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IRRIGATION ORGANISATION AND MANAGEMENT NETWORK

Newsletter 1/75 - July 1975.

1. PROPOSED RESEARCH PROGRAMME

The possibility of establishing a communication network for those with a professional interest in the organisational and operational aspects of irrigation schemes was discussed at the Second International Seminar on Change in Agriculture at Reading University in September 1974. A small group of readily accessible people subsequently met at ODI to discuss (a) the major issues such a network was likely to be interested in examining and (b) the location of a service unit with the functions of acquiring, analysing and disseminating relevant information. An offer to perform these functions on a temporary basis at ODI was accepted and in the intervening period numerous contacts have been made with institutions and individuals with an interest in the subject. A considerable amount of written material has also been located or assembled, but little analysis has been possible so far owing to the pressure of other work and shortage of finance. However, as from September 1975, the ODI unit will be in a position to carry out both desk and field research on a full-time basis and to provide network members with periodic information bulletins, selective bibliographies, propositions for discussion, etc.

The Irrigation Organisation and Management Network will be one of several major networks to be organised by the Agricultural Administration (Research and Advisory) Unit, based at ODI. The AAU will be concerned with examining in greater detail many of the administrative and institutional issues previously studied under the Reading/ODI Joint Research Programme on Agricultural Development Overseas. Financial support for a comparative study of the organisation and management of irrigation schemes is being provided by the World Bank. The study, which will be led by Mr. Anthony Bottrall, is expected to take two years. Finance is now assured for Stage 1 of the study, which will involve three or four months of desk work, during which hypotheses about alternative approaches to irrigation management will be developed, and three or four months in the field testing these hypotheses in a selected area or areas.

In ODI's proposal to the World Bank, it was suggested that the initial desk study should have the following objectives:

(i) To define the main factors which a) positively determine, or b) allow of options for the choice of institutions at various levels of an irrigation system, particularly 1) the Project or Area level, 2) the level of allocation among local communities, 3) the level of distribution among farm-users within a local community.

(ii) To suggest criteria by which new projects might be designed, or existing projects improved, in order to provide a better basis for choosing area and local institutions which would be most likely to achieve an optimal balance of various objectives, including especially -

a) efficiency of resource use, with particular emphasis on water and skilled personnel;

b) equity of water allocation among users, and minimum opportunity for corruption and abuse.

(iii) To draw conclusions about the nature and the sequence of decision making in the planning process, so that options for the eventual management system are not unnecessarily preempted by earlier decisions which neglected social, economic or managerial factors likely to arise at a later stage. It should be possible to indicate, within this sequence, the skill-combination needed at each stage and the contribution and responsibilities expected from each discipline in the planning team.

It was also suggested in the proposal that, once an analytical framework had been established, field work concerned with the central part of the study - the evaluation of a number of existing irrigation schemes - should begin and that this should consist of two elements:

(a) a broader comparative study of the effectiveness of irrigation organisation and management at all levels;

and (b) more detailed case studies of the effectiveness of the institutional arrangements (if any) at the local community/watercourse command level.

Mr. Bottrall will be mainly responsible for the comparative study, which will be concerned, among other things, with looking at management functions and costs, identifying constraints on administrative efficiency and equity, and evolving criteria by which the administrative and functional effectiveness of irrigation organisations can be compared. Tentative conclusions about desirable institutional changes at the local level - whether in the direction of delegating more responsibilities to the farmers themselves or of imposing stronger bureaucratic control - should emerge from this broader study. However, in view of the amount of ddtailed information required for the assessment of appropriate local institutional arrangements, provision has been made for commissioning several complementary in-depth field studies from other researchers. If network members know of people who might be willing to collaborate in this way, we should be very interested to hear from them. The scope for collaboration will to some extent depend on the areas eventually chosen (in consultation with the World Bank) for inclusion in the comparative study.

2. MEETINGS AT ODI

Two meetings were held at ODI during the first half of 1975 (summaries attached):

(i) A one-day seminar on "The Planning and Management of Irrigation Schemes in Different Social Environments", 26th. February 1975.

(ii) A lunch-time discussion meeting, at which Dr. Donald C. Taylor (Agricultural Development Council Associate, Malaysia) spoke on "Social and Economic Aspects of Irrigation in South and South East Asia", 27th. June 1975.

3. OTHER INFORMATION

Forthcoming Conferences, Seminars etc.

ECOSOC Conference on River Basin and Interbasin Development, Budapest, 16th.-26th. September 1975.

(For information, write to: Mr. A. Alagappan, Assistant Director, Water Resources Branch, Centre for Natural Resources, Energy and Transport, United Nations, New York 10017, U.S.A.)

Seminar on Irrigation and Employment Strategies, Institute of Development Studies, Sussex, May-June 1976.

(For information, write to: Dr. Robert Wade, IDS, University of Sussex, Falmer, Brighton, BN1 9RE, U.K.)

Research and Communication Activities

An International Irrigation Information Centre (IIIC) has recently been established in Israel, based at the Israel Agricultural Research Organisation's Volcani Centre in Bet Dagan near Tel Aviv. It is described as "a centre for disseminating all types of information about irrigation on the farm", with the main emphasis on semi-arid areas. In its first two years of pilot operation, the centre will concentrate on information about irrigation equipment for farmers and the consumptive use of water by crops; the range of subjects to be covered is likely to broaden greatly later.

(Source: Press release, 24th. June, International Development Research Centre, P.O. Box 8500, Ottawa, Canada).

The Agricultural Development Council is proposing to establish a communication network for people engaged in research "which provides programming and/or policy insights for the planning and improved management and operation of irrigation systems in humid areas of Asia". This would involve a periodic circulation among researchers of information on on-going research projects.

(For more information, write to: Dr. Ralph H. Retzlaff, Director, Interregional Program, Agricultural Development Council, Inc., Tanglin P.O. Box 84, Singapore 10).

Cornell University is running an interdisciplinary graduate seminar entitled Peasants, Water and Development. An extensive bibliography for use with the seminar has been prepared. Funds are also being sought for a programme of field research on existing indigenous irrigation systems in South East Asia.

(For more information, write to: Professor E. Walter Coward, Jr., Department of Rural Sociology, Cornell University, Warren Hall, Ithaca, N.Y. 14850, U.S.A.).

Information from network members about other forthcoming meetings and research activities will be gratefully received.

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IRRIGATION ORGANISATION AND MANAGEMENT NETWORK

Newsletter 2/75 - December 1975

1. AAU/ODI RESEARCH PROGRAMME

Reference was made in our first Newsletter in July to the establishment of an Agricultural Administration (Research and Advisory) Unit at ODI in September. This has duly occurred.

In addition to the research which I have been doing since then on aspects of irrigation management, my colleagues Guy Hunter and Stephen Sandford have been working on complementary subjects and building up their own network contacts. Guy Hunter is concerned with studying methods of survey and diagnosis of local agricultural potential; local planning and programming of agricultural services; and farmer groupings. Stephen Sandford is devoting his attention to the design and management of development programmes in arid and semi-arid pastoral areas (which might, of course, in some cases include projects to settle pastoralists on irrigated land). Further information about the general work of the AAU and the other research networks may be obtained from Janice Jiggins at ODI.

I have been involved in desk research since September and am at present engaged in analysing what I have read so far. I shall be in a position to review some of the literature very shortly - probably next month, when I expect to leave for India to visit one of the Command Area Development programmes which the World Bank is helping to finance.

This Newsletter contains no original thoughts or contributions from me. However, quite a lot of information has come to us recently about forthcoming conferences and study seminars (see below) and it seemed important to pass this on to network members without further delay.

2. MEETINGS AT ODI

Two lunch-time discussion meetings have been held at ODI during the second half of 1975:

(i) Dr Robert Wade (Institute of Development Studies, University of Sussex) spoke on "Water to the Fields: Institutional Innovations in India's Command Area Development Programme", 12th September 1975.

(ii) Mr Ian Carruthers and Dr Eric Clayton (Wye College, University of London) spoke on "Ex-post Evaluation in the Agricultural Sector - a Case Study of a Groundwater Project in Jordan", 26th November 1975.

Summaries are attached.

3. CONFERENCES

(i) U.N. Water Conference, Mar del Plata, Argentina, 7-18 March 1977

This is an intergovernmental conference convened by the U.N. Economic and Social Council. As part of the preparatory process for the conference a series of regional meetings are to be held under the auspices of the U.N. regional economic commissions between May and September 1976.

The item of the agenda which is likely to be of most interest to members of this network is one concerned with "how water policies and institutions can best be adapted to the physical and cultural conditions of individual countries and the kinds of technologies best suited to individual situations". The conference will of course be concerned with all aspects of water use, not only with irrigation. However, the conference organisers have indicated that they would very much welcome the injection into the conference of ideas about irrigation management and institutions.

Network members in a position to influence the form of their government's contribution to the conference, either directly or indirectly, might like to consider suggesting the submission of a special thematic paper on this subject, or at any rate the inclusion of a section relating to it as part of a more general country paper.

(For enquiries on this subject and more information about the conference, write to: Mr Thomas W. Oliver, Executive Secretary, U.N. Water Conference, Center for Natural Resources, Energy and Transport, United Nations, New York, 10017, U.S.A.)

(ii) Symposium on Arid Lands Irrigation in Developing Countries: Environmental Problems and Effects, Alexandria, 16-21 February 1976

The symposium, which is sponsored by the Scientific Committee on Water Research (COWAR), UNESCO, the Egyptian Academy of Sciences and Egyptian Ministry of Irrigation, is concerned with "the whole spectrum of irrigation in arid countries".

(For information, write to Mr Gamal Abdel Samie, Vice President of the Academy, Organising Committee for the COWAR Symposium, Academy of Sciences, 102 Rue Kasr el Aini, Cairo, Arab Republic of Egypt).

(iii) Workshop on drainage improvement, Korea, February 1976; and

(iv) Regional (Asia and the Far East) Seminar on Water Management and Control at the Farm Level, Bangkok, around November 1976 (Third in a series, following those in Manila, 1970 and Tokyo, 1972).

(For information, write to: Mr Kee Seung Park, Regional Water Development and Management Officer, FAO Regional Office for Asia and the Far East, Maliwan Mansion, Phra Atit Road, Bangkok 2, Thailand).

4. STUDY SEMINARS, COURSES

(i) Study Seminar on Irrigation and Employment Strategies (Africa and Asia), Institute of Development Studies, Sussex, U.K., 3 May-4 June 1976)

The two problems of irrigation improvement and employment creation are often treated separately. In other countries where the irrigated area is relatively large it is clear that they should be considered together, for irrigated areas have potential not only for high levels of output, but also for greater employment generation in agriculture and agriculture-related activities. It is important therefore that decisions about how to improve and design irrigation systems, and what sort of irrigated agriculture to aim for, be subject to criteria related not only to output but also to other national goals including employment, income distribution and regional development.

To ensure that the opportunities offered by irrigated agriculture are realised, policy makers need to have a comprehensive view of the problem and an ability to relate to each other the work of agriculture, economists and public administrators. In particular, they need to be familiar with the possibilities for attaining both output and distribution objectives at the same time. The overall aim of the seminar is to bring together people with experience in administration and planning of irrigation systems and agricultural policies in Asia and Africa, so that they can compare intentions and results on the basis of recent experience and research.

The seminar is intended for the following categories of participants: (a) those concerned with the administration of canals or groundwater projects; (b) those concerned with the design and administration of rural development programmes, in particular those involved in programmes of integrated development of canal areas; (c) manpower planners; (d) academic analysts concerned with overlapping questions of irrigation and agricultural development; and (e) representatives of aid organisations involved in irrigation projects. Candidates from developed countries are also encouraged to apply.

Seminar directors are Robert Wade, IDS, University of Sussex and Ian Carruthers, Wye College, University of London.

Applications should be submitted by 31st January, 1976. For those wishing to apply for a British Government Technical Assistance award (covering the cost of travel, accommodation, maintenance and seminar fees), application forms should be obtained from the British Council or the British Embassy/High Commission in the applicant's country. Applicants not wishing to apply for a Technical Assistance award should write for application forms to: The Administrator/Seminar 56, Institute of Development Studies, Andrew Cohen Building, University of Sussex, Falmer, Brighton BN1 9RE, Sussex, England.

(ii) Workshop on Implementing Public Irrigation Programs, The Food Institute, East-West Center, Honolulu, Hawaii, for about two weeks in August 1976.

Participants in the Workshop will constitute a cross section of interests from three types of institutions which share interests in managing water for use in agriculture: representatives from irrigation departments; academics from educational institutions which cooperate with irrigation agencies; and representatives of several international agencies which provide financing and/or technical assistance in water management.

The Workshop is designed to facilitate the initiation of work that will improve the implementation of public irrigation programmes. To date, two general areas have been identified for emphasis within the Workshop. These include: (a) manpower development of personnel employed by irrigation departments; and (b) policy implications of research on issues relating to obtaining cooperation from other agencies and farmers in implementing irrigation schemes. These foci will be expanded and further delineated through consultations with potential Workshop participants.

Consultations for developing the agenda for the Workshop are proceeding through correspondence and personal discussion. Responses to an initial announcement and questionnaire have been received and are being tabulated. These tabulations and a tentative agenda will be distributed in late December 1975.

Discussions will be conducted with potential participating agencies during February and March 1976. A final agenda will be developed after these consultations.

The East-West Food Institute will pay a portion of the costs of attending the Workshop for participants from Asian and Pacific Island nations and the United States. This includes local transportation to and from the Honolulu International Airport, medical insurance during the workshop (if needed), housing in the East-West Center dormitory, and an expense allowance of US$12 per day to pay for meals and incidental expenses during the workshop.

For the most part, the costs of air travel to and from the workshop are to be paid by the individual participants, the institutions they represent, or some sponsoring agency. A limited fund exists to finance the cost of air fares for a few participants who are unable to obtain external support.

(For information, write to: The Food Institute, East-West Center, 1777 East-West Road, Honolulu, Hawaii 96822, U.S.A., attention William J. Staub).

(iii) Advanced course for administrators from overseas on the Management of Water and Waste Water Resources, Institute of Local Government Studies, University of Birmingham, U.K., 27 September 1976-21 January 1977.

The purpose of the course is to associate lay administrators and technically qualified personnel in the study of the management and development of water and waste water resources, where the former are engaged in policy advice and implementation at national or local level and the latter in preparing or managing schemes and programmes.

While the application of modern management approaches is the core activity of the course, a major component is the study of engineering technologies appropriate to a wide range of environments. Problems of tropical public health and the application of water and waste water resources to agriculture receive detailed attention and sociological, economic and legal aspects are also subjects of close study.

