrigation agency to post staff to manage a large number of geographically dispersed systems, each of which may irrigate less than 100 ha.

(2) Staff assigned to a small, isolated system may consider it

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[4]This applies primarily to small-scale systems (under 1,000 ha), but NIA is beginning a phased program of turning over larger systems to the farmers.

[5]Louis Rijk, Project Manager, ILO Labor-Intensive Public Works Program, Kathmandu, Nepal. Personal communication.

technically unchallenging as well as a hardship post and not be motivated to perform well.

(3) The takeover of management responsibility by a government agency will nearly always result in a lower level of internal resource mobilization, even if the agency charges the farmers an irrigation service fee. Since many developing countries find it difficult to mobilize resources internally, especially from the rural areas, replacement of the resources mobilized by farmers to operate and maintain their irrigation systems by an allocation from the central treasury will rarely be desirable.

2. RESEARCH TO UNDERSTAND EXISTING FARMER-MANAGED IRRIGATION SYSTEMS

Before specific interventions can be considered intelligently in a particular country or region, certain basic information must be to hand. The types of understandings which are relevant to intervention can be summarized in two general questions: (1) How do farmers manage their irrigation systems, including both hardware and software technologies, and (2) How well do farmers manage their systems and in what, if any, aspects could they benefit from outside assistance? We then need to analyze different approaches to intervention in farmer-managed irrigation systems and the results of experience.

2.1 A descriptive framework

Two ways of looking at farmer-managed systems have been found helpful. The first focusses on activities. The second focusses on property rights and associated duties.

2.1.1 Activities

Farmer-managed systems are found in diverse environments using a wide range of technologies to exploit different types of water sources. All farmer-managed irrigation systems, however, require that certain essential tasks must be accomplished if the system is to function productively. Some management activities focus directly on the water, i.e., acquisition, allocation, distribution, and drainage.[6] Another set of activities deals with the physical structures for controlling the water, i.e., design, construction, operation, and maintenance. A third set of activities focuses on the organization of the people who manage the water and the structures, i.e., decision making, resource mobilization, communication, and conflict management (Uphoff et al., 1985). There is interaction among the activities of the three sets; for example, the organization must decide how to operate the structures to distribute water.

Not all activities are of equal importance in every environment, and farmers' irrigation management organizations will reflect the relative importance of activities in a particular location. For instance, in the hills of Nepal where irrigation systems often have long canals which must traverse steep, landslide-prone slopes, the most critical activity of the organization is mobilizing labor to maintain the intake and canals. The farmer organizations for managing systems in such an environment are structured to ensure that this function can be carried out effectively (Martin, 1986). Precise attendance records and cash accounts are maintained, and sanctions for being absent from maintenance work are strictly enforced.

Depending on environmental conditions and on the technology used, however, the management focus varies. In the farmer-managed tank systems of Sri Lanka, group decision-making on the timing of water releases is the most critical management task; mobilizing labor and cash to renovate the physical structures is relatively less important. For farmers in Bangladesh who collectively own irrigation pumps, it is the pump--its operation, repair, and financing--which is the key focus of management activity.

2.1.2 Property rights

Wherever irrigation systems have been developed, property rights regarding the physical structures and water also exist (Coward, 1983).

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[6] Allocation means the assignment of rights of access to the water among users, while distribution refers to the physical distribution of water among the users.

These property rights, which may be explicit or implicit, define who has access to the water and to how much, as well as the farmers' responsibilities for maintaining the physical works. The nature of property relationships and the way that water is allocated in farmer-managed irrigation systems affect both the efficiency and equity of irrigation resource use.

An understanding of property rights in regard to water is important when an agency is undertaking an intervention aimed at improved productivity of the system. If water is scarce, a system for rationing the water is required so that each farmer can receive his prescribed allocation. In some farmer-managed systems, locally produced proportioning weirs divide the flow proportionally among different secondary and tertiary canals. In other systems, strictly timed rotational distribution is practised with the length of each person's turn computed to supply him the proportion of the supply represented by his allocation. The technology for distributing water involves both physical mechanisms to handle the water distribution and social institutions to manage the mechanisms and to resolve conflicts when they arise. Disturbance of the distribution system without understanding the link between the physical and institutional components and their interactions can lead to disappointing results including the refusal of farmers to maintain the new system, as noted above.

2.2 Studies of the response of systems to change

Farmer-managed irrigation systems exist in many different environments. Those which have survived and prospered have been able to adapt to changes in the environment. Systems are now being exposed to more rapid change. What were once relatively isolated, self-sustained communities are becoming more integrated into regional and national economic systems, bringing different forces to bear on the irrigation organization. Can farmer-managed systems be sustained in the face of increased state intervention in all areas? What happens to farmer-managed systems when labor has a much higher opportunity cost as a result of industrial development? As the state penetrates more into rural areas, what happens when local customary water rights and national water laws are in contradiction? What macro factors induce change in farmer-managed systems, and are systems able to adapt to the change? These are all questions worthy of research.

Most studies of farmer-managed systems have concerned successful, relatively well-functioning systems. This has, perhaps, resulted in a rather idealized perception of farmer-managed irrigation systems. It is time to study systems which have failed entirely, or which continue to operate only through heavy government subsidies, in order to understand the underlying causes. In addition, studies of why systems have not been developed in areas where there is a potential irrigation resource should also be conducted

2.3 How well farmers manage their systems

Conventional wisdom concerning the performance of farmer-managed irrigation systems tends to place it at either of two extremes. Engineers often assume that the systems are inefficient in the capture, conveyance, and distribution of water because of the rudimentary technologies used. Social scientists, on the other hand, tend to assume that because the systems have evolved as part and parcel of the local social and environmental setting they are more efficient and sustainable than systems constructed and managed according to the designs and procedures of irrigation agencies. Appropriate institutional arrangements may compensate for less sophisticated technology. Little careful measurement and analysis of how well farmer-managed irrigation systems perform, employing the expertise of engineers in addition to social scientists, has been made, however. More rigorous studies are needed which include measurement of water flows, crop yields, and research into the institutional setting of farmer-managed systems. In this way we could see how far they reach goals of efficiency, productivity and equity.

Some principles of water allocation provide incentives for efficient water management and a mechanism for expanding the area irrigated, while others do not. For example, allocation of water in proportion to land area irrigated does not provide incentives for expanding the irrigated area, while allocation by purchased shares does (Martin and Yoder, 1983). In the first case, if a system is improved so that it supplies more water, the farmers with the water rights have no incentive to allow other farmers access to the water, but can irrigate the same area with less intensive management. If water is allocated by purchased shares, however, when the supply is increased, farmers with more water than needed can sell some water shares, allowing for expansion of the area that is irrigated.

Evaluating the performance of farmer-managed irrigation systems should include agricultural productivity and the extent of area irrigated by a given source. An analysis of the efficiency of performance of farmer-managed irrigation systems and an understanding of the reasons for a given level of efficiency are important when considering how and if to intervene to improve the systems' performance.

For example, it is necessary to determine whether water is a limiting constraint to increased production; if it is not, efficiency of water use should not be considered an important objective in system management. If the topography is such that no additional area could be irrigated with water from the source, for example, water application rates may be high without "wastage" of water.

In other cases, the irrigated area may be constrained by institutional factors, such as water rights. In a system in Nepal, farmers reported that it would be possible to double the area irrigated by changing from continuous-flow to rotational distribution, but the farmers with land adjacent to that which was irrigated had no water rights (Yoder, 1986).

In some cases there are technical inefficiencies in water acquisition, conveyance, or distribution that could be overcome through the assistance of an irrigation agency.