The course is designed for: (a) administrators and managers holding responsible positions in water and waste water resource management and development; (b) engineers and other professionals who are responsible for managing water and waste water and development projects; (c) teachers and trainers from universities, institutes of public administration, or other establishments concerned with training for management of water and waste water resources; and (d) non-officials such as Councillors, Board Members, Mayors or Chairmen whose organisations are responsible for schemes and programmes.

Most nominees should be eligible for scholarships from the British Government, which recognises this course for technical assistance. All applications must be received by 1st July 1976.

(Enquiries should be addressed to: The Director, Institute of Local Government Studies, University of Birmingham, PO Box 363, Birmingham B15 2TT, England).

5. RESEARCH AND COMMUNICATION ACTIVITIES

(i) The first Newsletter of an Asian Regional Irrigation Communication Network, coordinated by the Agricultural Development Council, was issued in October 1975. The newsletter provides interesting and valuable information about current research projects concerned with irrigation in Asia, mostly but not exclusively in its more humid areas. For more information, write to: Director, Regional Research and Training Program, Agricultural Development Council, Tanglin, P.O. Box 84, Singapore 10.

(ii) Finally, a request for information from Mr John Harriss, who is at present working with a team investigating the potential for groundwater development in South West Bali. He has asked for references on the "relevant literature both on the organisation of groundwater projects and on their appraisal and evaluation". We have made some suggestions regarding published material. If network members know of good material which may be either difficult of access or unpublished, perhaps they would be kind enough to write to John Harriss at P3SA, DPU Propinsi Bali, Jalan Beliton 2, Denpasar Bali, Republic of Indonesia.

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IRRIGATION ORGANISATION AND MANAGEMENT NETWORK

Newsletter 1/77 - April 1977 (1a)

1. THE LONG SILENCE - AN APOLOGY

Abject apologies must be made to all network members for the absence of newsletters and discussion papers during 1976. There were two main reasons for this lapse: (a) throughout the period, a heavy load of report-writing for the World Bank, who have been financing our programme of comparative research on the organisation and management of irrigation schemes; and (b) during the second half of the year, the organisation (including preparation and follow-up) of a workshop on Choices of Irrigation Management, held at the University of Canterbury, Kent (27th September - 1st October).

Over this period, much knowledge has been accumulated and there are many ideas to be exchanged, many debates to be initiated or developed. Three discussion papers are enclosed with this newsletter, to which all network members are invited to react. We hope from now on to produce newsletters and discussion papers three or four times a year; but their frequency will depend to some extent on the quantity and quality of comment we receive from participants. Regular comment, however brief, will greatly help us to sustain momentum. The aim will be to devote each issue to relatively detailed discussion of one or two specific themes.

2. THE AAU/ODI RESEARCH PROGRAMME

Our work so far has fallen into three phases: (i) the preparation of a preliminary desk review of readily available literature on irrigation management in less developed countries, submitted in draft form to the World Bank in January 1976; (ii) a "pilot" field study in N.W. India, focusing mainly on the Chambal project, Rajasthan (draft report submitted to the Bank in May 1976); and (iii) another period of desk study, during which some broad hypotheses have been developed concerning principles of good irrigation management and criteria for organisational and institutional choice; considerable thought has also been given to methodological problems associated with the evaluation of irrigation schemes, particularly with regard to their management and institutional aspects. The current emphasis is on the development of a detailed analytical framework to be applied, tested and modified in a series of further field studies during the second half of 1977. Some of the main issues with which we have been concerned in this third phase of our work are dealt with in the three discussion papers.

Preliminary desk review

This 65-page document is largely a precis of other people's case studies. It is by no means comprehensive and will be periodically added to and revised. There are plans to publish it, probably in several sections, mainly on a geographical area basis. Much of the material is at present widely scattered and difficult to locate, and it seems that many people, particularly practitioners, would find it convenient and useful to have an overview of the literature on irrigation management to refer to. As it stands, the desk review deals with surface irrigation schemes only; but groundwater management will eventually be covered too. (1)

A list of the material referred to in the desk review is given in Appendix A. Most of it is concerned with various aspects of overall project management and organisation. Only a few studies attempt to describe or analyse in any detail the operation of a projective water delivery system. (2) Information from network members about studies of this kind (whether published, in academic theses or consultancy reports) would be most welcome. So too would information about more general studies of irrigation management in the following categories, which are poorly covered in the desk review at present: projects in Latin America, francophone Africa and the Middle East; post-land reform projects; and major river basin projects in South East Asia.

The desk review is divided into three main sections: (a) Irrigated settlement schemes (mainly in Africa); (b) Canal irrigation in the low rainfall areas of N.W. India and Pakistan; and (c) Irrigation in the semi-humid, predominantly rice-growing areas of East, South East and South Asia. Although much of the material is descriptive, this very crude categorisation helps to point up the diversity of "irrigation environments" in different parts of the Third World on the one hand, and of forms of project organisation and management on the other. It also implicitly raises questions about the extent to which certain forms of organisation and management may (or may not) "fit" the particular irrigation environments being defined by a combination of their physical, technical, economic, social and political characteristics. (3)

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(1) Although nearly all the material in it is from "open" sources, the document itself, like all reports for the World Bank, is for restricted circulation only. Parts of it were, however, used as the basis for three of the papers for the Canterbury Workshop (see Appendix B), and are therefore obtainable from ODI in that form.

(2) For example, there are many articles and reports which discuss the management and organisation of the Gezira scheme in Sudan. But only one study appears to have been published so far which examines in detail the operation of its irrigation system; that by H.C. Farbrother in Cotton Research Reports (Rep. of Sudan), 1970-71, 56-99 (Cotton Research Corporation, London, 1973). To be incorporated into the desk review.

(3) For an illustration of how this kind of "typological" thinking might be developed, see Discussion Paper A, Proposition 1 and Table 1.

Irrigated settlement schemes. Projects of this type are characterised by a high degree of official management control over all agricultural and irrigation operations: a single agency acts as the principal, if not exclusive, provider of inputs (including water) to the farmers on the scheme and recovers the costs involved by deducting them from the value of their marketed output. Such a "closed" system can only be made to work effectively if a large proportion of the farmers' output consists of relatively high-value cash crops with a single marketing channel controllable by the management agency. Cropping patterns, crop rotations, the timing of agricultural operations, etc. are all decided by the agency; the farmers' responsibilities are often confined to the execution of certain labour-intensive crop husbandry activities. On many schemes in anglophone Africa, the enforcement of strict discipline on farmers is greatly facilitated by the insecurity of their tenure: they are usually tenants licensed by the scheme management, on an annually renewable basis, and can be threatened with eviction if judged to have performed poorly.

The Mwea scheme in Kenya has shown (Chambers and Moris 1973) that this kind of highly controlled "integrated management" approach can produce very successful results, both in terms of production and farmers' incomes, in the initial years of settlement when the farmers have had little or no previous experience of irrigated agriculture. (1) On the other hand, a common failing of this approach appears to be that, once its basic pattern has been established, there is an unwillingness to change or modify it. This tendency to institutional stagnation, accompanied by an overall lack of dynamism and innovativeness, has been experienced on the Gezira scheme, which was established in the mid-1920s but underwent no major changes in its institutions or cropping patterns until very recently: it is only in the last 3 or 4 years that significant steps have been taken to diversify and intensify the traditional cotton-dominated cropping pattern and to make corresponding changes in management structures and procedures which would allow tenants more autonomy.

The process of stagnation in Gezira was undoubtedly accentuated by certain features peculiar to the scheme, notably the crop-sharing arrangements whereby cotton proceeds are divided between the government, the scheme management and the tenants. But other contributory factors, common to other settlement schemes, seem to have been the short-term tenancy agreements and the dominance of a single crop - two factors which may often contribute substantially to the successful management of a settlement scheme in its initial stages.

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(1) It can also impose serious social stresses on the farm family (see, e.g., Chambers and Moris, pp. 299-341).

Of these, the tenancy factor appears to be the most damaging in the long run, since it reduces farmers' incentives to invest or innovate. A preferable approach would seem to be one in which settlers were able to purchase the land they cultivate in instalments over time. This would still allow the scheme management gradually to devolve some of its responsibilities to the farmers, thereby freeing staff with scarce administrative and technical skills for productive employment elsewhere. Irrigation settlement schemes with provision for land purchase appear ofte to be found in a post-land reform context, but not necessarily so. Two documented examples are Lower Medjerba in Tunisia and San Lorenzo in Peru. Further information about such projects would be welcome

Another variant of the highly controlled 'integrated management' approach, in a post-land reform situation, is to be found in Egypt. There the official management's ability to exercise control is not derived from land purchase procedures but from an imposed system of cropping by "block rotation". This is similar to the system used in Gezira, except that land is under private ownership. A consequence of the Egyptian Land Reform in 1952 was that numerous very small holdings were created. In the interests of improving technical efficiency (particularly with regard to pest-control on cotton) and economies of scale (in land preparation, provision of inputs and services, etc.) "unified rotation cooperatives" were introduced to allow cultivation of the same crops in blocks - currently of up to 300 acres - on a pre-ordained two- or three-year crop rotation cycle. Landowners can have holdings in more than one block to enable them to produce cash and food crops at the same time. (1)

Canal irrigation in N.W. India and Pakistan. Canal irrigation in these areas developed under the Northern India Canal and Drainage Act of 1873 and its design, operational and administrative characteristics remain similar on both sides of the national border. In recent years there has been extensive development of tubewells, both private and public, in parts of the region, which has permitted more intensive cropping through the conjunctive use of surface and ground water. But the review focuses primarily on the management of agriculture in those areas where surface water continues to be the main source of supply. Its most distinctive features, (many of which are in marked contrast to those of the settlement schemes) are: (a) an extremely extensive nexus of canal systems with low design intensities (the Indus basin in Pakistan contains 33 million acres); (b) few control facilities and hence limited flexibility of water supply; (c) very low rainfall, with fairly uniform and light, easily workable soils; (d) division of responsibility for operation and maintenance between Irrigation Department (the system down to and including the watercourse outlet) and farmers (the watercourse channels, each serving an area of up to 1000 acres); (f) "free choice" cropping patterns, in practice severely limited by water scarcity, together with multiple market channels; and (g) private ownership of land, with marked inequalities and landlord-tenant arrangements common.

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(1) 'Integrated management' systems should provide excellent opportunities for coordinated planning of water scheduling and allocation. It is surprising therefore that in Egypt, as in Sudan, responsibility for water delivery rests with a different agency (the Ministry of Irrigation) from the one concerned with promoting agricultural development. Elsewhere (e.g. Mwea) a single agency is responsible for both functions.

Policy changes have recently been made in India with the object of reducing the fragmentation of official responsibilities. At the centre, the irrigation portfolio was transferred to the Ministry of Food and Agriculture in October 1974. And in those parts of the country where Command Area Development (CAD) projects have been established, measures have been taken to improve departmental coordination at the project level and to extend official responsibility for the improvement of operation and maintenance within the watercourse command. (1) However, many of the irrigation schemes in N.W. India have not yet been affected by the CAD programme; and irrigation in Pakistan is still administered on the old pattern.

In this region, the two aspects of irrigation management which have attracted most attention from researchers are the methods of water allocation (principally Reidinger 1974); and operation and maintenance at the watercourse level (Colorado State University 1974 and subsequent reports).

Reidinger's study of water allocation was carried out on the Bhakra canal system in Haryana, India, which may be taken as a fairly extreme example of the "Punjab" type: an extensive layout with a planned irrigation intensity of only 62 per cent, in which scarce water is allocated by rotation, both between groups of canals and within watercourses. The scarcity of the water and the technical design of the system combine to limit its capacity for flexible operation. But Reidinger argues that a lack of correspondence between the lengths of the canal rotations and the watercourse rotations greatly increases the unpredictability of water supplies to each individual farmer. As a result, the quantity and timing of a farmer's water deliveries are so uncertain that he cannot match his pattern of water application at all closely to plant requirements. This has acquired particular significance since the introduction of high-yielding varieties of wheat, which require a much more closely controllable water regime than the traditional varieties. Reidinger's study suggests that, despite the limitations imposed by the system's design, there are still considerable opportunities for making its operation more responsive to farmers' needs through essentially administrative measures, without immediate recourse to major capital investment.

At the watercourse level, it is estimated that in Pakistan, on systems using only surface supplies, only about 50 per cent of the water delivered at the outlet is put to productive use. Some of the water losses are the result of wastage on farmers' fields owing to lack of correspondence between inflexible deliveries and crop requirements. But there are several measures which would enable farmers to use existing supplies more efficiently, notably better land levelling, which would reduce their present need to overwater, and extension advice on water management. However, the greatest potential for improvement appears to lie in better management of the watercourse, which is a communal responsibility. Maintenance is often poor and the practice of breaking the banks to divert water into farmers' fields is a major cause of leakage. Evidence from N.W. India indicates similar conditions.

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(1) One of the objects of the pilot field study was to look at the impact of the institutional changes introduced under the new CAD programme (see below).

In both countries, increasing attention is being given to the need for improved watercourse management. It seems to be widely agreed that this would initially require much closer official supervision of watercourse affairs than has been customary in order to mobilise the support of watercourse members for an improvement programme which they themselves would subsequently have an interest in sustaining. Suggestions have been made that this could be assisted by the introduction of water users' groups or associations of the type commonly found in the predominantly rice-growing areas of East and S.E. Asia. The complex interrelationships which would need to be taken into account when developing such a programme were among the issues examined in the pilot field study.

East and South-East Asia. In many parts of the higher-rainfall, rice-cultivating areas of East and South-East Asia irrigation has been practised for centuries. Farmer participation in the operation and maintenance of irrigation systems is much more frequently found in these regions than in the others under review. In East Asia (Japan, Taiwan, South Korea) a high degree of management responsibility has been devolved onto farmers and farmer groups within relatively large and complex systems. In South-East Asia, on the other hand (taken here to include South India and Sri Lanka) farmer participation is much less pronounced beyond the level of small, self-contained "indigenous" systems; indeed, it appears to be conspicuously lacking on many of the large river basin projects which have been developed more recently.