The equity of distribution of the benefits and costs is another measure of performance of farmer-managed irrigation systems. An irrigation system is often said to be equitable if there is proportionality between the costs borne and benefits received by individual farmers. A crucial test of the equity of distribution is presented when the supply is reduced below the amount required to irrigate the entire command. Are all farmers equally affected by the shortage, or do some suffer disproportionately? Again, before intervening it is necessary to see how and if farmers cope with seasonal shortage. Systems have been studied in the Philippines (Siy, 1982) and Sri Lanka (Leach, 1961) where the landholdings are intentionally distributed such that each household has some land at the head end of the system and some at the tail end. If the water supply is insufficient to cultivate the entire area, the tail section can be cut off, and all farmers still have some land that receives irrigation. Farmer-managed systems in Nepal substitute maize for rice over the entire command when water is scarce (Martin and Yoder, 1983). In North Yemen contributions to the replacement of temporary dams to catch spate floods fall into three classes according to the degree of likelihood that a farmer's land will benefit.[7]

In addition to the equity of distribution of costs and benefits among the members of an irrigation organization, the equity issue regarding access to benefits of the system is also important. If the water rights are attached to the land, then people owning more land also benefit more from the irrigation. Also, when water rights are attached to the land, the only way that persons who did not initially receive water rights can gain access to irrigation is by purchasing high-priced, already irrigated land. In some irrigation systems ownership of land and property rights in water are separated, and water is allocated through the sale of shares in the system. A farmer owning land within the hydraulic command area, but outside the original irrigated area, can gain access to water through the purchase of shares from another farmer or from the organization (Martin and Yoder, 1983). In rare cases (e.g., Sukhomajri in Haryana, India) water rights are distributed equally to all households in the area or in proportion to the family size instead of the size of landholding. Within the context of a project to increase the water supply in a system, it might be possible to bring about a change in the principle of water allocation to allow for greater access to water. This would have to be approached with a great deal of care or the institutions that function on the basis of existing property rights will be undermined. It might be necessary to find ways of assuring current members of the irrigation organization that they would not lose security of their water supply.

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[7]Mary Tiffen, ODI, personal communication.

3. RESEARCH ON ALTERNATIVE STRATEGIES TO ASSIST FARMER-MANAGED SYSTEMS

It is often the case that several agencies, both governmental and private, are involved in assisting farmer-managed irrigation systems within a single country. The approaches taken by these agencies typically include (1) completely ignoring existing irrigation organizations and systems, (2) taking over the management of existing systems, and (3) implementing projects entirely through the existing farmer organizations. Coward (1984) distinguishes between direct and indirect investment approaches. Under direct investment, the agency takes full control of implementation activities including design and construction. In these cases, the agency often takes over the management of the system, though it may aim to turn it back to the farmers for operation and maintenance after construction is complete. Under the indirect investment approach, the agency provides resources (financial, technical assistance, materials) to existing irrigation organizations in the form of grants, subsidized loans, and technical assistance which support that organization in improving its irrigation system. Management control of the system remains with the farmers.

Historical and bureaucratic factors underlie some of the different approaches taken by different agencies. For instance, departments of irrigation and public works, whose main activities are the design, construction, and operation and maintenance of major irrigation schemes, tend to use the same direct investment approach when dealing with small-scale, farmer-managed systems (Wensley and Walter, 1985). Departments of local and rural development, by contrast, tend to follow an approach of indirect investment by providing assistance to existing irrigation organizations which are responsible for implementing the project and for ongoing operation and maintenance. Systematic study of different intervention programs are needed to identify the key aspects of the particular approaches which seem most effective.

A comprehensive understanding of different agencies' approaches to assisting farmer-managed systems requires analysis of the internal organization of the agencies. The flow of information into the agency and the demand for information within it needs to be understood. Equally important is an analysis of the incentive structure for different groups within the agency. If, for example, field officers learn that farmers do not want a diversion weir built at a certain location, what are the incentives for going ahead with the project anyway, or for making modifications? The kinds of information which the agency recognizes as important before a project is launched, and the incentives for seeking or not seeking particular kinds of information, can be important aspects of understanding agency behavior in assisting farmer-managed systems. Research in this area would aim to identify the organizational constraints to improved agency operation.

The relevance of this type of research is seen in the example of the National Irrigation Administration (NIA) in the Philippines which wanted to adopt a new approach to assisting farmer-managed systems. It soon became apparent that it would be necessary to make internal changes in the functioning of the agency (Korten, 1982). Socio-technical profiles of the existing irrigation system were compiled and a cadre of community organizers hired to strengthen farmers' organizations' capacity prior to the project. NIA engineers were required to work with farmers in the process of system layout through a series of meetings and a "walk-through" of the proposed canal locations. Farmers' association construction committees were formed to observe the opening of bids from contractors, check the quantity and quality of materials, recruit and place laborers, and record association members' contributions to the project and the project costs. Construction contracts given to farmers' associations were broken down into smaller units that could be completed, inspected and paid for in two-week cycles. NIA reconciled its project accounts with the association every month instead of only at the completion of the project with the result that the association had a clear understanding of project costs. Special training courses in water management and financial management were designed for the associations.

Of particular importance to the viability of farmer-managed irrigation systems is the impact of agency intervention on the mobilization of resources by farmers. When the agency assumes full responsibility for the intervention and does not involve the existing organization in planning and implementation in a meaningful way, farmers may lose their sense of ownership of the system. They will see no reason to contribute their own resources to the maintenance of an irrigation system now owned by the agency. Without the active participation of existing farmer organizations, the agency intervention may well result in a decline instead of the anticipated improvement in system performance. Comparative research on alternative intervention strategies can help in identifying the essential elements of effective assistance programs.

4. CONCLUSION

Farmer-managed irrigation systems represent a rich field for research into issues of irrigation management. In some countries considerable research has been done on these systems, while in others this sector has yet to receive much attention. Research on farmer-managed irrigation systems is one of the primary program areas of the International Irrigation Management Institute (IIMI). IIMI researchers have begun research on farmer-managed systems in Sri Lanka and Nepal which aims at gaining a better understanding of how farmer-managed systems in different environments function as well as studying government intervention in the systems. The research in Nepal includes both small-scale hill systems and large (5-10 thousand ha) systems on the plains, while in Sri Lanka village tanks as well as diversion (anicut) systems are being studied. In both countries, one focus of the research is the convention of property rights in the irrigation works and water. An issue that is being examined is how the traditional property rights are affected by government intervention, the organization's response to intervention, and the impact on resource mobilization. In Nepal, an action research project in collaboration with the Water and Energy Commission Secretariat aims to develop more effective approaches to assisting farmer-managed systems.

IIMI seeks to facilitate communication and interaction among researchers and irrigation agency officials who are involved in the farmer-managed/small-scale irrigation sector. As a first step, IIMI conducted an international workshop on "Public Intervention in Farmer-Managed Irrigation Systems" in Kathmandu, Nepal, in collaboration with the Water and Energy Commission Secretariat of the Ministry of Water Resources in early August 1986. Participants included approximately 60 researchers and irrigation agency personnel, primarily from universities and irrigation agencies in Asia and Africa. A research network of interested researchers and irrigation agency officials who are working on similar problems and programs is now being established. It is being called the *FMIS Network* (Farmer-Managed Irrigation Systems). The objective of the network is to facilitate the sharing of knowledge and experience as well as to identify and support new research efforts. Administrative support for the network will be provided by IIMI. Persons interested in the network should write to the FMIS Network Coordinator, IIMI, Digana Village via Kandy, Sri Lanka.

REFERENCES

Bagadion, Benjamin U. 1986. "Government Intervention in Farmer-Managed Irrigation Systems in the Philippines: How Research Improved the Process." Paper presented at the Conference on Public Intervention in Farmer-Managed Irrigation Systems. International Irrigation Management Institute and Water and Energy Commission Secretariat, Kathmandu, Nepal. August 1986.

Coward, E. Walter, Jr. 1983. "Property in Action: Alternatives for Irrigation Investment." Paper presented at Workshop on Water Management and Policy, Khon Kaen University, Khon Kaen, Thailand. September 1983.

Coward, E. Walter, Jr. 1984. "Improving Policies and Programs for the Development of Small-Scale Irrigation Systems." WMS Report 27. Paper prepared at Cornell University for the Water Management Synthesis II Project, USAID Contract DAN-1427-C-00-0086-00, to the Consortium for International Development. Ithaca: Cornell University.

de los Reyes, Romana P. and Sylvia Ma. G. Jopillo. 1986. "An Evaluation of NIA's Participatory Communal Program." Paper presented at the Conference on Public Intervention in Farmer-Managed Irrigation Systems. International Irrigation Management Institute and Water and Energy Commission Secretariat, Kathmandu, Nepal. August 1986.

FAO. 1986. "Small-Scale Water Control Schemes in Sub-Saharan Africa: Past Experience and Development Options." Working paper prepared by the FAO Investment Centre in cooperation with IFAD Africa Division. Rome: FAO.

Gowing, John. 1986. ODI-IIMI Irrigation Management Network Newsletter 86/2a. London: Overseas Development Institute.

Gunadasa, J.M., P. Wickramasekera, H. M. Gamini Herath. 1981. Socio-Economic Survey of Minor Irrigation in the Dry Zone of Sri Lanka. University of Peradeniya, Sri Lanka.

Korten, Frances F. 1982. Building National Capacity to Develop Water Users' Associations: Experience from the Philippines. World Bank Staff Working Paper Number 528. Washington: The World Bank.

Korten, Frances F. 1986. "The Policy Framework for Community Management." In David C. Korten (ed.) Community Management: Asian *Experiences and Perspectives. Forthcoming Kumarian Press.*

Leach, E.R. 1961. Pul Eliya, a Village in Ceylon: A Study of Land Tenure and Kinship. Cambridge: University Press.

Martin, Edward D. 1986. Resource Mobilization, Water Allocation, and Farmer Organization in Hill Irrigation Systems in Nepal. Unpublished Ph.D. dissertation. Ithaca: Cornell University.

Martin, Edward D. and Robert Yoder. 1983. "Water Allocation and Resource Mobilization: A Comparison of Two Systems in Nepal." Paper presented at

Twelfth Annual Conference on South Asia, University of Wisconsin, Madison, Wisconsin, November 4-6, 1983.

Siy, Robert Y. Jr. 1982. Community Resource Management: Lessons from the Zanjera. Quezon City: University of the Philippines Press.

Uphoff, Norman, Ruth Meinzen-Dick, and Nancy St. Julien. 1985. "Improving Policies and Programs for Farmer Organization and Participation in Irrigation Water Management." A report prepared at Cornell University for the Water Management Synthesis II Project, USAID Contract DAN-1427-C-00-0086-00, to the Consortium for International Development. Ithaca: Cornell University.

Water and Energy Commission. 1981. Irrigation Sector Review. Kathmandu: Ministry of Water Resources.

Wensley, Christopher J. and Michael F. Walter. 1985. "Small-Scale Irrigation: Design Issues in Government-Assisted Systems." WMS Report 39 prepared at Cornell University for the Water Management Synthesis II Project, USAID Contract DAN-1427-C-00-0086-00, to the Consortium for International Development. Ithaca: Cornell University.

Yoder, Robert. 1986. The Performance of Farmer-Managed Irrigation Systems in the Hills of Nepal. Unpublished Ph.D. dissertation. Ithaca: Cornell University.

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IRRIGATION MANAGEMENT NETWORK

OPERATIONS AND MAINTENANCE LEARNING PROCESS: COMBINING TRAINING AND MANAGEMENT

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OPERATIONS AND MAINTENANCE LEARNING PROCESS:

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Gaylord Skogerboe works for the International Irrigation Center, Utah State University, Logan, Utah 84322-8305, U.S.A. We are grateful for their permission to reproduce this paper. The approach to operations and maintenance advocated here was developed as a result of assignments under the USAID funded Water Management Synthesis II project in Nepal, Sri Lanka and Thailand. Earlier versions have been produced as WMS II reports. The approach has benefitted from the suggestions of both Dr. Alan C. Early, Colorado State University and Khun Nukool Thongwatee, Director, Operation and Maintenance Division, Royal Irrigation Department, Thailand.

OPERATIONS AND MAINTENANCE LEARNING PROCESS: COMBINING TRAINING AND MANAGEMENT

Gaylord V Skogerboe

1. CONCEPTUAL APPROACH

An irrigation system can be subdivided into three major subsystems: (a) water delivery, (b) farm, and (c) water removal. The "heart" of an irrigation system is the farm subsystem. The purpose of an irrigation system is to grow food by delivery of water to the root zone. Water delivery and water removal subsystems support the growth of plants that provide food for humans and animals.

Even if all three irrigation subsystems have been properly designed, the lack of an adequate technological and institutional framework for operating the system in accordance with the design criteria may lead to failure of the system or low agricultural production levels. Those operating conveyance facilities have not always seen their objective as sustaining long-term productive agriculture. Deteriorating irrigation channels and inadequate operating procedures can preclude any significant improvements in the farm water management practices which lead to higher production. Technology alone will not bring about the necessary improvements. Instead, technological changes and institutional modifications will usually help existing irrigated lands become more productive.

For example, it is not sufficient to rehabilitate a network of irrigation channels; the channels must be maintained *season-after-season* so that a dependable water supply can be delivered to every farmer. Likewise, it is not sufficient to just fill the channels with water; flow measurement devices are needed so that irrigation supplies are equitably delivered to each farmer. First of all, in order to operate and maintain an irrigation system on a sustained basis, high-ranking government officials need to provide the necessary manpower, equipment and budget. Secondly, the personnel responsible for operations and maintenance must provide farmers with timely and equitable water deliveries.

The operations and maintenance "learning process" described here provides one approach for effectively sustaining an irrigation network over a long time period. This process emphasizes: (a) maintaining rather than rehabilitating; (b) documenting maintenance needs to improve financial management and accountability; (c) using existing flow control structures in irrigation channels for water measurement; (d) developing more detailed physical knowledge about what is occurring within the system; (e) increasing sensitivity about operating the system to meet the needs of farmers; and (f) documenting the need and costs for irrigation system improvements.

In discussing operations and maintenance (O&M) issues, it is useful to subdivide the irrigation system into the "main subsystem", usually called the main system, and the tertiary subsystem or Unit Command Area (UCA). The tertiary system or UCA is the land served by the last flow control structure along the main system. An irrigation project consists of a main system channel network that serves many UCAs. Many irrigation projects around the world have a division of O&M responsibilities between the main system and the UCA. Usually, a government agency is responsible for O&M activities in the main system, while the farmers within a UCA are responsible for O&M activities in the tertiary channel network.

2. OPERATIONS

The first step in the operations process is to do a field survey of required essential structural improvements (ESI) for flow control (eg. replacing gates) and water measurement (eg. repairing damaged structures or installing new flow measuring devices). This operations survey can be done separately or simultaneously with the maintenance survey. In either case, the results of the operations survey are incorporated into the maintenance survey to develop a maintenance plan.

The operations survey is conducted by walking along the full length of the main system consisting of main, branch and distributary (or main, lateral and sub-lateral) channels. Of particular importance is each division point in the channel network because these are locations where water is diverted from a larger channel into a smaller channel, and the smaller channels' discharge rate should be measured. These division structures should be inspected for necessary cleaning, repairs and replacement (eg. gates, bricks, etc.). The field inspection results for each structure should be recorded in a field book with sufficient detail so that a good cost estimate can be prepared later for necessary maintenance to have the structure function for both flow control and water measurement.

In many irrigation systems, numerous open channel constrictions can be used for measuring water such as drop structures, check structures or flow regulating structures. Many of these structures should be improved (ESI) so that they can function as water measurement devices. Then, the channel losses between two structures can be measured. Sometimes, measurement will require special operating procedures for from half a day to two days so that water is not diverted between the two structures (unless the water diversions can also be accurately measured).

A detailed Essential Structural Improvements Plan should be prepared that includes:

1. Physical description of irrigation system
2. Proposed flow measurement program for equitably distributing water supplies
3. Proposed flow measurement program for evaluating channel losses
4. Essential structural improvements
5. Costs of essential structural improvements and
6. ESI Implementation Plan

Once the ESI Plan has been approved, then detailed cost records should be kept of actual expenditures during ESI implementation. This is important for planning similar investments in other irrigation networks because these costs reflect the minimum investment that should be made in upgrading the irrigation channels' operation. Accumulating this information for many irrigation systems will allow planners to allocate more realistic funding for upgrading other irrigation projects in their region or country.