The literature on irrigation in East and South-East is very extensive and only a small proportion of it was covered in the review. Within East Asia, attention was focused on the case of Taiwan and the operation of its irrigation associations, whose success has led some observers to recommend them as a 'model' for adoption elsewhere in the developing world. In South-East Asia, the small "indigenous" systems have been the subject of close scrutiny by social scientists. One of the main interests of these systems in the context of a comparative study is that they prompt the question as to why they have developed where they have, and not elsewhere; another is that a careful analysis of their characteristics and methods of operation may suggest certain principles of micro-layout and local organisation which could be incorporated, with adaptations, into the design of much larger irrigation schemes.

In Taiwan, population densities are high and both land and water resources are scarce. Farms are small and intensively cultivated; and land ownership is fairly evenly distributed, as a result of land reform measures carried out in the early 1950s. Today, primary responsibility for the construction, operation and maintenance of irrigation facilities is delegated by government to irrigation associations - self-governing bodies organised by, and representing, the farmer-irrigators. These may have jurisdiction over areas ranging from 12,000 to 250,000 acres. They are expected to meet part of the construction costs and all operating costs by raising fees for their members and they employ technical staff to work on their behalf. Within the associations, there are "small groups" responsible for operation and maintenance at the 100-350 acre level, and these in turn contain working squads of 10-15 farmers at the 20-25 acre level.

Efficiency of water use on irrigation systems in Taiwan is high: on most it exceeds 60 per cent and in one case it is reported to be over 90 per cent. This is partly a reflection of the general scarcity of water supply in relation to its demand (rotational irrigation is practised within 100-acre - "small group" - units, and on-farm irrigation is handled on a 24-hour basis). But it is also due to two other factors, which may be seen as a response to increasing water scarcity: first, recent technical improvements, particularly at the micro-level (e.g. watercourse channels frequently lined with concrete; control gates and Parshall flumes at each watercourse outlet; extensive systems of farm ditches): and secondly, the very detailed calculations for estimating water demands and allocating supplies, which encourage equitable distribution as well as efficient use. This process is greatly assisted by an easy and rapid two-way flow of information between the agencies responsible for operating the water delivery system at different levels. At each level, close linkages have been established between farmers (or their representatives) and technical staff. The latter are given strong incentives to be responsive to farmers' needs: the irrigation association may reward good performance by financial bonuses, promotions and prizes, and penalties for poor performance include dismissal.

It is easy to understand why the present decentralised and apparently democratic system of irrigation management in Taiwan is widely admired. However, there are clearly dangers in looking on Taiwan as a 'model' for other developing countries if this is interpreted in the crudest sense to mean that its current institutions and techniques can be transplanted and grafted on to other very different environments and be expected to flourish. A glance at Taiwan's own history of development should be enough to indicate the implausibility of such an assumption. Taiwan's sophisticated methods of irrigation management did not spring into existence overnight. They have evolved over a long period as part of a complex process of political, economic and social change. During the period of Japanese rule (1895-1945), when Taiwan was developed into a major rice exporter to Japan, the management pattern was entirely different: in seeking to stimulate increased agricultural productivity, the government relied principally on close supervision of farmers and, if necessary, enforcement of new cultivation practices and techniques (cf. Mwea). Though they were introduced in 1922, it was not till the end of Japanese rule that the irrigation associations became self-governing; and rotational irrigation was introduced only in the mid-1950s. All this suggests that important lessons for other countries can be drawn from the Taiwan achievement, but they are lessons about <u>sequential</u> changes in irrigation technology and management; and perhaps studies of past changes in Taiwan could often yield more immediately useful insights about how to proceed elsewhere than studies of its present state (see Abel 1975).

In most of South-East Asia, the efficiency of irrigation water use is much lower than in East Asia, even on the numerous small "indigenous" systems. These appear to fall into two main categories: (i) relatively simple, self-contained hill stream diversion systems; and (ii) somewhat larger systems in areas with greater population pressure on land and water which include more complex arrangements for water allocation among the communities they serve.

Schemes of the first type are found widely in small river valleys, not only in South-East Asia (e.g. northern Thailand, Philippines) but elsewhere too (e.g. Ecuador). They are typically planned, constructed, operated and maintained by the farmers themselves under leaders who are selected from among their numbers and are remunerated by them. The dams they construct are made of locally available material, and the irrigated area is usually small (rarely more than 500 acres). Though such schemes could nearly always benefit from external technical advice, attempts by governments to incorporate them into larger projects often appear to have led to the disintegration of the previously dynamic farmer groups, no doubt because most of their original responsibilities have been taken away from them. However, Coward (1975) has recorded a sensitive and apparently successful attempt at official incorporation of several independent schemes in western Laos, in which important functions continued to be given to the traditional "water headmen".

Of the more complex systems, the best known is the Balinese subak system (for details, see Geertz 1967; Birkelbach 1973). Subaks (areas irrigated from a single dam) are also found mainly in narrow river valleys, but they rarely operate independently owing to high population pressure and hence relative water scarcity; water is commonly rotated between and within them. Leaders are elected by all subak members; water allocations are made on the basis of detailed calculations and with particular concern for equitable distribution. Similar attention to detail and equity is also reported from some village-operated tank-irrigation schemes in South India and Sri Lanka, though others have encountered technical difficulties which they have been unable to overcome on their own and in the absence of government support (Chambers 1974).

By contrast, standards of water discipline and management on many of the larger government-operated irrigation schemes in South and South East Asia are often very low. This is attributed in part to the "permissive" attitudes of irrigation officials and their ineffectiveness as arbitrators on matters of water allocation between different irrigating communities (see, e.g. Harriss 1974, Chambers 1975 on Sri Lanka). (1)

Report on field study in N.W. India

The main purpose of this "pilot" study were to bring out more clearly the range of factors most likely to be important in affecting the quality of irrigation management, particularly on large canal schemes; and to suggest ways of developing an analytical framework for evaluating irrigation management which could be further tested and refined in subsequent field studies elsewhere. Special attention was paid to the details of operation and maintenance of the water delivery system, on which so little information had emerged from the preliminary desk study.

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(1) There are no doubt honourable exceptions to this sweeping generalisation, of which the Muda project in Malaysia appears to be one (see, e.g. Appendix B, Paper C7 by Thavaraj).

The 63-page draft report is concerned mainly with the Chambal project in eastern Rajasthan, though short visits were also made, for purposes of comparison, to the Gang canal project in northern Rajasthan (near the border with Punjab) and the other Chambal project in the adjoining state of Madhya Pradesh. It is intended for limited circulation only, though ODI is prepared to seek permission from the World Bank and the Indian authorities concerned to extend its distribution in special cases. An article based on the field study is being prepared for an Indian journal.

Irrigation was introduced to the Chambal area in 1960. Both physically and culturally its environment is very different from that of the other, older-established areas of major irrigation in North West India, though the canal designs and irrigation institutions introduced into the area are similar. In Chambal, the soils are mainly heavy clay loams with poor draining properties, the micro-topography is often uneven and the project area is traversed by ravines. Average rainfall is relatively heavy (850 mm/yr.), with about 90% falling in summer. Communications are poor, especially during and after the heavy rains. Average farm size is relatively small (3.5 ha), holdings are fragmented and farm boundaries irregular. Literacy rates are low and farmers' technical knowledge is much lower than in Punjab and Haryana. The difficulties of the project have been compounded by two major deficiencies in the original designs of the irrigation system (intended to supply cultivable commanded areas of 229,000 ha. in Rajasthan and 224,000 ha. in Madhya Pradesh, with a designed cropping intensity of 76%): (a) the absence of drainage, which, in the soil conditions of Chambal, led to the very rapid spread of waterlogging; and (b) failure to provide adequate layouts at watercourse level. Both these deficiencies are commonly found on other systems in India constructed at around the same period (see Vohra 1975, passim).

As a result, both Chambal projects were beset with major management problems: in addition to the environmental damage caused by the lack of drainage, conditions of "water anarchy" arose, in which farmers in the head reaches were permitted to install additional "illegal" outlets, partly to overcome some of the physical difficulties caused by uneven micro-topography within existing watercourse layouts; as a result, tail enders usually went short and any possibility of allocating water on a rational or equitable basis was removed.

Partly because they had run into so much trouble, the two Chambal projects were among the first in India to be transformed into Command Area Development (CAD) projects (in 1974/75). The main object of the CAD programme is two-fold: (a) to establish much better coordination between line departments - particularly Irrigation and Agriculture - at the project level, by setting up unified Command Area Authorities, each headed by a Commissioner with direct control over project staff; and (b) to introduce improvements in both physical and institutional conditions at the watercourse level. In both the Chambal projects, this programme received financial support from the World Bank, which provided funds for essential rehabilitation work on the main canal systems (including additional control structures) and for construction of main

drainage networks as well as for the "on-farm development" programmes at the watercourse level (including land levelling, land consolidation, realignment of watercourses, construction of field drains). (1)

The Chambal projects were therefore undergoing major physical and administrative transformations at the time of the field visit. This meant that they provided less than ideal conditions in which to do any detailed analysis of the quality of project/system management and its effect on project/system performance over time (for example, many of the engineers were having to devote more time to design and construction work than to operation and maintenance). On the other hand, the fact that such a large and complex package of changes was in the process of being implemented meant that it was possible to gain insights into the interdependence of certain technical and institutional factors; this emphasised the importance of tackling different elements in an irrigation development or improvement programme in the correct sequence.

Briefly, the main conclusions of the study, other than those of primarily local significance, were:

(i) Coordination between key departments was much better in the two Chambal projects, where the CAD programme had been introduced, than in the Gang Canal area, where line departments were still operating independently and decisions about system operation continued to be taken by engineers with little or no consultation with agricultural officials or farmers.

(ii) The level of finance provided for operation and maintenance in all the three projects visited appeared to be quite inadequate. It was unclear on what basis the state governments reached their decisions as to the levels granted in each case, but it was unconnected with the amounts recovered through water charges (which exceeded O & M budgets in all cases, even on Chambal, Rajasthan, with a current recovery rate of only 48%). (2) It seems logical that O & M budget allocations should be linked (a) to the difficulty of O & M in different projects (Chambal is much more difficult to operate and maintain than Gang); and (b) to the level of recovery of water charges. Water charges could in any case be charged at much higher rates than they generally are at present in most Indian states; this would not only help to increase government revenue but should also stimulate greater efficiency of water allocation and water use at watercourse level.

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(1) Details of the Chambal projects and the plans for their rehabilitation are given in the World Bank appraisal reports (World Bank 1975).

(2) In the Gang Canal area, here the recovery rate is 90-95%, returns from irrigation charges are nine times greater than the O & M budget.

(iii) Irrigation staff, particularly in Rajasthan, have to operate within a legal framework which gives them insufficient disciplinary powers to deal effectively with the conditions of "water anarchy" which were allowed to develop in Chambal. In the absence of political support for effective measures to punish cultivators for wilful infringements of irrigation rules, the proposed improvement programmes (e.g. on-farm development, installation of new control structures, introduction of rotational water distribution within watercourses) are bound to be gravely handicapped.

(iv) Although the CAD programme had made provisions for improvements at the top of the system (unified project administration) and at the bottom of it (on-farm development, rotational distribution within watercouses, creation of local irrigation associations), there was a crucial area in between which appeared to have been almost entirely overlooked, viz. the area of water scheduling and water allocation. The very crude techniques of water demand estimation and supply allocation on Chambal (Rajasthan) derived historically from Punjab, where they were originally developed with very different physical and social conditions in mind. On the other hand, those used in the adjacent (and very similar) Chambal (Madhya Pradesh) project were - in theory, at least - entirely different and derived from Maharashtra. There was a striking lack of any clear logical relationship between local agro-climatic conditions on the one hand and choice of techniques of cropping-cum-water-allocation planning on the other. In Chambal (Rajasthan) there was some talk of introducing "crop zoning"(in contrast to the "free choice cropping" approach used so far), which would have important implications for water allocation, but no firm decisions had been taken. Yet plans had already been made to install new outlet control structures, the design of which ought logically to have been determined by a prior decision as to the nature of the overall cropping and water allocation policy.

(v) For various complex reasons, the start of the on-farm development programme, designed to bring about physical improvements at watercourse level, had been delayed on Chambal (Rajasthan) and it was therefore impossible to evaluate its likely impact. Attempts had, however, been made to introduce institutional changes at the watercourse level (rotational distribution, irrigation associations), but to no noticeable effect or advantage. It was concluded that administrative effort devoted to encouraging such local changes was likely to be wasted unless certain other conditions were first fulfilled, notably the creation of conditions of relative water scarcity in the currently over-outletted head reaches and the guarantee of more regular and predictable supplies of water to watercourse outlets generally throughout the main delivery system. In the Chambal context, this could mean delaying such changes until after a water allocation plan had been worked out, additional control structures had been installed and effective disciplinary powers had been given to irrigation staff. (1)

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(1) Cf. Appendix B, Paper C10 by Valera and Wickham, who also concluded on the basis of more detailed studies of irrigation schemes in the Philippines that little benefit is likely to be obtained from attempting physical or institutional improvements at watercourse level unless reliability of water flows in the main canal system can be assured first.

(vi) The vital importance of a dynamic agricultural extension programme in the initial stages of an irrigation project have been clearly demonstrated in Chambal. There, after 15 years of ineffective extension work, rapid increases in yields have been achieved through the introduction of a new much more closely supervised and concentrated approach, largely in the absence of significant improvements on the water delivery side, which are naturally taking longer to implement. Most of the improvement so far has been achieved through the teaching of fairly simple techniques (e.g. improved plant population, timely sowing, etc.), combined with insistence on timely input supplies through better inter-departmental coordination. Soon, however, there will be increasing demand for more specialist extension advice, particularly with regard to water management practices; and in this respect these projects, like many others in developing countries, are very poorly equipped: Chambal (Rajasthan) had only one senior official specifically designated to give advice on water management practices, in an area covered by 142 agricultural field assistants and containing about 69,000 farm families.

Development of analytical framework and methodology

Since the completion of the Chambal study, effort has been concentrated on the development of a general analytical framework and a methodology for evaluating the management of irrigation schemes for application and testing in further field studies in the second part of 1977. In view of the complex interdisciplinary nature of this work, arrangements have been made to use the services of short-term consultants during the next two months who can advise on aspects of the subject where specialist knowledge is particularly important. These include someone with extensive knowledge of management theory and practice, as well as irrigation engineers, an agriculturalist and an agricultural economist. Some ideas which have emerged from my own thinking during the past six months are contained in Discussion Papers 1/77/1 (Some general propositions about irrigation project and system management); 1/77/2 (Some basic problems of evaluating irrigation management); and 1/77/3 (Skills, functions and organisational forms in relation to project and system characteristics). Clearly, none of these is near to being final or definitive: rather, they are intended to provoke comment and criticism. Comments of the kind "In my view Proposition X must be modified (or scrapped) because it does not apply in such-and-such a context for the following reasons . . ." would be particularly welcome.