After making necessary structural improvements, a concerted effort will be needed to develop discharge ratings for all of the flow control structures. For the large main canals and branch canals, a current meter could be used to calibrate each structure, whereas, portable flow measuring flumes can probably be used to calibrate the inlet structures for smaller irrigation channels (eg. watercourses or sub-laterals). Distributary or lateral channel structures should be rated using portable flow measuring devices wherever feasible; otherwise, a current meter should be used. Periodically, the discharge ratings should be checked and adjusted, if necessary. This should become a routine operations procedure. Also, detailed field books should be kept to describe the physical condition of the structure and nearby channel each time a discharge rating is made. With periodic maintenance, the discharge rating for each structure will change very little with time. Although this technology is simple, periodic maintenance and attention to details are important in order to have discharge measurements that are accurate within five per cent.

After discharge ratings have been developed for each flow measurement structure, channel losses can be evaluated for most of the reaches in the irrigation network using the inflow-outflow method. In fact, stage readings collected at each structure prior to developing a discharge rating can be converted to calculated discharge rates that will be fairly accurate provided there has been no significant change in channel sedimentation or vegetative growth, both of which are problems in many irrigation systems. Channel losses should be measured periodically throughout each irrigation season to determine the effects of channel water depths and water table depths on seepage rates. There will usually be some reaches where ponding tests will need to be conducted prior to or after the irrigation season, or perhaps before and after a scheduled rotation period, in order to accurately measure the conveyance losses.

Each irrigation project needs detailed maps showing all irrigation and drainage channels, along with all cropped lands served by these channels. These maps, along with adequate flow control structures that have been rated for discharge measurement, provide the tools for developing an operations plan. Presently, water delivery schedules are calculated for most irrigation projects in the world, but the lack of flow control and water measurement structures precludes measuring water deliveries. Consequently, conveyance efficiencies are estimated by "pulling numbers out of the air" because there is usually only a meager amount of data, or none, on actual conveyance losses.

A simple operation plan can be prepared on paper beginning with some methodology for establishing water requirements or water demands for each tertiary system that is served by an outlet from the main system. Then, by knowing the conveyance losses in the main system between the canal headworks and the inlet to the tertiary system, the discharge requirements at the canal headworks can be calculated. The remaining data that is needed will be the time lag from the time that the appropriate discharge rate is diverted into the canal headworks until it reaches the main system outlet serving the tertiary system. The time lag can be determined by field experience, but preferably by field measurements.

Implementing the operations plan will provide more equitable distribution of irrigation water supplies throughout the irrigation project because channel losses will be taken into account, and the water delivered to each outlet from the main system can be measured. Monitoring can improve water delivery schedules as more field data are collected, and those individuals doing the monitoring will become more sensitive about what is happening within the system.

The monitoring, evaluation and feedback (ME&F) program should be designed to develop communication between the water users and those personnel responsible for controlling the main system outlet gates, which are the inlet gates to the tertiary systems. In addition, cropping patterns and discharge measurements are monitored and reported to project management staff, who in turn provide feedback to project field personnel for improving water delivery schedules.

To achieve truly equitable water deliveries to farmers, more information is required to determine water losses in the tertiary channels and calculate water budgets on croplands. This can be done by undertaking a field data collection program to determine channel losses and irrigation application efficiencies. Tertiary channel (watercourse) losses for each UCA can be determined using the rated inlet structure and portable flow measuring device(s). Irrigation application efficiencies can be field measured on a relatively small sample of cropland areas taking into account the various soil types. This will provide much more realistic estimates of the water requirements at each tertiary system (UCA) inlet (main system outlet) throughout the irrigation season.

If sufficient field data are collected, then the operations plan could be placed on a micro-computer model that would adequately simulate the real irrigation system. A simple steady-state, volume balance operations computer program could be utilized consisting of three models: (a) weekly (or any other appropriate time period) irrigation requirements; (b) weekly water delivery schedules; and (c) weekly records and seasonal analysis. Experience has demonstrated that computer modelling leads to more field data collecting, greater sensitivity about the system, and more equitable distribution of irrigation water supplies.

The more field data collected, the better the internal workings of the irrigation project will be understood. The field data will lead to some preliminary conclusions as to necessary improvements that would reduce water losses, thereby allowing more water to be available for crop production. A computer model, if developed, can be effectively used to simulate potential irrigation water management improvements in meeting crop water requirements anywhere in the irrigation system. For example, channel losses might be reduced in some high water loss reaches by placing compacted clay lining, soil-cement lining, plastic membrane lining, brick-and-mortar lining, or concrete lining. In other cases, some modifying of the rotation schedules might reduce losses. Providing farmers with technical assistance to improve their water management practices might also be beneficial. In some cases, additional storage on the irrigated lands could lead to more beneficial use of the available water supplies. Then, a cost estimate should be prepared for each potential improvement. The two data sets (water saving and costs) can be combined to formulate options for improving the irrigation scheme that would achieve higher levels of water use. These options can be prioritized by ranking according to cost per unit of water or analysing cost-effectiveness to develop a package of technologies that would cost the least to achieve whatever objectives were used in the analysis.

The prioritized options should be documented and presented in an Irrigation System Improvement Plan. The advantage of this document is that justifying the options can be readily understood by government and donor officials. Therefore, these officials can easily decide the level of investment that they consider appropriate at that point in time. Thus, this document makes it easier to seek support and obtain funding for implementing some, or all, of the recommended improvements.

3. MAINTENANCE

The first step in the maintenance process is to conduct a detailed field survey that lists all maintenance needs along each main canal, branch or lateral canal, and distributary or sub-lateral including the inlet structure to each tertiary system (UCA). The survey requires 2-3 individuals (eg. irrigation engineer and technical assistant) walking along the irrigation channels, taking notes on each maintenance need (eg. removal of sediment, repair of canal bank, repair of damaged structure, etc.). These notes must provide sufficient details for preparing a cost estimate for correcting each maintenance need.

Walking, rather than driving, makes field personnel gain more sensitivity about maintenance problems, not just major problems, but also minor problems that often develop into major maintenance problems in another year or two. Many of these minor problems are overlooked when driving, even slowly, along a canal bank.

The term "diagnostic" is very important in all aspects of irrigated agriculture, including maintenance. The majority of maintenance problems are easily observed in the field. Unfortunately, on many irrigation projects around the world, only the major maintenance problems are corrected, so that minor problems that could be corrected inexpensively are ignored until they grow into major expensive problems. Even more importantly, often only the symptoms of the problem are treated rather than the cause of the problem. This is done sometimes purposefully because of less expense and sometimes because the causes are not recognized.

A report should be prepared for each irrigation project that describes a maintenance plan to be implemented and completed within a reasonable time period, preferably 3-5 years. This report should include:

1. Essential structural improvements (ESI)
2. Costs of essential structural improvements
3. Inventory of required maintenance
4. Maintenance costs
5. Priority maintenance needs (PMN) and costs
6. Maintenance equipment requirements
7. Maintenance manpower requirements
8. Maintenance plan
    a. Force account maintenance
    b. Private contractor maintenance
    c. Farmer organization contract maintenance
    d. First-year priority maintenance work plan
    e. Proposed work plans for second, third, fourth years, etc.

For each fiscal year, a Priority Maintenance Needs Work Plan would be forwarded to appropriate authorities for approval and funding. At the end of each year, the Irrigation Engineer for each project area would prepare a maintenance completion report that lists each maintenance need that had been corrected and its actual cost. This report would also be forwarded to appropriate authorities for their review.

Accountability is a key factor in this annual cycle of preparing a work plan and filing a completion report. Irrigation project personnel must develop credibility with central headquarters that the provision of manpower, equipment and funds will be used appropriately to correct PMN. In turn, this documentation allows central or regional headquarters to monitor and audit the effectiveness of the field maintenance program as well as provide essential data for central planning of future maintenance funding requirements.

Some funds will already have been expended for Essential Structural Improvements, while additional funds will need to be allocated to correct Priority Maintenance Needs. The allocated funds to the project may not be sufficient to correct all maintenance needs, so the highest priority maintenance needs should be corrected first, then the next highest priority, etc. until all allocated maintenance funds have been expended, or all Priority Maintenance Needs have been corrected.

When the operations process has proceeded to the point where channel losses (including the tertiary system) are being measured, along with field evaluations of irrigation application efficiencies on cropped fields, then the maintenance plan should be refined. A revised maintenance plan should be prepared that includes a section on maintenance requirements for tertiary systems, which would be undertaken by the farmers' organization (eg. Water Users Association, WUA) for each UCA with technical assistance provided by appropriate government agency personnel. As a minimum, the irrigation engineer, farmer representative for the particular UCA being inspected, and the technical assistant responsible for delivering water to the UCA should walk along the tertiary (watercourse) channel network and collectively prepare detailed notes on maintenance needs. At the same time, revisions in the previous maintenance plan can be made based on new information and experience gained during implementation. One of the more valuable insights that should have been gained by this time is the causes of the maintenance problems, rather than just the symptoms.

After completing PMN, and gaining experience and credibility with WUAs, a preventive maintenance plan should be prepared that would be the basis for continued long-term maintenance activities. This plan should discuss:

1. Physical causes of maintenance problems
2. Anticipated extent of maintenance problems
3. Maintenance equipment requirements
4. Maintenance manpower requirements
5. Maintenance requirements for farmers organizations (WUAs)
6. Estimated annual maintenance costs
7. Preventive maintenance plan

This document should be forwarded for appropriate review and approval.

Khun Nukool Thongwatee, Director of Operations and Maintenance Division, Royal Irrigation Department, Thailand, is actively engaged in implementing this process on some schemes in Thailand. He comments that it is a practicable system if field staff have sufficient knowledge of calculation, and some years experience in construction or operation. If they have this background, they can be trained quite easily to carry out these procedures. However, new staff find it difficult to cope with the requirements.

odi

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IRRIGATION MANAGEMENT NETWORK

NEWSLETTER

ODI/IIMI Irrigation Management Network 87/1a April 1987

Agricultural Administration Unit, Overseas Development Institute, London

The Overseas Development Institute (ODI) is an independent, non-profit making research institute. Within it, the Agricultural Administration Unit (AAU) was established in 1975 with support from the British Aid programme. Its mandate is to widen the state of knowledge and flow of information concerning the administration of agriculture in developing countries. It does this through a programme of policy-oriented research and dissemination. Research findings and the results of practical experience are exchanged through four Networks on Agricultural Administration, Irrigation Management, Pastoral Development and Social Forestry. Membership is currently free of charge to professional people active in the appropriate area, but members are asked to provide their own publications in exchange, if possible. This creates the library which is central to information exchange.

The International Irrigation Management Institute, Kandy

The International Irrigation Management Institute (IIMI) is an autonomous, non-profit making international organization chartered in Sri Lanka in 1984 to conduct research, provide opportunities for professional development, and communicate information about irrigation management. Through collaboration, IIMI seeks ways to strengthen independent national capacity to improve the management and performance of irrigation systems in developing countries. Its multidisciplinary research programme is conducted on systems operated both by farmers and by government agencies in many co-operating countries. As an aspect of its dissemination programme it is joining ODI in the publication of the Irrigation Management Network papers, to enable these to appear more frequently to an enlarged membership. It has also provided equipment to link ODI's irrigation library into an international irrigation management database centred on IIMI.

NEWSLETTER

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NEWSLETTER

We apologise for the delayed appearance of the Newsletter and Papers. Part of the reason was the amount of material received as a result of my visit to India in February, which forms the basis for Network Paper 87/1e, and which also led to a larger than usual section here of news from networkers. Preparation was also delayed by events in the London office. Fiona Harris, who was Network Secretary from the time I took over in January 1983, resigned at the beginning of April. She is marrying and moving to a job nearer her home. She will be greatly missed for her efficient services in maintaining the Register, preparing papers for printing, and answering members' requests for information. It proved difficult to find the person with the right combination of qualities to replace her, but on May 5 Jyoti Bhardwaj joined as the new Network Secretary. Camilla Toulmin was temporarily away for the birth of a daughter, but we are now back to full strength.

1. NETWORK PAPERS AND DISCUSSION

a. The Present Issue

The current issue contains four papers, on planning techniques, water charges, computers in water management and groundwater issues.

The Dominance of the Internal Rate of Return as a Planning Criterion and the Treatment of O&M Costs in Feasibility Studies (87/1b)

This paper is the result of a review I undertook for the British Overseas Development Administration of the social, economic and institutional difficulties mentioned in the post-project evaluation reports of various aid agencies. With the co-operation of the aid agencies and of many Network members engaged in planning and appraisal, I also investigated the methods of planning projects, to see in what ways these could be improved. It became clear that detailed knowledge of, and consultation within, the area where the project is located is as important on the economic and institutional side as it is on engineering issues. It is particularly important to ensure that farmers derive attractive incomes from the project, and that the managing authority has the resources of appropriate manpower and funds to maintain it. If the Internal Rate of Return is used as the dominant criterion for project choice, these other issues can be under-valued. The paper was first given at the FAO/USAID conference on recurrent costs in September, 1986 and was also the subject of lunch-time meetings in London and New Delhi. There was a fair measure of agreement at all meetings that the decision to implement has to be taken in a multi-criterion framework - that is, the strengths and weaknesses of the project according to different objectives have to be balanced up. On a more technical economic issue, some economists felt Net Present Value could be a better measure of national economic benefit than the IRR; others disputed this. In India, some people expressed fears that if there was more local consultation, big projects that could not easily be comprehended by laymen could fail to gain acceptance. However, most people accepted the necessity of local consultation and the importance of farm incomes. The report is now being prepared for publication; I also hope to publish is a forthcoming issue of the Network a discussion of the interconnections between social, economic and institutional conditions and engineering choices.

Irrigation Service Fees in Asia (87/1c)

The way projects are planned, and the amount of attention given to their revenue generating capacity, has important national implications. An article by Himmat Patel in the *Economic Times*, India, on 5 March 1987 reported that the total loss made by all states on their irrigation projects through the excess of working expenses over revenue had risen from Rs 5.8 million in 1950-51 to Rs 1,500 million in 1971-2 and was estimated by the Eighth Financial Commission to be Rs. 15,000 million in 1988-9. Repetto, in *Skimming the Water: Rent-seeking and the Performance of Public Irrigation Systems*, Research Report 4, December

1986, World Resources Institute, 1750 New York Avenue NW, Washington DC 20006, USA, states that in Pakistan, gross public revenues from irrigation services were estimated at Rs 1 billion in 1984, when outlays for operation and maintenance were Rs. 2 billion. The scale of these losses shows the importance of the current discussion of methods of charging for water. Paper 87/1c by Leslie Small reports on a survey of irrigation financing in five Asian countries undertaken by the International Irrigation Management Institute and financed by the Asian Development Bank. The report makes a crucial distinction between dependent irrigation agencies (receiving funding from central government revenues) and autonomous agencies, receiving revenues from farmers' payments and other sources (as, for example, in Korea and China). When the report was discussed at a Seminar in Manila in July 1986, many people felt there were difficulties in changing from a Government-financed to an autonomous regime. As recent work has shown the advantages of a direct financial link between management and farmers, we hope in future issues to carry information on practical ways of moving in this direction on large schemes. One way is to wholesale water to co-operatives, and an example is quoted in Section 2a below. The report by Ronald Repetto, quoted above, makes useful additional reading on this topic and costs \$7.50. The Report on the *Expert Consultation on Irrigation Water Charges*, held in September 1986 in Rome, and referred to in the last issue, is now available from FAO. It contains the main conclusions and recommendations emanating from the Workshop and short summaries of the papers. The latter should soon be available in a second volume.