In addition, I am planning shortly to produce - and circulate - a fairly concise questionnaire designed to elicit pertinent information about the performance and management of individual irrigation projects in order to enlarge and strengthen the empirical case study base on which the analytical framework must be built. If network members know of others (project managers, researchers) who might be interested and willing to provide such information, please let us know. Since we are well aware that busy people have an understandable aversion to being asked to fill in lengthy, time-consuming questionnaires, we undertake to make it as short and to the point as possible. All assistance will of course be duly acknowledged.

3. ODI WORKSHOP ON CHOICES IN IRRIGATION MANAGEMENT, CANTERBURY

With the assistance of the British Ministry of Overseas Development, the Commonwealth Foundation and the International Development Research Centre (Ottawa), who all provided generous financial support, ODI organised a small workshop on Choices in Irrigation Management, held at the University of Kent, Canterbury, from 27 September to 1 October 1976. It was attended by 35 participants, of whom 12 came from eight different countries in Asia, Africa and Latin America. The majority of these had had extensive first-hand experience of irrigation management at project level. The rest of the participants were a well-balanced mixture of practitioners - from consultancy firms and donor agencies - and academics, ranging in their disciplines from civil engineering to social anthropology and public administration. Most of them had been directly concerned with the appraisal or evaluation of irrigation projects in a wide variety of countries.

The 21 papers written for the workshop and presented at it are listed in Appendix B. In addition to discussing these papers, workshop participants helped to produce an Action Programme document on priorities in irrigation management with the object of having it discussed at the UN Water Conference in Argentina (March 1977). This strongly worded paper was subsequently adopted by the British Government as part of its official submission to the Conference and was widely distributed there under the reference number E/conf. 70/TP 219. (1)

There were several ways in which the agenda of the workshop might have been ordered, but it was decided that the best place to start was with the physical delivery system. The reason for this was that most people involved in irrigation management are faced with having to operate a system which has already been designed and installed, and (in the short term at least) they have to do the best they can with it, within the physical limitations of what the design allows. During the initial sessions, therefore, the intention was that the engineers should explain to the non-engineers what management options were open or closed to them as a result of the design and operational characteristics of different types of physical system.

The next set of sessions was devoted to the discussion of case studies, both to give overseas participants an opportunity to discuss specific management problems which they had encountered in the field and also to illustrate the variety of conditions with which we were concerned; they also served to bring out the similarity of many of the problems occurring in these diverse conditions.

This was followed by several sessions of more structured discussion about many of the management issues already raised by the case studies. Among the major items covered were: irrigation management objectives; economic aids to irrigation management (water pricing policies); inter-departmental co-ordination; the role of agricultural extension; relationships between farmers and irrigation officials; and farmer groupings.

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(1) Copies of the workshop papers (in mimeo form) are available from the Agricultural Administration Unit of ODI (price £4.00 per set, plus postage if airmail; or 35p - 70p for individual papers). The text of the Action Programme document is printed, with a short introduction, in <u>ODI Review 1-1977</u> (issued in April) and can be obtained as an offprint for 50p. We regret having to make these charges, which are necessitated by high reproduction costs, but they may be waived in exceptional cases (e.g. [illegible] regulations).

We concluded by returning to the beginning again: what were the implications of the discussions about management issues for (a) project planners and system designers; and (b) those involved in research on, and evaluation of, irrigation management?

Discussions were notable for their outspokenness and frankness, especially on the part of the "practitioners" from overseas, who were very open in their criticisms of major weaknesses they perceived in the design and management of their projects as well as in government policies. This demonstrated the value of having a small, informal and unofficial meeting at which participants were present as individuals, not as representatives of their governments. And the concentration on specific practical issues at project level and below ensured that no time was wasted on long recitations of unmemorable and unilluminating statistics about "irrigation in country X". A summary of the papers and proceedings of the workshop is currently being prepared for publication as an 'ADU Occasional Paper' (probable price not more than £1.50).

Although there were some issues which were inadequately covered in the papers and discussions, it was generally agreed that a useful formula had been found which might be used again, with modifications, as the basis for further workshops on irrigation management. Discussions are currently being held with potential sponsoring agencies about the possibility of organising regional workshops overseas, in collaboration with local research or training institutions prepared to act as hosts. If network members have reason to believe that there might be some interest in their countries in collaborating or participating in such meetings, we would of course like to hear from them.

4. OTHER MEETINGS, COMMUNICATION ACTIVITIES, ETC.

Meetings

(i) Expert meeting on water resources utilisation and management, OECD Development Centre, Paris, 17-19 March 1976.

A Summary and Conclusions document has been issued, which contains sections on (a) areas of priority research with reference to water sector policy and planning; rural drinking water systems; irrigation system studies; (b) some social science issues in water resource development; and (c) a useful selected bibliography on water resources. It is obtainable from the OECD Development Centre, 94 rue Chardon Lagache, 75016 Paris, France.

(ii) Research Seminar on Irrigation Policy and the Management of Irrigation Systems in Southeast Asia, sponsored jointly by Agricultural Development Council (ADC), the International Rice Research Institute (IRRI) and the South East Asian Regional Center for Agriculture (SEARCA), at Los Banos, Philippines, 22-25 June 1976.

The seminar was organised: (a) to provide a forum for the presentation of recent research results on irrigation policy and the management of irrigation systems; (b) to provide an opportunity for researchers and irrigation agency staff to interact and exchange ideas; (c) to derive directions for future research relevant to the needs of professionals in the field of irrigation policy and water management; and (d) to augment the scarce literature presently available to students and professionals involved in irrigation research and management in the region. An interpretative summary report is in preparation.

For more information, write to Prof. Donald C. Taylor, Dept. of Agricultural Economics, University of Wisconsin, Linden Drive, Madison, Wisconsin 53706, USA, or Dr. Donald Wickham, International Rice Research Institute, P.O. Box 933, Manila, Philippines).

(iii) Workshop on Implementing Public Irrigation Programs, Food Institute of the East-West Center, Hawaii, 18-31 August 1976.

The workshop gave emphasis to manpower development and management training for operations and maintenance personnel. A report on the workshop proceedings is to be published shortly, containing 15 or 16 papers, abstracts of others, and reports on committee discussions.

(For more information, write to Dr. William Staub, Food Institute, East-West Center, 1777 East-West Road, Honolulu, Hawaii 96822, USA).

(iv) Symposium on farm water management, Asian Productivity Organisation in collaboration with the Japan Ministry of Agriculture and Forestry, Tokyo, 7-13 September 1976.

The discussion centred on five topics: roles of gov ment and farmers in providing irrigation, engineering aspects of water management at the farm level, water management problems in rice cultivation practices, socio-economic aspects of irrigation associations at the terminal level, and irrigation and water management strategies for accelerating rice production in Asia.

(For more information, write to Dr. Yoshimaru Inouye, The Asian Productivity Organisation, Aoyama Dai-Ichi Mansions, 4-14 Akasaka 8-Chome, Minato-Ku, Tokyo 107, Japan).

(v) National workshop on water management and control at the farm level in Burma, Rangoon, 7-12 February 1977.

(vi) National workshop on upland irrigation with emphasis on drip irrigation in Korea, Anyang, Kyunggi-Do, 25-30 April 1977.

(vii) National workshop on engineering and socio-economic aspects of land consolidation works in Thailand, Bangkok, 27 June - 2 July 1977.

Further national workshops in the series being organised by the FAO Regional Office for Asia and the Far East in Bangkok.

(For more information, write to Mr. Kee Seung Park, Regional Water Development and Management Officer, FAO Regional Office for Asia and the Far East, Maliwan Mansion, Phra Atit Road, Bangkok 2, Thailand).

(ix) Workshop on irrigation development planning (with particular reference to conditions in Africa south of the Sahara), FAO Regional Office for Africa, University of Southampton (U.K.) and Ghana Ministry of Agriculture, Accra, Ghana, 17-30 April 1977.

The workshop is intended primarily (but not exclusively) for engineers engaged on the planning of irrigation development, to give them an opportunity to discuss ways in which project planning can be made more effective and efficient. Subjects covered include: estimation of surface water

resources; groundwater resources; land resources; the social impact of irrigation development; health hazards of irrigation projects; estimation of irrigation water required and of irrigation system capacity; estimation of development costs and resulting benefits; project appraisal techniques; planning for effective project management; lessons from field trials and research; the feasibility report; programming of development; monitoring of project performance; sources of external assistance (consultants, United Nations, bilateral, IBRD, African Development Bank); institutional problems of irrigation development.

(For more information, write to Mr. C. de Bouvrie, Technical Secretary, Workshop on Irrigation Development Planning, FAO Regional Office for Africa, P.O. Box 1628, Accra, Ghana).

Communication Activities

(i) The Asian Development Council continues to produce issues of the Asian Regional Irrigation Communication Network Newsletter. This contains information on current research in the Asian region and continues to add to the list of relevant bibliographical material. (For information, write to the Director, Regional Research and Training Program, Agricultural Development Council Inc., Tanglin P.O. Box 84, Singapore 10, Republic of Singapore).

(ii) The FAO Regional Office for Asia and the Far East also continues to issue its Information Notes on Water for Agriculture. Recent issues have contained short notes on the Mahaweli Ganga Project in Sri Lanka (No. 4) and on the Jatiluhur Project in Indonesia (No. 5).

(iii) The Irrigation Information Center produces a periodic news-sheet (Irrinews), as well as current annoted bibliographies, mainly on technical aspects of irrigation, and research reviews on particular topics. (For information, write to International Irrigation Information Center, P.O. Box 8500, Ottawa K1G 3H9, Canada; or IIIC, Volcani Center, P.O. Box 49, Bet Dagan, Israel).

5. PUBLICATIONS, REPORTS

Two recent publications likely to be of widespread interest are:

(i) a series of Technical Memoranda produced by the World Bank on "The Substitution of Labour and Equipment in Civil Construction". Most items deal with highway work, but the basic principles are applicable to many other types of projects, including irrigation. Copies may be obtained from: Transportation Projects Department, International Bank for Reconstruction and Development, 1818 H Street N.W., Washington D.C. 20433, USA.

(ii) A report of the US Water Resources Delegation's visit to Mainland China in August-September 1974, entitled "Hydraulic Engineering and Water Resources in the People's Republic of China", and prepared by Dr. James E. Nickum. This is obtainable from the US-China Relations Program, Room 162-J, Building 160, Stanford University, Stanford, California 94305, USA, for the price of $5.00 per copy, plus postage. This fascinating report consists of 57 pages of main text, written with admirable clarity for the non-China specialist, plus another 60 pages of of appendices detailed notes on the technical characteristics of the

structures and projects visited. Chapters 3 and 4 (Organisation and Incentives for Water Control; and Technical and Economic Observations) should be read by anyone who has an interest in irrigation organisation and management.

Jim Nickum has also written more detailed papers on local irrigation management organisation in China (incorporating evidence from written material) in The China Geographer (No. 5, Fall 1976) and in Chinese Economic Studies (summer 1977, forthcoming). We are currently looking for ways of getting some of this important work reprinted in places more easily accessible to non-China specialists.

APPENDIX A

LIST OF REFERENCES IN PRELIMINARY DESK REVIEW

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APPENDIX B

PAPERS SUBMITTED TO ODI WORKSHOP ON CHOICES IN IRRIGATION MANAGEMENT

27 September - 1 October 1976
University of Kent, Canterbury

A. Technical Factors Affecting Management Options

(A1) C.J.N. Davey, J.R. Rydzewski: "Relation between irrigation project technology and management".

(A2) M.G. Kay: "Methods of water demand estimation and water delivery on surface irrigation systems".

B. Groundwater Management

(B1) R.F. Stoner: "Conjunctive use of surface and groundwater supplies".

C. Case Studies

(C1) Note by AAU/ODI: "Mwea, an irrigated rice settlement in Kenya".

(C2) M.G. Kay: "Water management practices on a sugar estate in Somalia".

(C3) M.F. Ali: "Performance of Ganges-Kobadak project (Bangladesh)".

(C4) R.Wade: "Rationing Water: principles and practice in South India".

(C5) Note by AAU/ODI: "The evolution of irrigation associations in Taiwan".

(C6) Note by AAU/ODI: "Canal systems in North West India and Pakistan".

(C7) S.H. Thavaraj: "Development of an optimum irrigation system planning strategy for the Muda irrigation project".

(C8) E.E. Kikaho: "Irrigation development and management problems at Mbarali in the Usangu Plains Southern Highlands of Tanzania".

(C9) R. Zabala: "Chimborazo irrigation district, Ecuador".

(C10) A. Valera, T. Wickham: "Management of traditional and improved irrigation systems: some findings from the Philippines".

D. Management Policy and Objectives

(D1) M.T. Powell: "Agricultural extension and water management".

(D2) R. Chambers: "Criteria for evaluating and improving irrigation management".

(D3) J. Harriss: "Problems in water management policy and objectives: the role of local institutions and their relationship with bureaucracy".

(D4) W. Doppler: "Determination and levying of water charges on irrigation schemes".

(D5) A.F. Bottrall: "Some propositions about irrigation project and system management".

(D6) J.A. Sagardoy: "Associations of irrigation water users".

(D7) E.W. Coward: "Irrigation management alternatives: themes from indigenous irrigation systems".

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1b

DISCUSSION PAPER 1/77/1

SOME PROPOSITIONS ABOUT IRRIGATION PROJECT AND SYSTEM MANAGEMENT (1)

INTRODUCTION: THE NEED FOR GUIDELINES

1. The object of this paper is to put forward some generalised propositions about certain aspects of irrigation management in developing countries on which, whatever the characteristics of a particular project or system may be, strategic decisions will at some point have to be made. The immediate purpose of the propositions is that they should stimulate debate (about their validity, the usefulness of this kind of generalisation, etc.). But a longer-term objective would be to use them, after further testing against practical experience, as a basis for generating guidelines to decision-makers for choosing the combination of institutions, management methods and - where possible - technologies most likely to be appropriate in a particular situation. The propositions are concerned primarily with projects dependent on surface water delivery systems.