Computerised Control of Irrigation Water Distribution (87/1d)

Paper 87/1d by Jean Verdier, discusses the advantages of computerised control of water distribution and describes systems which have been used for some years in France. France was a pioneer in this type of work, but it is currently being further developed by several other countries. Jean Verdier is soon to join IIMI as Resident Scientist in Morocco. Computerised control can be considered during rehabilitation programmes, and may save investment costs in construction works. However, it does necessitate longer design studies, and very careful adjustment to the local situation. We hope the Paper will start a discussion of the situations in which it is appropriate, and of the changes in staffing requirements (in both quality and numbers) which it might entail. One prior necessity may be a reliable, non-interruptable electricity supply. Readers interested in control systems may also want to look at the discussion by J A Repogle and A J Clemmens of different types of gate and a new mechanical control system, which appears in *Irrigation and Drainage Systems*, 1, 2, 1987.

Groundwater Management: Equity, Feasibility and Efficiency (86/1e)

Paper 87/1e reviews current work on groundwater development, particularly in India and Bangladesh. It brings in to the open areas of conflict between the objectives of equity, economic efficiency, resource conservation and practicality. It also discusses how farmers organise themselves to exploit and pay for groundwater. Recent work in India has much to offer all those interested in farmer groups - particularly those who think that co-operation is necessarily either easy or the preferred solution. It is intended to stimulate further work and discussion and we give the names of those who can be contacted for further information.

b. First French Edition

In March we brought out, in co-operation with the Centre de Formation Internationale à la Gestion des Ressources en Eau, Sophia Antipoulis, France, the first French edition of the ODI-IIMI Newsletter. It was accompanied by one paper, describing IIMI's programme (86/1b by Robert Cowell). We shall assess the response to this, and then hope to put a French edition on a firm basis. If any present Networker knows of French-speaking persons who would be interested in the French edition, could they please send us their names and addressees.

2. IIMI ACTIVITIES

a. Pakistan

IIMI's branch office in Pakistan was formally opened in March 1987. We regret a slight error in reporting their address in the last Newsletter.

Please note it is 1-B Danepur Road, GOR 1, Lahore, Pakistan (not AT1-B Danepur Road, as previously stated). Initial research evaluated the impact of lining on water supply on two distributaries, at the request of the Punjab Irrigation Department. Research in 1987 and beyond will depend partly on the recruitment of staff and funding but may include:

- Improving the reliability and equity of water deliveries in surface irrigation systems
- Managing systems to minimise water-logging and salinity problems
- Use of surface and groundwater supplies
- Improving the performance of rice-wheat rotations

IIMI Pakistan now invite enquiries on their programme for research fellows and scholars. These will work at Masters, Doctoral or Post Doctoral level. Stipends and research expenses will be available; they will not normally cover tuition and other University costs of a Masters or Ph.D student. Awards will be based mainly on the extent to which the research project is consistent with the IIMI Pakistan programme and the research potential of the candidate. Further information is available directly from IIMI Pakistan, but some details are also held at ODI.

b. Diversified crops

The Asian Development Bank has agreed to fund the second phase of a study of irrigation management for diversified crops in the Philippines. The study will be supervised by IIMI and carried out by the National Irrigation Agency and various state colleges and universities. Phase 1 identified three principal constraints to diversified cropping:

- the lack of guidelines for irrigation managers in allocating and delivering water
- the wastage of water and the longer time needed for basin flooding
- the need for on-farm facilities such as field and drain ditches

Other important constraints concern a. prices for non-rice crops and the necessary inputs and b. the need for improved communication between farmers and system operators, since the intermittent nature of irrigation for non-rice crops demands quick response from the managers. The Proceedings of a Workshop on these findings are in press.

In Phase 2, the research will seek to identify those irrigation practices at the farmer and system levels most likely to enhance the cultivation of non-rice crops in limited parts of the irrigation system during the dry season. The most promising practices will be field tested. The final report is planned for August 1989.

c. Conferences, publications and training activities

Irrigation Design for Management: Asian Regional Symposium was held in Kandy in February 1987, organised by Hydraulics Research, Wallingford in collaboration with IIMI and the Irrigation Department Sri Lanka. A large number of interesting papers were discussed. The proceedings are available from Hydraulics Research, Overseas Development Unit, Wallingford OX10 8BA, UK.

In addition to the publications noted in the last issue, IIMI has launched a Working Paper series. These are produced for discussion and not to be quoted, as they generally present preliminary results. IIMI Working Paper No 1 is by S Bulankulame, on social aspects of water management in two areas of Sri Lanka during 1985-6.

A *Regional Course on the Planning and Management of Irrigation Schemes*, sponsored jointly with the Economic Development Institute of the World Bank and the Asian Development Bank, is being conducted at IIMI from 27 April to 7 June 1987. This has become an annual part of IIMI's programme. It is for senior irrigation personnel from Asia and Africa.

The first issue of F M I S, the *Farmer Managed Irrigation Systems Newsletter* (see ODI-IIMI Newsletter 86/3a, page 7) has been issued, and contains information on members' activities and publications. Further information is available from the Editor, David Groenfeldt, at IIMI.

3. NEWS FROM NETWORKERS

a. India

Currently, much interesting research is being carried out in India, as I had the opportunity to discover during visits to Delhi, Bangalore, Madras and Roorkee in February. The groundwater work is discussed in the accompanying paper 87/1c. Various publications are now available containing the proceedings of recent seminars. The following deserve mention:

i. The Institute for Command Studies and Irrigation Management, (ICSIM), Bangalore 560 041, India, organised a national seminar on *Integrated Command Area Development Organisation and Management* in December 1985. The Proceedings contain a history of the CADA programme which was initiated in 1973. The objective was to secure better use of irrigation water by on farm development work, introduction of rotational water supplies, encouragement of farmer investment, and provision of agricultural support programmes. (These were described in two 1983 Network papers by Hashim Ali - 7d - and K K Singh - 8d). There was a vigorous discussion amongst high level planners and administrators on the past results and future roles of CADAs. Generally, the results have been disappointing. (We hope to have a case-study soon). Nevertheless, some people felt their role should be expanded by giving them substantially more powers over all departments responsible for almost any aspect of rural development. Others questioned whether they had the resources and ability for this, and suggested a more restricted monitoring and co-ordinating role by a small but high powered staff. To an outsider like myself, the latter might seem advisable, especially if, as was also suggested with general agreement, their role should be extended to water resource development and conservation within the river basins. It was noticeable that many speakers stressed the absolute necessity of protecting water sheds and preventing run off, partly to increase infiltration so that more groundwater becomes available. B B Vohra, Chairman of the Advisory Board on Energy, New Delhi, emphasised the importance of groundwater development financed by the farmers, which was much cheaper than the development of large and medium scale new projects by the Government.

ICSIM, Bangalore 560 041 has also published *the proceedings of a seminar* for the Karnataka CADAs and the banks involved in financing on-farm development works in December 1986. It highlighted the tension between the CADAs, who see the advantage of uniform on-farm development throughout contiguous blocks, and the principle of farmer involvement. Some farmers may prefer alternative methods of farm development, and the wealthier ones often carry it out themselves. Consequently, the Banks find less than half the money they have allocated to on-farm development loans is taken up. At present many farmers who have their lands developed are not necessarily satisfied with the quality of the works, and may feel no strong obligation to repay the money they are charged, creating problems for the Banks which finance the work.

The Director of ICSIM, Dr B K Narayan, also organises informal seminars which bring together Ministry personnel and University researchers with an active interest in irrigation management. They invited me to speak to them on the background to African irrigation schemes, with special reference to the control of cropping. I was honoured by the presence of the Hon H D Deve Gowda, Minister for Irrigation and Public Works, Karnataka State. There was subsequently a vigorous discussion of cropping localisation, and the approach to rehabilitation.

ii. Like ICSIM, the Water Resources Centre at Peraringnar Anna University of Technology, Madras 600 025, has a vigorous programme of research and consultancy. Its Director, Professor R Sakhivadvel, and his colleague C R Shanmugham told me about their 4 year programme of action research and improvement in collaboration with the farmers of a tank near Madras. This is to be extended to a further two or three tanks using the community organiser model already tried in the Philippines and the Gal Oya project, Sri Lanka. The Water Resources Centre held a Workshop in January for representatives of several organisations interested in tank modernisation. The strongest opinion emerging from the Workshop was that some types of on-farm development and lined channels do not provide expected benefits in paddy areas, and that training, involving the farmers, and maintenance need to be given more prominence. Dr Vaidyanathan, Madras Institute of Development Studies, has also been carrying out research into community action in a Tamil Nadu tank system, and his results are discussed in a paper in the *Indian Economic Review*, January 1986. He found there was usually a good reason for non-operation, and that wherever there was a reasonable prospect of getting water there was some collective action. Individually owned wells within the tank weakened the collectivity. However, as was apparent at the tank the Water Resources Centre team were working on, they might also be an essential source of supplementary water during droughts.

The important role of private exploitation of groundwater to supplement that provided by canals was shown in an assessment of new medium scale irrigation projects in Rajasthan carried out recently by USAID. In the recently completed projects there was a rise in the water table and a proliferation of wells. Ideally, this should have been foreseen in pre-project planning, since it can affect the size and cost of the command area, and the degree of drainage needed. For further information contact D Wendel, IRRAG/USAID, American Embassy, Chanakyapuri, New Delhi 110021, India.

iii. I was not able to visit the National Institute of Bank Management, at Kandwhe Khurd, Pune 411 022, but they sent information on a Symposium on *Community Management in Irrigation Systems* held in November 1986, and sponsored by USAID. An interesting innovation was that farmers were invited to participate in the discussions. The Papers and Proceedings are now available. It was agreed that it was an illusion to think that farmer management was successful in cases where it has been promoted by large investments in improving the physical structure and intensive staff efforts to train and supervise farmers since it is impossible to replicate these conditions. Many cases were cited of small programmes for small schemes where farmer involvement had been intensively promoted, but where it had not necessarily been sustained after a few years. However, a few experiments had succeeded. The most notable was the Mohini Water Distribution Co-operative Society in south Gujerat, described by K R Datye and R K Patil. There the State decided to make the experiment of handing over water distribution in an area of 500 ha served by several sub-minors to the farmers, who were willing to form a co-operative for the purpose. The State sells the water to the Co-operative on a volumetric basis, and the Irrigation Department remodelled some of the sub-minors for the designed flows and installed measuring devices at the main off-take points. The farmers pay on the basis of crop area. The Co-operative is financially successful and is able to pay its staff good salaries by local standards. Sugar is an important crop. In the discussion there was general agreement that there should not be a rigid approach to forming farmer organisations, as this should evolve out of a learning process. However, at the same time, there was a need for a broad legal framework, and in some cases, for bureaucratic reorientation. In the latter case, the WALMI (Training Institute) at Aurangabad was trying to evolve training modules for government officers.

iv. Training was the subject of a seminar on *Human Resources Development for Irrigation Management*, held in Darjeeling in November 1986. The Proceeding are available from Dr. A Sundar, Irrigation Research Academy, 35/4, 38-A Cross Road, 8th Block Jayanagar, Bangalore 560 082. Besides discussing training, the workshop identified political interference in postings and transfers as having a most detrimental effect on efficiency and morale.

There are also interesting programmes in India concerned with improving large scheme management, but we shall postpone discussion of these to a future issue. It is good to see that *Wamana*, the quarterly Newsletter on Irrigation and Management, published by A Sundar, Irrigation and Research Academy, 38 A Cross Road, 8th Block, Jayanagar, Bangalore 560 041, India has taken on a new lease of life with several stimulating articles in the April issue. Those who want to keep in touch with developments in Indian irrigation can subscribe US $20 per year as individuals, or US $100 for institutions (Rs 50 and 250 respectively for those in India).

b. Africa

FAO has now published the *Consultation on Irrigation in Africa*, FAO Irrigation and Drainage Paper 42. This is the Proceedings of the Consultation held in Lome in April 1986, together with background papers. It provides an invaluable resource for all interested in irrigation policy and practice in Africa.

c. Water pumping and lifting; groundwater exploitation

A conference was recently held on water pumping and lifting in Africa. It was hosted by the Government of Botswana and USAID in cooperation with the Cooperation for Development in Africa Energy Group and FAO. It provided and opportunity for an exchange of information from several African countries between engineers responsible for selecting, installing and maintaining pumps for small schemes. Amongst the documents discussed were the FAO Irrigation and Drainage Paper 43, *Water Lifting Devices*, by

P L Fraenkel of Intermediate Technology Power Ltd. The aim of this publication is to provide a basis for comparing and choosing between options for water-lifting devices appropriate to holdings in the size range 0.25 ha to 25 ha. It covers various prime movers, - human, animal, electric, solar power etc. Comments on this first edition would be welcomed by the Chief, Water Resources, Development and Management Service, Land and Water Development Division, FAO, 00100, Rome, Italy. Also under discussion was a draft *Handbook for Comparative Evaluation of Technical and Economic Performance of Water Pumping Systems*, which aims to provide a consistent format for the collection of data on pump performance. This is being promoted by several aid agencies, but contact Weston Fisher, Energy Advisor, Bureau for Africa, USAID, Washington DC 20523 for further information.

The World Resources Institute, 1735 New York Avenue, N.W., Washington DC 20006, USA has produced Study 6, *Troubled Waters, New Policies for Managing Water in the American West*, October 1986, cost $7.50. It explores the relationship between American groundwater law and institutions, and the developing competition for the groundwater resource through several case-studies. It could make enlightening comparative reading for any-one considering their national groundwater issues.

d. Planning Rehabilitation

The British National Committee of the ICID held a one day seminar on this topic in March. Prepared papers were given by Professor Carruthers, Mr. J F Robson, Dr. M Tiffen, Mr. C Finney, Mr. J R Hennessy, C L Abernethy, ME Bramley and P Johnson. The mix of academic and practical consulting experience proved stimulating. The papers are available from the British National Committee of ICID, Institution of Civil Engineers, Great George Street, Westminster, London SW1P 3AA, and provide a relatively brief but insightful guide to some of the problems involved.

A succinct overview of the principles to be considered in rehabilitation projects is available in Volume 1: *Proceedings, International Conference on Irrigation System Rehabilitation and Betterment.* This 5 day conference, organised last year by Dr. Mohammed Haider of Colorado State University as part of the USAID Water Management Synthesis II Project, included officials from 20 countries as well as representatives of several international agencies. Volume 1 includes the summaries of the discussions and working groups. As a participant, I would say the only thing overlooked in the summary is the emphasis several participants put on the need to include investigations into what is happening on the watershed in the rehabilitation investigations. Maybe this is because it opens a new set of problems, including how to induce people who do not benefit from irrigation to cease activities profitable to themselves but damaging to those below the dam. Nevertheless, in many cases this issue has to be faced if the benefits of rehabilitation are to be sustained. Volume 2: *Papers* is also available; it contains two or three general papers and 7 very useful case studies of particular rehabilitation projects in Asia. The first of these, which looks at the lessons to be learnt from Sri Lanka's first major rehabilitation programme, covering 5 tanks, is particularly useful in showing why it is necessary to understand the objectives of the farmers, as well as the specific physical characteristics of each area, if rehabilitation is to be carried out in an economical way, and with sustained benefits. (We hope to have a shortened version of this paper in a later issue). Both volumes are available from WMS II Project, University Services Centre, Colorado State University, Fort Collins, Colorado, USA. There are other good studies of systems in Thailand, Philippines, Indonesia and Sri Lanka, many of which show the interrelation between physical improvements, reliability of supplies, effective water user associations and the state of government services.

e. Environmental Impact

A conference on Sustainable Development, *Only One Earth*, organised by the International Institute for Environment and Development, was held in London from 28-30 April, 1987. Coinciding with publication of the Brundtland Report on Environment and Development, *Our Common Future*, the aim of the conference was to examine some 30 case studies of successful projects which were environmentally sustainable. Key characteristics of these projects were identified, amongst which local participation, high benefit cost ratios and strong government commitment appeared to be of greatest importance. Several irrigation schemes figured amongst the case studies, such as rainwater harvesting in Burkina Faso and Irrigation

Project XV and the Dumoga National Park in Indonesia. IIED plan to publish proceedings of the conference, which also covered topics such as soil conservation, forestry, planning techniques and the role of non-governmental organisations in promoting sustainable development. Enquiries should be sent to IIED, 3 Endsleigh Street, London WC1H ODD, telephone 01.388.2117.