2. The work of the Agricultural Administration Unit at ODI is based on the assumption that attempts to generalise, and to develop broad guidelines, about institutional and administrative choice are essential. This is largely because of the very crude or perfunctory reasoning on which so many current recommendations or decisions about institutions for agricultural development appear to be based, particularly those intended to improve access to the rural poor. In the field of irrigation management, the two most common bases for choice seem to be historical precedent (adherence to a local "model" within a particular geo-political region) and automatic cross-cultural transfer (Taiwan-style irrigation associations are currently fashionable). It is extremely rare to find any attempt to justify institutional choices by reference to the specific agro-climatic and socio-economic characteristics of the area concerned. We would argue, therefore, that the sooner guidelines can be developed which take account of these factors, the better - however imperfect or oversimplified they may appear to be initially.

3. The propositions advanced here are derived primarily from observations made during field research in North West India and from the desk review of case studies in other parts of the developing world. The first set of propositions is concerned with the broader aspects of project organisation and management, the second set with more detailed aspects of water delivery system design and operations. But there is clearly a large degree of interdependence between propositions in each set.

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(1) This is a modified version of Paper D5, submitted to the ODI Workshop on Choices in Irrigation Management, Canterbury, September 1976.

(A) PROJECT MANAGEMENT AND INSTITUTIONS

Alternative Management Structures and Methods of Control

P.1 In very general terms, there should be a high degree of correlation, or of "appropriateness" and "fit", between the organisational form and management methods of an irrigation project (ranging from authoritarian/centralised to participatory/decentralised) and its basic physical, technical, social and economic characteristics. (1)

P.2 In the early stages of an irrigation project strong official control - both technical and administrative - is likely to be beneficial, but over time (with increases in farmer knowledge and income, better and more varied market opportunities) increasing benefits are likely to come from decentralisation of decision-making and more farmer participation (compare Taiwan in 1920 and now).

P.3 On settlement schemes, official staff have opportunities to exercise overall control and discipline by various means unconnected with the water delivery system (e.g. land tenure, cropping patterns, single channel marketing), which may assist rapid initial progress; but unless provision is made for adaptation over time - particularly with regard to land tenure - institutional rigidity and economic stagnation are likely to result at a later stage.

P.4 On irrigation schemes introduced into previously cultivated areas, the choice of methods for exercising control and discipline is likely to be smaller and the difficulties of encouraging good water management in the initial stages correspondingly greater; depending on circumstances, choices will have to be made among methods of water control which are (a) administrative (e.g. strict supervision and policing of water use; crop zoning,(b) economic (e.g. high water charges) or (c) technical (e.g. more control structures). (2)

Universal Ingredients of Good Management

P.5 In all newly-irrigated areas, the introduction of a strong agricultural and water management extension programme is essential, either from the inception of the project or, preferably, on a pilot basis before irrigation water is provided at all on a large scale.

P.6 On all irrigation projects and at all stages in their development, the activities of the engineering and agricultural staff should be co-ordinated by a superior officer or agency with direct administrative control over both; close co-ordination between Irrigation and Agriculture is also required at Ministry level.

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(1) The range of possible management approaches (with examples taken mainly from the desk review study) is indicated in Table 1. To those who find it helpful to think in terms of 'types' of management approaches and 'types' of local situation, certain probable correlations are likely to suggest themselves immediately. But to draw firmer conclusions about the extent to which a particular kind of management approach (A) is likely to fit well with a particular kind of locality (B), it would be necessary to assess in some detail the performances of a largish sample of widely contrasting projects. Problems of evaluating project performance, and particularly that part of performance which may be attributable to 'management' factors, are discussed in Paper 1/77/2.

(2) The choice may, of course, involve a combination of these methods.

P.7 Project staff will generally perform better under a management which works on "commercial" rather than "bureaucratic" principles (e.g. promotion on merit, not seniority; rewards for good performance, punishment or dismissal for bad performance).

Project Scale (1)

P.8 Despite certain potential economies of scale on larger projects (e.g. larger reservoirs which permit reduced fluctuation in water deliveries; better opportunities for maintaining an effective local research capacity), farmers tend to be more efficient in their use of each unit of water delivered on smaller projects than on larger ones within the same locality. They are also likely to be more co-operative in accepting decisions about allocations of scarce water. This is because it is easier for them to obtain accurate information about overall water supply and demand within the project area. E.g. total water availability may often be checked first-hand; and inequitable water distribution, whether between individuals or groups, is more easily identifiable and social pressures against abuse are therefore likely to be stronger.

P.9 In the initial years of large-scale projects, with water delivery systems of limited flexibility, water supplies tend to exceed an unpredictable demand by a particularly large amount, especially when the whole project comes on-stream within a very short space of time. This leads to major water losses and in some cases serious environmental damage. Wherever possible, therefore, large projects should be developed on a stage-by-stage basis. (2)

Communication and Feedback

P.10 To assist communication and feedback between official management and farmers on large-scale projects, staff should be organised on a decentralised "irrigation sector" basis, with each sector headed by a co-ordinated irrigation-drainage-agriculture team, rather than be directed through long, extended centralised chains of command operating in parallel. (3)

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(1) The advantages of smaller scale and greater divisibility suggested in Propositions 8 and 9 could be brought out still more strongly by reference to well irrigation.

(2) This should also allow a more effective deployment of agricultural and water management extension staff (especially where these are in short supply), by permitting greater concentration of effort on different areas in sequence and making it possible for earlier-developed units to be used as demonstration areas for later-developed ones. See also Proposition 5.

(3) It should be possible to develop more detailed hypotheses about optimal densities and locations of staff (in accordance with their skills and functions) in different conditions, both through further field study and through study of management theory derived from experience in other types of enterprise. The same applies to the size and functions of farmer-irrigator groups.

P.11 Key people in any extensive irrigation system are the most junior-ranking staff who are supposed to form the immediate link between the official management and farmers (ditchtenders, village extension officers): if for any reason they do not or cannot work effectively (e.g. poor incentives; inadequate contact with or supervision by senior officials), the overall performance of the project will be severely affected, whatever the technical skill of top-level management.

Farmer Participation and Irrigation Groups

P.12 Farmers will be more inclined to accept group responsibility for operation and maintenance tasks at watercourse level if they have previously had to contribute resources (especially labour) at the construction stage towards the installation of local infrastructure - irrigation and drainage channels, land levelling, etc. - as, for example, in Mainland China and on small "indigenous" irrigation systems elsewhere.

P.13 When government offers external technical support to farmer-irrigator groups which are already well established as a result of spontaneous local action, great care must be taken to ensure that, if certain traditional functions are taken away from the groups (e.g. repair and maintenance of diversion structures), they continue to be given sufficient responsibilities to encourage retention of their dynamism and identity; otherwise they will tend to become dependent on government in all respects, with the result that performance deteriorates and/or major increases in administrative cost occur.

P.14 Although local groups are administratively convenient, they cannot easily be created where they have not existed before: just as there are a number of reasons which can be found to explain why groups have tended to develop in certain environments (e.g. hill-valley topography and/or relatively easy local control of water source; social cohesion; coincidence between size of local social unit and size of terminal irrigation unit; rice cultivation, often with field-to-field flood irrigation; perhaps also population density and settlement pattern), so there are equally good converse reasons why they have not developed elsewhere. In the latter areas, little advantage is likely to come from blanket government decrees that (formally constituted) irrigation groups or associations should be established; if groups are to take root at all in such environments, they may often need to be developed on a selective basis, after careful research has been done into the possible functions and felt needs round which (initially informal) group activity might, with sensitive external assistance, be gradually built up.

P.15 Although in many of the societies in which they are found indigenous groups may not be particularly democratic or egalitarian, attempts to replace them by formalised would-be democratic institutions - e.g. co-operatives as developed in North America or Europe - are likely to produce the opposite effect from that intended: instead of encouraging greater equity, they will tend to reinforce the power base of the existing local elite - and often little else. This effect is likely to be still more pronounced if such institutions are introduced into societies which are markedly unequal and lacking in social cohesion. In this latter case, the first step towards achieving greater equity should be the introduction of stronger official control and more effective penalties against abuse rather than loosely-supervised unrepresentative farmer bodies.

(B) SYSTEM DESIGN AND OPERATION

System Design and Capacity to Manage

P.16 At the project planning stage, much more attention should be paid than is usually the case to relating the design of the system (a) to the capacity of the irrigation staff and the farmers to operate and maintain it; and (b) to the capacity of the farmers and the agricultural extension staff to raise the level of agricultural production at a rate which will justify the capital and recurrent costs which the design entails.

Maintenance and Finance

P.17 A frequent reason for poor system maintenance is the inadequacy of finances to cover a project's recurrent costs. This is usually directly or indirectly linked with a policy of low water charges.

P.18 Highly subsidised water charges are rarely justifiable, though apologists for them sometimes argue (a) that when irrigation is first introduced to an area farmers are inhibited from taking water by charges of any significance or (b) that smaller farmers cannot afford higher charges at any time. In fact low water rate policies are usually maintained as a result of pressure from large farmers, who could easily afford to pay higher rates but are usually a politically powerful pressure group. (1)

System Operation

P.19 The method of system operation (matching water supply and demand as closely as possible) - and, by extension, the design of the system which has to be operated - should be chosen according to agro-climatic criteria, not geo-political ones.

P.20 There appear to be a limited number of significantly different techniques for attempting to optimise the match between water supply and demand on surface-water delivery systems. According to its design (and cost) a system may offer more or fewer opportunities for flexibility of supply, depending on whether (a) it is with or without storage; (b) it is designed to operate on a 24-hour basis, by rotation or on demand. On the demand side, water demand estimation and control of water use may be facilitated by legislative controls over cropping, whether by area or type; or choice of cropping pattern may be merely limited <u>de facto</u>

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(1) The reasons for slow up-take of water by farmers at the beginning of many irrigation projects may often have little to do with the level of irrigation charges: e.g. ignorance of irrigation practices; labour bottlenecks or shortage of draught power or machinery for land preparation, etc. The capacity of smaller farmers to pay higher charges will obviously vary from situation to situation, but if the subsidy is intended as a welfare measure, this is an inefficient (and inequitable) way of providing it; where needed, separate welfare measures should be found.

TABLE 1

← MORE CENTRALISED | LESS CENTRALISED →

	MWEA (Kenya)	GEZIRA (Sudan)	MEDJERDA (Tunisia)	TAIWAN 1920	EGYPT	W. INDIA (Maharashtra)	N.W. INDIA (Chambal)	TAIWAN 1976	S.E. (tradit...
A. MANAGEMENT CHARACTERISTICS									
(1) Main operating agency	Parastatal Board	Parastatal Board	Parastatal Board	Government Departments	Government Departments	Government Departments or CAD Authority	CAD Authority	Irrigation Associations	Farmer (
(2) Methods of official management control	(a) threat of tenant expulsion (b) control over crop rotation (c) control over timing of cultivation operations (d) control over water delivery to field (e) control over all marketing outlets (f) "social control" - policy of mixing clan groups	(a) threat of tenant expulsion (b) control over crop rotation (c) control over water delivery to 10-farm outlet (d) control over cotton marketing outlets	(a) sanctions against non-repayment of land purchase loan (b) partial control over cash crop marketing (c) control over water delivery to - (unspecified) level	(a) enforcement of farming practices with police supervision (b) allocation of water to - (unspecified) level with police supervision (c) control over rice marketing (?)	(a) control over cropping pattern and rotation ("blocks") (b) control over water delivery to - (unspecified) level (c) control over all marketing outlets	(a) control over area and acreage of certain crops, especially sugarcane (b) partial control over water delivery to farm (by indent) (c) control over water delivery to ? watercourse	(a) control over water delivery to watercourse outlet (b) legislation against damage, abuse (ineffective)	(a) control of water allocation to project (b) legislation	often n...
(3) Density of official staff coverage	1 irrigation officer:3000 acres, 1 junior extension officer and waterguard: 500 acres (120 farmers)	...	...	...	...	...	1 junior engineer: 18,000 acres 1 village extension worker:320 farmers	...	...
(4) Farmers' responsibilities	Labour-intensive cultivation activities	All cultivation activities excluding land preparation; water application to field	All cultivation activities; water application to field	All cultivation activities; water application to field	All cultivation activities excluding land preparation; water application to field; O and M (including rotation?) within watercourse	All cultivation activities; water application to field; informal participation in water allocation and maintenance within watercourse	All cultivation activities; water application to field; informal participation in water allocation and maintenance within watercourse	All cultivation activities; water application to field; watercourse O and M (including rotation); coordinating water allocation; staff supervision through associations	Cultiv... conser... and O ... of ... system
B. PROJECT CHARACTERISTICS									
(1) Physical									
Soils	Uniform black clay	Clays	Alluvial deposit valley basin between sand-stone cliffs	Alluvial	...	Clays, undulating	Clays, undulating	Alluvial	...
Rainfall (average)	Medium	Low	400-1000mm/yr to the north; 200-400mm/yr to the south	2525mm/yr	75-200mm/yr	High	850mm/yr	2525mm/yr	High
(2) Technical									
Project irrigated area	12,000 acres	2,000,000 acres	...	...	...	...	550,000 acres	12,000 - 250,000 acres	.e. 10...
Type of system design	Diversion, gates to field	Storage; night storage	...	...	...	...	Storage; control structures to head of minors	Control gates, flumes at 10-15 acre outlets	Simple divers...
Date of construction	Late 1950s	Late 1920s	...	? recent	...	...	1960	...	...
Cropping pattern	1 crop rice only	Cotton and subsistence	Livestock, horticulture	Mainly rice	Cotton and subsistence	Sugarcane and subsistence	Wheat, rice, coarse grains	Mainly rice	Mainl...
Cropping intensity	200%	69%	...	...	? 200%	...	76%	High	...
Water scarcity/abundance	No shortage at present	Sufficient	...	? Abundant (no rotation)	Watercourse rotation	...	Excessive at head, deficient at tail	Watercourse rotation	? Abu...
(3) Social/economic									
Settlement/non-settlement project	Settlement	Settlement	Post-land reform settlement	Large and small-holders	Mainly small-holders (post-land reform)	Large and small-holders	Large and small-holders	Mainly small-holders (post-land reform)	Smallh...
Type of tenure	1 year renewable tenancy	1 year renewable tenancy	Purchase of land over 2 years	Private ownership and tenancy	Mainly private ownership	Private ownership and tenancy	Private ownership and tenancy	Mainly private ownership	Priv...
Average farm size	4 acres	15-20 acres	...	...	...	...	8.5 acres	...	...
Average farm income	(target income £100 p.a.)	...	...	...	...	...	...	...	...
Length of farmer experience of agriculture/irrigation	? 5-10 years	Originally nomadic pastoralists	Mostly previously landless	...	...	...	10-15 years	? long	...
Literacy rate	...	...	...	...	...	...	16%	High	...

DISCUSSION PAPER 1/77/2 (1c)

SOME BASIC PROBLEMS OF EVALUATING IRRIGATION MANAGEMENT

Introduction

1. One of the main purposes of our study is to develop effective and practicable techniques for evaluating the quality of management - and the appropriateness of the organisation and institutions - of individual irrigation schemes. The evaluation of project performance (and more specifically of project management) can be extremely valuable in at least three ways: (i) as a means of improving the performance (and management) of the particular project being evaluated; (ii) as a means of improving the performance (and management) of other already established projects, by helping to illuminate certain principles of good management and theories of appropriate organisational form; and (iii) as an input to the planning and design of new projects.

2. At present detailed project evaluation is a neglected activity: it is only infrequently carried out, the results are still less frequently publicised, and far less attention has been paid to techniques of project evaluation than to those of project appraisal (indeed, many would argue that much of the energy and ingenuity devoted in recent years to increasing the sophistication of appraisal techniques has been misplaced). (1) One of the reasons for this, of course, is that evaluation tends to impinge much more immediately on the sensibilities of individuals and governments than planning, since it is concerned with actual occurrences in the immediate past and the present (for which specific people or agencies may be held responsible) whereas planning refers to a relatively abstract future. Because its purpose is to draw conclusions about the causes of good or bad performance, and because these causes are often human (political, social, administrative), evaluation calls - especially in the case of bad performance - for special qualities of honesty and tact. It also makes demands on certain social science skills which are at present only rarely employed in conventional planning activities and are therefore poorly represented within the predominantly planning-oriented "development profession".

Defining 'Management'

3. Particular difficulties are introduced into the evaluation process when its object is not merely to assess performance but, as here, to focus specifically on the assessment of management. The first problem to be overcome is to establish what we mean by 'management', particularly in the context of an irrigation scheme. It is, unfortunately, an ambiguous term. There are two senses in which it is not used in this paper: (i) it is not used to refer, in an exclusive sense of the term, to 'top management' alone (i.e. 'the managers', as distinct from 'staff' or 'farmers'); nor (ii) is it used in the relatively limited, technical sense which is often given to it in the context of 'water management'.

4. It is particularly important to avoid the confusions introduced by equating 'management' with 'top management', because if such an equation is permitted, it enables people to dismiss the need to think about the essential details of irrigation management by making remarks such as: "The way to get good irrigation management is to appoint a good manager".

(1) See, e.g., the paper by Carruthers (E1) to the Canterbury workshop.

This is not of course an entirely silly remark (though it is likely to be near-tautologous and therefore unhelpful unless the speaker can explain what he means by a 'good manager'): on any irrigation scheme which is dependent on a common, shared water source there is bound to be some hierarchy of decision-making with regard to resource allocation and one would therefore expect a priori that in most cases a necessary condition of a successful irrigation scheme was that those at the top of the hierarchy should be 'good managers'. However, the dangerous assumption in the remark is that this would be a sufficient condition. It is dangerous because it implies that an irrigation scheme is a single closely-integrated enterprise (or 'system') with the same organisational characteristics as a typical industrial enterprise, i.e. one in which all important areas of decision-making are subject to direct influence or control by senior management.

5. In fact, irrigation schemes only come near to being like industrial enterprises in two extreme cases: (i) when they are 'integrated management' schemes like Mwea, where all major decisions, including decisions at farm-level, are made by the project managers (a unified production enterprise); or (ii) when their sole responsibility is to provide water on demand to independent (and usually large) farm units, as in parts of the USA and Europe (a conventional service enterprise). In the first case, farmers operate totally within a single 'system': they become analogous to shop-floor workers in a factory. In the second case, they operate totally outside it: they are the 'clients' of the service enterprise.

6. But the majority of irrigation schemes in developing countries fall into neither of these categories. Although, admittedly, irrigated agriculture nearly always permits (or indeed demands) a greater degree of co-ordinated management than most forms of rainfed agriculture, because of the central importance of institutional arrangements to deal with the allocation of water - a common and usually scarce resource - the position of farmers in irrigated areas is likely to resemble that of rainfed farmers much more closely than it does the position of factory workers, so long as their land-holdings are operated on a private basis. They are most conspicuously different from factory workers in the following respects: they have more choice about what to produce and how to produce it; they are usually competitors with each other for the use of scarce inputs, including water; and many of them consume a substantial part of their production. In such conditions, the senior managers of an irrigation scheme clearly cannot be regarded as being in direct control of a highly integrated production enterprise. On the other hand, it is equally clear that they are not concerned with running a straightforward service enterprise either. In addition to providing services to farmers - or more commonly to groups of farmers, because average holdings are much too small and numerous to be served individually - they are also expected to take responsibility for supervising and training them, stimulating local investment, enforcing legislative controls, etc.

7. As far as this study is concerned, the term 'irrigation management' is taken to encompass all important areas of decision-making affecting the performance of an irrigation scheme, at whatever level. Since decision-making responsibilities are often (for better or worse) (1) so widely dispersed, it follows that analysis of irrigation management must involve

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(1) The relative merits of a greater concentration or dispersal of responsibilities will depend considerably on the nature of the local physical and social environment (see Paper 1/77/1, especially Propositions 1-4).

detailed scrutiny not only of what happens at the highest levels of the hierarchy but also of what happens at various points on the frequently long-extended chain of official staff; at the local community level; and at the farm level. And it must be concerned to discover not only how well certain functions and responsibilities are carried out at each of these levels but also why certain standards of performance have been achieved. This will entail looking closely at relationships between different agencies or individuals within the hierarchy: both vertical relationships - the quality of two-way communication and response between different levels; and horizontal ones - the effectiveness of coordination between specialised functional agencies at each level (irrigation staff, agricultural extension staff, suppliers of inputs other than water, collectors of revenue, etc.). (1)

Evaluating performance and evaluating management

8. Having attempted to define what we mean by 'irrigation management', we are now confronted by a set of problems about how it should be evaluated. Briefly, they are these:

(a) In most developing countries, it cannot be assumed that the quality of an irrigation project's performance is necessarily a direct reflection of the quality of its management. There are often many other factors besides project management which affect performance, e.g. deficiencies in technical design; deficiencies in project planning; and political and legalconstraints external to the project.

(b) Even when evaluating performance (a more straightforward task than evaluating management), there may be difficulties in establishing what evaluation criteria to use. The relevant criteria will depend on the project's objectives; these are likely to be multiple and, in some cases, conflicting.

(c) When criteria have been established, there may still be considerable argument as to the appropriate standards against which to measure actual performance or quality of management. This is clearly important, since judgements of 'good' or 'bad' are expressions of the difference between actual achievement and what the evaluator believes to be achievable.

Of these three problems, the second and third are of course regularly encountered in any evaluation, whether of performance

(1) The emphasis placed in the foregoing paras. on the major differences between the management of irrigation schemes in developing countries and that of 'modern' ('Western') industrial enterprises may serve to underline the danger of attempts to apply uncritically the conclusions of mainstream management and organisation theory, derived from modern industry, in such an alien context. This is not to say that some of the concepts of this body of theory may not be very usefully applied to the analysis of irrigation management; but they must be used with care, taking account of the important differences in the structure and functions of the enterprise - to say nothing of often highly significant differences in the cultural environment. Valuable work has been done by Chambers and Belshaw in applying management theory and techniques to the development of small-farm agriculture; see, e.g. R. Chambers, Managing Rural Development (Scandinavian Institute of African Affairs, Uppsala, 1974). See also Earl M. Kulp, Designing and Managing Basic Agricultural Programs (PASITAM Publications, Bloomington, Indiana, 1977). With regard to irrigated agriculture, Chambers and Moris have analysed the management and organisation of the Mwea scheme in Kenya (Chambers and Moris 1973) - but in reading their comments it should not be forgotten that Mwea is something of an extreme case.

or of management. The first arises only when the object of an evaluation is management; it acquires particular importance in the contexts with which we are concerned. (1)

9. Some readers may feel that we are trying to make things unnecessarily complicated: surely the need is to find simple techniques of evaluation which can readily be applied in the field without undue cost in terms of extensive data-collection or highly specialised analytical expertise? We would certainly agree with this (see the last section of this paper). On the other hand it is vital, before seeking to develop relatively simple evaluation techniques, to ensure that the complexity of the issues we are dealing with is fully understood first. Premature simplification can have many serious consequences: among them, the exclusion of important questions which need to be asked and the formulation of wrong questions, resulting in a misallocation of resources in data-collection and wrong prescriptions. To illustrate this point, it may be useful to demonstrate the inadequacy of two fairly simple yardsticks which appear to be quite commonly used in practice to judge the quality of irrigation management. There is of course an element of caricature in what follows, but the main point of it is this: both yardsticks are inadequate because they overlook or ignore at least one of the three problems referred to in para. 8 above.

10. The first yardstick is an essentially technical one which seems to be not infrequently used (either consciously or unconsciously) by some engineers. It implies the existence of some kind of absolute standard of good management. This absolute standard is rarely if ever specified, but it seems to be based on a level of technical efficiency in operation and maintenance obtainable on irrigation systems of advanced design; and it is often extended to include, by association, the "modern management methods" and institutions which are commonly found on such systems. Reference to some such yardstick is often latent in advice of the following kind, which appears quite frequently in the literature on the planning and operation of irrigation schemes in developing countries: "x will work provided there is strong/good/correct management"; "operation and maintenance should be carried out to the highest possible standards"; "farmers should be organised in the correct manner". If the value terms here ("good", "correct", etc.) were being used in some relative, locale-specific sense, this sort of advice would be verging on the tautologous and hence have little practical significance. However, it is much more likely that the advice is intended to carry some meaning with respect to action to be taken, and this would only be possible if the value terms were being used with reference to some absolute (though concealed) standard of the kind already described.

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(1) In the management literature, level of performance is often taken as a measure of quality of management. This assumes a capacity on the part of senior managers to control all that happens within their enterprise - an extreme assumption even in the case of a technologically advanced industry operating within a laissez-faire economy. But it is safe to say that in that kind of context performance is much more likely to provide an approximate indicator of management quality than it is on most irrigation schemes in developing countries.

11. The uncritical use of a yardstick based on some form of "ideal" standard of "modern management" could have very unfortunate consequences in many developing country environments, since it would tend to generate policy decisions which were highly inappropriate to local resource endowments. Because it has built into it a propensity to encourage cross-cultural transfer of technology and institutions, it would often make unnecessarily heavy demands on scarce financial and administrative resources, at a high social cost. Against such a yardstick, it would be impossible for a low-cost, simply designed "indigenous" irrigation scheme, of the kind found in many parts of South-East Asia, to be judged well managed. The most obvious fault of this yardstick is that it is based on an inappropriate standard - point (c) in Para. 8; points (a) and (b) are more or less ignored.

12. The second yardstick is somewhat more sophisticated and appears to be subscribed to by some members of the planning profession. In this case, the quality of management is judged by measuring the actual performance of an irrigation project or water delivery system, in cost-benefit terms, against its planned performance at any given point in time. This kind of yardstick is a great improvement on the first in that it takes explicit account of costs as well as benefits and it is capable of allowing for multiple objectives - point (b). It is, however, unsatisfactory with regard to the other two points. First, it assumes that the planners' targets - e.g. a certain level of agricultural production or of efficiency in water delivery in response to a certain level of annual management and capital costs - provide an appropriate standard against which to measure actual performance, but this may not be so: planners are fallible and in any case many factors may have changed since the time of planning - point (c). Secondly, it attributes the difference between actual and planned performance to "management" alone - point (a). The extent to which the use of such a yardstick could lead to wrong prescriptions for action would depend partly on the realism of the assumptions on which the planners' targets were based (particularly their assumptions about the management capacities of project personnel and farmers); and partly on the extent to which factors other than management have affected project or system performance.

13. It is difficult to avoid concluding that, in order to develop a satisfactory method of evaluating irrigation management, we need to construct an analytical framework of the following kind:

(a) One which seeks to isolate those aspects of project or system performance which are specifically attributable to internal management factors. This can only be done by starting with an evaluation of performance and then identifying and excluding those aspects which are attributable to other factors, such as government policy (e.g. scale of budgetary support, legal framework), characteristics of project planning (e.g. imposition of unrealistic targets) or characteristics of system design (e.g. inflexible operational characteristics, inadequate drainage).

(b) One which enables the range of possible project objectives, and hence the relevant criteria for evaluation, to be clearly and comprehensively considered. Chambers, after rejecting the feasibility of concocting a single comprehensive criterion and warning against the opposite danger of an 'over-inclusive proliferation' of criteria, has suggested five 'generic' objectives or criteria: (i) productivity,

(especially the productivity of water); (ii) equity (fairer rather than less fair distribution of resources, especially water, to cultivators); (1) (iii) "convenience" (i.e. the convenience of cultivators, with particular reference to the predictability, quantity and timeliness of water delivered) (iv) environment stability; and (v) cost-effectiveness (in terms of the costs of achieving the benefits embodied in the other four objectives). (2)

and (c) One which ensures that the standards against which current performance is measured are "feasible" or "attainable" in relation to local resource endowments, and especially in terms of the management capacities of project personnel and farmers. These capacities are of course always changing through time, and training can be crucial in accelerating their change. The standards to be used are thus relative and dynamic as opposed to absolute and fixed.

14. Such a framework would make it possible to adopt an analytical approach containing the following main elements:

(a) Estimation of attainable project objectives, present and future - "attainable" being principally limited by (i) the physical characteristics of the water delivery system; (ii) management capacities; and (iii) (to the extent that it is regarded as unamenable to change) government policy.

(b) Measurement of actual project performance, past and present, in terms of selected criteria.

(c) Identification of the extent to which differences between present performance and present attainable objectives can be attributed to different factors.

(d) Deduction about the sequences of action required in order to move from present performance to the achievement of future attainable objectives, in the light of conclusions drawn in (c) above, with special reference to potential improvements in management.

15. The two elements in this approach which will depend most heavily on field investigation are items (b) and (c). The following outline provides a brief check-list of the kinds of questions which would need to be asked during these stages of the evaluation process and indicates a logical sequence in which they might be arranged:

A. Measurement/assessment of performance of (a) project and (b) water delivery system

"How well is the project/system judged to have performed, in cost-benefit terms, according to the following criteria?"

(i) productivity
(ii) equity
(iii) environmental stability

(followed by more detailed indicators of performance at different points within the system: e.g. water losses at primary, secondary, tertiary, field levels; quantities and timings of water delivery/cropping intensities in head reaches, tail reaches).