Assessing the environmental impact of development projects is the subject of 2 recent publications. *Environmental Impact Assessment For Developing Countries* edited by A K Biswas and Qu Geping contains papers from a workshop held in 1983 by the United Nations University in Guangzhou, China (published by Tycooly International, London, 1987). It presents a general discussion of environmental impact assessment followed by case-studies from Thailand, China, India and Egypt. We have also received a report from the Centre for Environmental Studies, Leiden, The Netherlands, on environmental aspects of floodplain development in Africa, *Taming the Floods* by C A Drijver and M. Marchand (Leiden, 1985). Seven detailed case-studies are investigated from Senegal, Mali, Cameroon, Kenya, Sudan and Zambia. Both books stress the vital importance of taking environmental effects into account when water management projects are being planned. Serious adverse side-effects have frequently come about as a result of dam building and modern irrigation development, damaging the interests and livelihoods of livestock herders, fishermen and some farming groups and putting at risk the long term benefits to be derived from the natural resource base.

f. Irrigation research

Several Dutch Universities and research institutions have formed a working party for research into irrigation and development. They have identified five themes: history of irrigation, irrigation and social dynamics, irrigation and organisation, the environment and irrigation, and applied irrigation technology. The concept is to encourage students and research workers to work on these themes in specific locations. Each theme has a co-ordinator, and recently, there have also been project groups bringing together those pursuing different themes in the same regional area. Details from the Irrigation and Development secretariat, Department of Irrigation and Civil Engineering, University of Agronomy, Niewe Kanaal 11, 6709 PA Wageningen, The Netherlands.

Hydraulics Research, Wallingford OX10 8BA, UK hosted a Research Colloquium on *Research Needs in Third World Irrigation* in collaboration with the Overseas Development Administration and the British National Committee of the ICID. Representatives of Irrigation Departments in developing countries and of other aid agencies were invited along with the research and consultancy interests in the UK. The aim was to define what the most important research priorities are, and to identify programmes that could usefully be carried out in UK institutions, or abroad in collaboration with user organisations and research groups. The proceedings will be available.

4. FORTHCOMING CONFERENCES AND WORKSHOPS

The most important forthcoming conference is the XIIIth International Conference on Irrigation and Drainage, which will be held in Casablanca, 21-26 September, followed by optional tours of irrigation schemes in Morocco. Details are available from ANAFID, BP 602, Rabat - Instituts, Morocco. The central theme of the Congress is *Improving Water Management in Developing Countries*, with one question focussing on the needs in rehabilitation of the users and operators, and the other on improvements through training. Co-inciding with this the International Irrigation Centre, Utah State University and the Centre International de L'Irrigation, Institute Agronomique et Vétérinaire Hassan II, Rabat, will have a Workshop for senior professionals and technical managers on *Planning and Policy Strategies for Irrigated Agriculture*. Participants will also attend Congress sessions. Details from Institut Agronomique et Vétérinaire Hassan II, Département de l'Equipement de l'Hydraulique, Centre International de l'Irrigation, BP 6202, Rabat - Instituts, Morocco.

A Symposium on *Irrigation of Sugar Cane and Associated Crops* will be held in Mauritius in April 1988. Details from the Symposium Secretary, c/o MSIRI, Réduit, Mauritius.

A Conference on Project Identification in Developing Countries will be held at the University of Manchester 7 - 11 September 1987. Details from The Institute for Development Policy and Management, University of Manchester, Crawford House, Precinct Centre, Oxford Road, Manchester M13 9QS, U.K.

5. TRAINING COURSES

a. Short Courses

The following have been notified to us:
International Irrigation Centre, Utah State University, Logan UT 84322-8305, USA. July 19 - August 15 1987: *Development of Irrigation Training Programs, Instructional Products and Teaching Methods.* July 12 - Aug 1: Main System Irrigation Scheduling. August 16 - Sept. 27: *On-Farm Water Management* (in Morocco, English and French). August 23 - Sept. 26: *Soil and Water Conservation and Management* (English and Spanish). Sept. 13-Oct. 4: *Workshop on Planning and Policy Strategies for Irr. Agriculture* (in Morocco, English and French). Sept. 27 - Oct. 24: *Pumping for Irrigation and Drainage* (English and Spanish). Oct. 11 - Nov. 21: *Management, Operation and Maintenance of Irrigation Delivery Systems* (English and Spanish).
ISARD, Colorado State University, Fort Collins, CO 80523 USA. July 6-July 31 1987: *Applied Management Skills for Economic Development.* July 6 - July 31: *Microcomputer Applications in Agriculture and Resource Management.* July 27 - August 14: *Microcomputer Workshop on Irrigation Data and Project Management.* (ISARD can also offer special courses for individuals and small groups, if they have financial support).
Irrigation Research Academy, 35/4, 38-A Cross Road, 8th Block, Jayanagar, Bangalore-560082, India. Oct. 23 - Oct. 26 1987: Workshop on *Simulation and Games in Irrigation Management Training* (Gangtok, Sikkim). Feb. 5-Feb. 8 1988: Seminar on *Irrigation Management Training* (Kodaikanal, Tamil Nadu). May 12 - May 15 1988: Workshop on *Objectives, Characteristics and Limitations of Public Systems of Irrigation* (Gangtok, Sikkim). August 25 - August 28 1988: Workshop on *Simulation and Games in Irrigation Management Training* (Kulu, Himachal Pradesh).
Wye College, University of London, Ashford, Kent TN25 5AH UK. Oct.-Dec. 1987: *Microcomputers for Agricultural Development.*

Institute of Irrigation Studies, Southampton University, Southampton SO9 5NH. July 6 - Sept. 11 1987: *Management for Rehabilitation Projects.*

b. Academic Courses

Institute of Irrigation Studies, Southampton University, Southampton SO9 5NH UK: MSc Course in *Irrigation Engineering - Planning, Design, Management and Operation.*
Postgraduate Centre in Irrigation Engineering, Kardinaal Mercierlaan 92, B-3030 Leuven, Belgium. 1-Year Postgraduate and 2-Year Master's program in Irrigation Engineering (in English).

c. WALMIs in India

The Water and Land Management Institute (WALMI) which have been set up by some States in india, have a potentially important role in training irrigation personnel and others. However, M K Singhal, Chief Engineer and Director of the WALMI in New Delhi, in an article in the *Journal of Indian Water Resource Society*, July 1986, suggests they were set up due to pressures from the USAID and World Bank, rather than arising out of needs felt within India. He would like to see better institutional links between the WALMIs and the Central Board of Irrigation and Power, the CADAs, etc. He also provides a list of questions that need to be answered in deciding what type of training is desirable. He sums up by saying the focus on training has to be on training people for a definite job, in an organisation. This should be the great advantage of in-country training- that it can be specific to country needs and country institutions. We hope Singhal has started a fruitful discussion.

6. ODI ACTIVITIES

John Farrington joined the Agricultural Administration Unit in January 1987 as Research Officer in Agricultural Research Management and Organisation. He was previously with the Tropical Development and Research Institute in London, and before that was in Sri Lanka as a major contributor to the Reading/ARTI study on Farm Power and Water Use. He has also worked for the Centre for Overseas Pest Research, U.K. and as a lecturer in Economics, Malawi Polytechnic and as a Senior Agricultural

Marketing Adviser in Brazil. He thus brings considerable additional strength to our sister Network, which has been renamed the Agricultural Administration (Research and Extension) Network.

Members may also like to know that the Pastoral Development Network had a paper, 23c, on *Livestock in the Gezira Scheme*, 1986, by Roger Blench. Copies are available on application to the Pastoral Development Network Secretary at ODI. Its most important finding highlights the essential role of livestock in the household economy of both tenants and non-tenants. In addition, there is a far greater variety of types of livestock enterprise than has been commonly recognised, with some people specialising for example, on production of sheep or equines. Livestock producers combine the use of crop residues at certain seasons with the exploitation of outside pastures at others. It is all too seldom that we have a study of farm economics that takes into account the livestock as well as the farm production of irrigators and their labourers.

Mary Tiffen 31 April 1987

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