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(1) It is interesting to note that equity of distribution in an irrigation context tends to refer primarily to the more equitable supply of water between top-enders and tail enders rather than (as in the case of other inputs) between larger and smaller farmers.

(2) Paper by Chambers (D2) to the Canterbury workshop.

B. Possible causes of good or bad performance

"If the project/system performance has been judged good or bad, which of the following can be identified as significant contributing causes?"

(a) Causes external to project

(i) Within control/responsibility of government

e.g. Adequacy of finance for operation and maintenance
Water rate policy
Pricing policy generally
Legal framework (e.g. groundwater control legislation; effectiveness and simplicity of legal procedures against abuse)
Powers and responsibilities of senior project or district administrators
Salary structures, promotion policies, staff incentives

(ii) Beyond control of government

e.g. Climatic factors
Major changes in input or product prices

(Evaluation feedback directed primarily at government)

(b) Causes attributable to project characteristics but beyond powers of project management to rectify

(i) Attributable to project planning

e.g. Imposition of targets beyond management capacity of project personnel or farmers

(ii) Attributable to system design

e.g. Inflexible operational characteristics
Inadequate control structures
Inadequate drainage
Minor canalisation incomplete
Terminal units too large
Excessive demand on local technical and/or management skills
Over-reliance on imported/scarce/costly spare parts

(Evaluation feedback directed primarily at planners and designers of new projects/systems)

(c) Causes within capacity of project management to rectify (i.e. within constraints identified under B (a) and (b))

(i) Overall project management

e.g. Coordination between specialist wings at each level of project organisation; especially coordination between agriculture and irrigation staff to devise optimal water allocation programme

Financial management

(ii) Management of water delivery system

e.g. Operation and maintenance functions in context of water allocation programme (what should they be? Are they being performed? Are they being performed well?)

Rules, routines, procedures (What are they? Are they good/workable? Are they applied?)

Supervisory, checking techniques

Levels of responsibility for different functions (Who is supposed to perform certain functions? Is this the appropriate person/body? Might it be done better with a different organisational structure?)

Adequacy of staff numbers (and transport, mobility)

Technical and management skills of staff/farmers

Information about, understanding of, each other's functions and objectives

(Evaluation feedback primarily to senior project executives and their staff)

Data collection and techniques of analysis

16. A lot of emphasis has been placed in this paper on the need to understand in detail the complexity both of the irrigation management process and of the local environment in which it operates, as a precondition of reliable evaluation. This emphasis on detail and complexity must inevitably raise doubts as to the possibility of reconciling such an approach with the aim of producing widely applicable methods of evaluation which are not dependent on excessively costly data collection or on highly sophisticated analytical techniques. It may therefore be worth looking again at those elements in the suggested analytical process which appear to be most 'difficult', in terms of the data or analytical skills they require, in order to identify more precisely just what kinds of demands are being made of the evaluators. They would include:

(a) Estimation of what level of present or future performance is "attainable";

(b) Attribution of weights to different (possibly conflicting) objectives and assessment of possible trade-offs between them;

(c) Estimation of the proportions in which the level of present performance can be attributed to different causes;

(d) Detailed analysis of current management activities and assessment of potential for improvement.

17. What kinds of data or analytical skills are required in each of these cases? With (a), the essential requirement is mature judgement, based on a thorough understanding of local technical, economic, administrative, social and political factors; judgement of what is "attainable" must always depend to a high degree on well-informed guesswork (cf. planners' estimates of future benefits). With (b), judgement is again important, but in this case especially political judgement - an ability to assess what priorities can be given to different objectives in the light of actual or ostensible official policy. In the case of (c), it must once more be ultimately a question of "judgement", backed by a lot of detailed information and indicators; in theory some kind of multi-factorial analysis might be attempted here but, even if the necessary accurate data were readily available (which in most cases it would not), the time and other costs involved would make it an exercise of very doubtful utility. Finally, with (d), the main emphasis here is on detailed information. Though essential technical and economic data will of course be quantifiable, much of the rest - relating to 'man-management' (skills, relationships, levels of responsibility, etc.) - will be essentially qualitative, even if it is expressed in terms of performance indicators.

18. The important conclusion to be drawn from this is that the principal requirements for evaluating irrigation management are: (i) "judgement", based on extensive knowledge of the local environment - <u>not</u> a knowledge of sophisticated techniques of quantitative analysis or a capacity to construct a single index of management performance; and (ii) detailed information (in the sense of comprehensive coverage of essential issues) - <u>not</u> highly precise information, which would provide better opportunities for 'objective' measurement through quantitative analysis. This emphasis should ensure that the evaluation techniques we eventually propose are widely usable. The most important immediate task, as we see it, is to establish with some degree of confidence what are the central issues to be studied and the right questions to be asked; and this will be uppermost in our minds during the next phase of our research.

19. The emphasis placed on detail in the preceding paragraph at the expense of precision should not be taken as implying that quantified information, as accurately measured as possible, is not considered of vital importance in project evaluation. Clearly it is, especially as a means of assessing the technical aspects of project performance (e.g. measurement of water losses, timing of water allocations, maintenance standards) and as an input to economic analysis. But there are two main reasons why it is felt that, at the moment at least, efforts to ensure a detailed and comprehensive coverage of information merit even more attention than those designed to increase the accuracy with which it is measured.

20. The first reason is that the need for very accurate data and sophisticated analysis tends to increase proportionately with the level of efficiency with which a project or system is operating: for example, on the Chambal project it was not necessary to measure water losses in detail to perceive that great water wastage was occurring in the higher reaches; (1) but on a project operating much more closely to the limits of its potential efficiency detailed measurement would be much more necessary as a means

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(1) See Newsletter, pp. 8-12.

of identifying priorities for action to be taken. At the same time, the chance that accurate data will be readily available on a project also tends to increase proportionately with the sophistication of that project's management. The cost of collecting additional data designed to ensure a generally 'acceptable' level of accuracy would therefore tend to be higher on 'less advanced' projects (where the need for accuracy would be less) (1) than on 'more advanced' ones. If this is commonly true, it would seem important that in developing a methodology for evaluating irrigation management a high degree of perfectionism in data collection and analysis should not be universally insisted upon. The prime requirement is to develop a logical and consistent method of analysis which can be applied in all kinds of social and economic conditions, and will help to identify with some confidence measures which will significantly improve performance. But the amount of precision required will vary from case to case. (2)

21. The second reason for giving greater stress to detail than to accuracy is that, whatever the local circumstances, the usefulness of attempting to measure things quantitatively depends very much on the kind of causal relationships which are being analysed. Where the more exact sciences are concerned it would clearly be foolish to deny the central importance of quantitative analysis. But the value of trying to introduce elaborate quantitative techniques into the areas of social, political or administrative behaviour is much more dubious. Simple indicators of management performance (e.g. frequency of staff meetings) may often provide a good starting-point for analysis, but it is usually only in conjunction with other essentially unquantifiable evidence (e.g. content or "style" of meetings) that they can begin to tell us much about effectiveness of management. And even then it will require an act of judgement to explain _why_ performance is good or bad. Judgements about human causation are essentially qualitative. Dressing them up in fancy quantitative clothes is at best unhelpful (costly too), and it may even be downright misleading if it has been done in the belief that they will thereby be made more 'objective' and 'value-free'. In fact, all that may have been achieved is a concealment of the evaluator's underlying system of values which, in the interests of honesty and clarity, ought to be made fully explicit.

22. A further - and potentially greater - danger which can arise from excessive insistence on quantitative analysis is that it will encourage the _exclusion_ of all factors and relationships which are not easily quantified. An automatic consequence of this, whether intended or not, is to impose serious restrictions on the scope of an evaluation and prevent due weight being given to social, cultural and political factors.

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(1) I.e., there is less need for accuracy _as far as the evaluator is concerned_. It is, of course, very possible that insufficiency of accurate data is a major reason why a project is performing badly. In that case one might recommend, _after_ evaluation, that more accurate data be collected in the future. But it is not required now in order to reach that conclusion.

(2) For some acute comments on the importance of adapting one's research methodology (and management methods) to the availability of resources in the locality which is being researched (or managed), see Chambers, _Managing Rural Development_, pp. 150-155

23. These arguments (which are really about the content and balance of evaluation, not just about analytical techniques) lead on to the final question as to who should undertake evaluations of irrigation management. There seem to be three main issues here. First, should the evaluating agency be from inside or outside the project? The answer is fairly clear: although regular monitoring of performance is an important internal project task, detailed evaluations of the kind envisaged in this paper should be done by an external body; this might be a specialised government agency or an independent academic institution. Secondly, should the results be made widely available or kept confidential? There can be no universal answer to this, but it is worth repeating here that evaluations can have an important part to play not only in improving the performance of the project concerned but also as an input to the general body of theory about irrigation management and in feeding back information to project planners; for the latter two purposes dissemination of the results in some form or another is obviously essential. Lastly, what are the most important kinds of expertise needed for evaluation? The main point to emphasise here is the highly interdisciplinary nature of the subject of irrigation management. This does not mean that every single discipline which may be pertinent to the subject should be represented by a different individual on the evaluation team; that would be undesirable on cost grounds alone. On the contrary, each person involved (and in extreme cases it may just be a single person) should be able to think in an interdisciplinary way, i.e. well beyond the boundaries of his own specialisation. That said, the essential areas of knowledge seem to be: (i) engineering (particularly with respect to the operational characteristics of the water delivery system); (ii) agricultural; (iii) economic; (iv) management and organisation (with special reference to the practicalities of irrigation management); and (v) local institutions and politics. It may also be worth reiterating here the warmly-approved observation made by a distinguished participant at the Canterbury workshop that one of the prime requirements of a good evaluator (if not the prime requirement) is "an analytical mind"!

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April 1977

DISCUSSION PAPER 1/77/3 1d

SKILLS, FUNCTIONS AND ORGANISATIONAL FORMS IN RELATION TO PROJECT AND SYSTEM CHARACTERISTICS

1. In the next phase of our research programme we shall be concentrating on trying to improve our overall analytical framework by sharpening its focus in two main respects. First, we shall be aiming to get away from talking about the 'management' of irrigation in broad, general (and often vague) terms by looking in detail at its component parts - skills, functions, responsibilities - and examining the wide variety of combinations and permutations in which these skills etc. may need to be applied in different circumstances. Secondly, we shall be giving special attention to the application of these skills, etc. to the central activity of water allocation.

2. Before we go on to illustrate the kind of 'skills matrix' which we are planning to use as our immediate point of departure, it may be worth explaining briefly why we have decided to treat water allocation as a central issue. There is a combination of reasons. The principal one is that, on any surface irrigation scheme where water is scarce, water allocation is inevitably a central activity because of the important consequences it has for project objectives, especially productivity and equity. Moreover, it is a complex technical activity which has been very inadequately studied by researchers and is often neglected by policy-makers, despite evidence that the effectiveness of programmes designed to improve conditions at the field and watercourse levels may be greatly reduced unless weaknesses in the operation of the main water delivery system are rectified first (or at least simultaneously). (1)

3. Water allocation also provides an attractive and fruitful focus for interdisciplinary research because attention to it obliges one to look at the interdependence of so many other activities within the overall management 'system'. For example, it provides a much better central focus than 'operation and maintenance', on which we were originally intending to concentrate. Water allocation embraces operation; and maintenance is subordinate to both, inasmuch as its purpose is to provide conditions in which good operation and water allocation are possible. But 'water allocation' has much broader and more creative connotations than 'operation', which is often regarded rather narrowly as an essentially routine, technical, engineers' activity concerned only with water supply. Water allocation, on the other hand, is concerned just as much with the management of water demand as with that of water supply. Focussing on water allocation, therefore, ensures that adequate attention is paid to the agricultural (demand) side of an irrigation project as well as to the engineering (supply) side. This means looking closely not only at the performance of irrigation personnel but also at the performance of agricultural extension staff (and farmers!) and at the effectiveness of senior project managers in coordinating the activities of both sides.

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(1) See Newsletter, page 11, items (iv) and (v).

4. To return to the proposed development of our analytical framework: during the next few months we shall be attempting to produce fairly detailed hypotheses concerning:

(a) the different types of management skills likely to be required for efficient water allocation and maintenance on irrigation projects with different sets of (physical, technical, economic, social, political) characteristics;

(b) the functions which support staff (and farmers) might be expected to perform in each case;

and (c) the alternative organisational forms through which the management tasks might be achieved, with special attention being paid to possible sequential changes in the allocation of responsibilities over time.

5. Using data from various sources (including, we hope, responses to a questionnaire which we shall be circulating to network members shortly), the main parameters we shall be examining are: (i) project and system characteristics (with implications for management skill requirements, etc.); (ii) actual management skills, support staff numbers, recurrent finance, maintenance equipment, transport, etc. available on the project; and (iii) project performance. A crude test of the likely validity of the hypotheses developed about management requirements in different circumstances could be made by checking the extent to which the divergence between requirements (i) and actuality (ii) is reflected in performance (iii). It is most unlikely that any very sophisticated techniques of comparative analysis will be entertainable at this stage, both because of the incompleteness and/or imprecision of much of the data which will be assembled and also because of the likely difficulty in many cases of assessing the degree of influence which factors external to the project may have had on project performance. Nevertheless, we hope that this new approach will help to provide the basis of a coherent framework which can be more stringently tested, revised and refined in our subsequent field studies.

6. The three tables appended to this note are intended to illustrate the wide range of management skills, etc. which are likely to be required on irrigation projects with different characteristics. In Table 1, eleven factors are listed which seem likely, on the basis of evidence so far, to have a significant bearing on the type of management skills required on any large surface irrigation project. In Table 2, the characteristics of two highly contrasted project "types" are shown, in terms of the eleven factors. And in Table 3, the very different implications for the management skills required in each case are brought out (and in the case of Project A, possible changes in skill requirements over time are also indicated).

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TABLE 1

Principal characteristics of irrigation projects relating to management skills required

(with special reference to water allocation and maintenance) (1)

1. Technical assumptions, design criteria and characteristics of main water delivery system (e.g. high technology/low technology; controllability and capacity for flexible operation; night storage/24-hour flow).

2. Physical characteristics and parameters (e.g. climate; soils; topography).

3. Drainage requirements and other ancillary works and components.

4. Cropping intensities for which delivery system is designed (e.g. extended system with fewer options in choice of cropping pattern; or compact system with more options).

5. Characteristics of watercourse command (e.g. 'rationalised'/consolidated or irregular/unconsolidated holdings; extent of physical control structures; regularity/irregularity of micro-topography).

6. Water availability in relation to demand.

7. Reliability/variability of water supply.

8. Degree of management control over farmers' choice of cropping patterns (for agronomic or other reasons).

9. Level and method of water charges.

10. Local socio-political factors (social cohesion of farmers at village/channel level; access of local pressure groups to higher-level political support; skewness of farm size/incomes; proportion of owner- and tenant-operated farms).

11. Level of farmers' agricultural and water management skills.

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(1) Most of these characteristics are compounds of many factors and will therefore need to be sub-divided for the purposes of more detailed analysis.

TABLE 2

Two projects with contrasting characteristics

Project A (Years 1-5):

1. High technology water delivery system (e.g. automated downstream control).
2. Low rainfall, light soils, even topography.
3. Adequate drainage installed.
4. Compact system, designed for high cropping intensities.
5. Regular layout; control structures to field level.
6. No water scarcity.
7. Predictable supply.
8. Control over cropping patterns: monocrop rice.
9. High water charges (indirect charges).
10. Farmers are tenants (with equal plot sizes) under project authority's control.
11. Farmers' technical knowledge low.

Project A (Years 5-10):

The same as in Years 1-5, except for the following changes:

6. Greater water scarcity, owing to increased demand (increased intensity of water use).
10. Pressure from tenants for greater autonomy of decision-making (including, e.g. diversification of cropping pattern).
11. Increased technical knowledge.

Project B:

1. Low technology water delivery system (e.g. up-stream control, rotational distribution, capable of some flexibility).
2. High rainfall in concentrated peak periods, heavy soils, broken topography.
3. Drainage required but not installed.
4. Extended system, designed for low cropping intensities.
5. Irregular layout; irregular topography; facilities for water control poor.
6. Water scarcity.
7. Significant inter-seasonal variations in patterns of water supply.
8. Free choice of cropping.
9. Low water charges (based on area irrigated, not volumetric).
10. Poor social cohesion; farm sizes/incomes highly skewed; local politics highly active.
11. Farmers' technical knowledge low.

TABLE 3A

Requirement of management skills on Project A

Project A (Years 1-5):

1. High demands on engineering skills and supervisory/training skills at top level; good technical back-up staff for maintenance (particularly on mechanical repair side); low demands on unskilled operators; low demands on staff for reporting up-stream about supply and demand for water (information function).
2. Low demands on staff for maintenance of earthworks, roads and structures (aqueduct, siphon); water supply calculations not complicated by rainfall.
3. Only routine maintenance required.
4. No special demands on management skill.
5. Quantity of water supplied easily checked; equity of water distribution easily controlled: simple routine procedures required for water-guards and/or extension staff.
6. No particular water allocation skills required.
7. Ditto.
8. Simplifies water allocation function skill further; but seasonal peak demands may need to be evened out by staggering of farming operations on an area-by-area basis - calling for technical (agronomic) expertise (e.g. use of longer/shorter duration crop varieties) and high level of administrative skills in organising rotation of farming operations, organising input supplies, etc.
9. Need for administrative control over water use and allocation minimised (cf. 5 above); and indirect charges (by deduction at point of marketing) require no special revenue-collecting agencies.
10. Problems of conflict with farmers or with outside political influences relatively minor.
11. Need for good agricultural and water management extension staff.

Project A (Years 5-10):

6. Increased need for water allocation skills: engineers will need skills in demand management as well as supply management: but need for close coordination between engineers and agriculturalists reduced by technical characteristics of supply system. (1)
10. Increased need for two-way information flow instead of merely one-way: need for local (and federated?) irrigators' associations to facilitate discussion; increased need for more complex farm management (i.e. economic) skills on agricultural extension side.

11. Possibility for greater delegation of certain functions to farmers; extension staff with fewer purely supervisory functions can concentrate more on farm management/planning functions (cf. 10 above).

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Irrigation Management Network 1/78/1 2a

November 1978

AGRICULTURAL ADMINISTRATION UNIT

THE ORGANISATION AND MANAGEMENT OF IRRIGATED AGRICULTURE

NEWSLETTER

1. The Network: past difficulties and future plans

The last Newsletter in this series was issued as long ago as April 1977. On that occasion I expressed 'abject apologies' for the long period of silence which had preceded its appearance. What sort of apologies can I possibly offer this time? My main excuse (as before) is that much more of my time than I expected has had to be devoted to my studies on behalf of the World Bank: from July to December 1977 I was engaged on field studies in Indonesia (Pekalen Sampean region, East Java), Taiwan (Yunlin Irrigation Association) and Pakistan (Sargodha region, including SCARP II project, Punjab); and since the beginning of this year I have been writing up reports on these field studies, together with a final report containing recommendations for a general method of evaluating the management of irrigation projects.

A further difficulty has been that the papers I sent out with the last Newsletter generated less critical response than I had hoped for. There were plenty of general comments to the effect that the papers were 'useful', 'interesting', 'stimulating', etc, but these, though gratifying, were not enough to provide a basis for continuing argument and discussion in further issues. In the meantime, I have also greatly benefited from numerous bilateral exchanges of information with individual members - but again, valuable as these have been, they are no substitute for the regular multilateral communication which the AAU Networks are intended to stimulate.

Clearly, a new approach is needed. Now that my World Bank study has been virtually completed, I am confident of being able to provide Network members with a better service. What I should like to be able to do is to produce a set of documents regularly - two or three times a year - which would include:

(a) A Newsletter
(b) A paper on a particular subject (such as the paper on evaluating management, enclosed with this issue, or possibly a case study)
(c) A paper containing comments by network members on previous papers in the series.

In order to ensure regularity of production, some of the subject papers would need to be written by people other than myself. If you therefore have any papers on some aspect of irrigation management, so far unpublished, on which you would welcome comments and criticism, please let me know.

It would also be extremely helpful to have your views as to how you would like the Network to develop. Even the briefest of comments would be most welcome: a short questionnaire is attached at the end of this Newsletter for the purpose. But please do not be inhibited from commenting at greater length, if you wish.

2. Commonwealth Workshop on Irrigation Management, Hyderabad, India, October 19

A Workshop was held in Hyderabad, India, from 17-27 October to discuss the problems of irrigation management in the semi-humid tropics. It was sponsored by the Commonwealth Secretariat and the Government of India, in association with the Administrative Staff College, Hyderabad (the hosts) and ODI. Delegates attended from eight Commonwealth countries of South Asia and Africa (Bangladesh, India, Kenya, Malaysia, Nigeria, Sierra Leone, Sri Lanka, Tanzania) and from two non-Commonwealth countries (Indonesia and Thailand). The idea of holding the Hyderabad Workshop originated partly as a result of discussions at the earlier ODI Workshop on Choices in Irrigation Management held at Canterbury, England, in October 1976 (Newsletter 1/77, page 13). The range of themes discussed was similar on both occasions, but there were many more opportunities at Hyderabad to explore them in depth and to relate them to the particular conditions of projects in the semi-humid tropics.

Seven lead papers were presented and discussed, together with numerous country policy and case study papers. A four-day field-visit was also made to irrigation projects in the State of Andhra Pradesh. The lead papers were as follows:

1. Review of Irrigation Development in Semi-humid Tropics (A. Ellman and G. Pingle, Commonwealth Secretariat, London)

2. Agricultural Technology for Irrigation Schemes: Research, Extension and the Farmer (S. Bhuiyan, International Rice Research Institute, Los Banos)

3. Irrigation Engineering Technology (D. E. Campbell, FAO/World Cooperative Programme, Rome)

4. Problems in the Management of Large Irrigation Schemes (Syed Hashim Ali, Secretary, Command Area Development Department, Government of Andhra Pradesh)

5. Alternative Organisational Strategies for Command Area Development (K. K. Singh, Administrative Staff College, Hyderabad)

6. Problems in the Management of Minor Irrigation Schemes (Waheeduddin Khan, Administrative Staff College, Hyderabad)

7. Evaluating the Organisation and Management of Irrigated Agriculture (A. F. Bottrall, Overseas Development Institute, London)

A Report on the Workshop, including the Conclusions and Recommendations, the Lead Papers, and summaries of the country policy and case study papers, is being produced by the Commonwealth Secretariat. Copies may be obtained by writing to:

A. O. Ellman,
Food Production and Rural Development Division,
Commonwealth Secretariat,
Marlborough House,
Pall Mall,
London SW1Y 5HX
United Kingdom

5. Recent publications, reports, etc.

The Asian Regional Irrigation Communication Network continues to publish extremely valuable lists of recent literature on irrigation management. Their Newsletter is now obtainable through Dr. Donald C. Taylor, Agricultural Development Council, Inc., 20 Jalan Cangkat Damansara, Kuala Lumpur 10-05, Malaysia.

Some recent papers which I have seen and are likely to be of interest to network members are:

a) S. D. Biggs, C. Edwards and J. Griffiths, Irrigation in Bangladesh, Discussion Paper No. 126, Institute of Development Studies, University of Sussex, Brighton BN1 9RE, England, February 1978 (a longer version of the same study is available as Discussion Paper No. 22, Overseas Development Group, University of East Anglia, Norwich NR4 7TJ, England).

b) D. W. Bromley, D. C. Taylor and D. E. Parker, The Economics of Water Reform: Institutional Design for Improved Water Management in the Ldcs, Working Paper No. 8, Centre for Resource Policy Studies, School of Natural Resources, University of Wisconsin, Madison, Wisconsin, U.S.A., October 1977.

c) E. W. Coward and Badaruddin Ahmed, "Village, technology and development: patterns of irrigation organisation in Comilla District, Bangladesh", Department of Rural Sociology, Cornell University, Ithaca, New York State, U.S.A., 1977 mimeo.

d) ICRISAT Economics Program, Annual Report 1976-77; containing sections on History and economics of existing tank irrigation in India (pp 76-88) and Approaches to group organisation and action for improved land and water resource utilisation in the semi-arid tropics, ICRISAT, 1-11-256 Begumpet, Hyderabad 500016 (A.P.), India.

e) School of Oriental and African Studies, University of London, Land use and socio-economic changes under the impact of irrigation in the Lam Pao project area in Thailand, (report obtainable through Dr. R. C. Y. Ng, Department of Geography, SOAS, Malet Street, London W.C.2, England).

f) K. Shanmugarajah, various papers describing pilot projects and training programmes designed to reduce water wastage on tank (small reservoir) irrigation schemes in Sri Lanka (for further information, please refer to the author, at 76 Southbury Road, Enfield, Middlesex, England, or to Mr. K. D. P. Perera, Deputy Director, Irrigation Department, Colombo 7, Sri Lanka).

6. Recent/current research activities

a) A. Ansell (University of Reading, UK) is engaged on studying the economics of water storage and supplementary irrigation in tropical bimodal rainfall areas.

b) Christ Elsten is a member of a group working for the International Agricultural Centre, Holland, who are studying small-scale irrigation (Project group 'The Small Farmer and Development Cooperation', P.O. Box 211, Wageningen, Netherlands).

c) Michael Howes (Institute of Development Studies, University of Sussex, UK) is doing a study on small-scale irrigation in Bangladesh: a socio-economic evaluation of alternative techniques.

d) S. C. Hoyle (Bedford College, University of London, UK) is studying the settlement of nomads in the Sudan: the case of Khashm el Girba agricultural scheme.

e) Georges G. Landau (Inter-American Development Bank, Washington DC 20577) is studying institutional aspects of international river basin development projects, with special reference to the Amazon basin. He would be grateful for suggestions on documentary or other sources, persons to be interviewed, examples of projects germane to the study and any other ideas which might help him to plan his investigations.

f) R. W. Palmer-Jones and J. C. Jackson (Institute for Agricultural Research, Ahmadu Bello University, Zaria, Nigeria) are studying the impact of large-scale irrigation projects on small farmers in N. Nigeria.

g) E. Scarlett (University of Reading, UK) is studying farming systems in Niger State, Nigeria, comparing irrigation development in government schemes with indigenous development by villagers in the Nupe Tribal Area on the Niger River.

h) David Seddon (University of East Anglia, UK) is currently directing an evaluation of the Lower Moulouya irrigation project in N.E. Morocco.

i) Linden Vincent (University of East Anglia, UK) carried out a case study of the Medjerda irrigation scheme, Tunisia, in 1977, which was designed to throw light on "efficiency and realism in the design and management of irrigation schemes".

j) Hans Walker and Wolfgang Castell (University of Hohenheim, Stuttgart, W. Germany) have recently been examining the organisation and management of the Ahero Pilot Irrigation Scheme in Kenya and have drawn on this experience in writing a draft paper on "The contribution of organisation analysis to the appraisal of development projects".

k) Robert Wade (Institute of Development Studies, University of Sussex, UK) is in the process of writing a book based on the findings of his studies of irrigation management on two major canal systems in Andhra Pradesh. He has also written numerous papers, including one (still unpublished) on "The Social Response to Irrigated Agriculture", which describes and analyses the way in which farmers on the canal systems concerned have - in some cases - organised themselves in order to obtain and distribute irrigation water.

6. Lunchtime meetings at ODI

The following lunchtime meetings have been held at ODI since the last Newsletter was circulated:

a) 27 April 1977: W. R. Rangeley (Sir Alexander Gibb and Partners): "Irrigation water demands: need for improved procedures and controls".

b) 11 May 1977: J. A. Allan (School of Oriental and African Studies, University of London): "A study of soil and water conditions in Bulandshahr District, Uttar Pradesh, India".

c) 1 June 1977: Stephen Walker (Land Resources Division, Ministry of Overseas Development) and John Harriss (University of East Anglia): "Groundwater development in South West Bali, Indonesia".

d) 23 June 1977: S. Biggs (IDS, Sussex) and C. Edwards (University of East Anglia): "Irrigation in Bangladesh: on contradictions and underutilised potential".

e) 9 February 1978: A. Bottrall (ODI), W. T. Chiu (Wye College) and J. B. Downs (Howard Humphreys & Sons): "The Management of Irrigation in Taiwan".

f) 13 April 1978: H. Demaine (School of Oriental and African Studies, London) and C. J. Dixon (City of London Polytechnic): "Problems and prospects of irrigated agriculture in North East Thailand: the case of Lam Pao".

7. <u>Other AAU Networks</u>

In addition to this Network, there are two others being run by colleagues within ODI's Agricultural Administration Unit, John Howell and Janice Jiggins have been operating an Agricultural Administration Network, which in its last two issues has contained papers on agricultural extension (N. Roling), technology (M. Collinson), district-level planning (K. Davey and J. Howell), the politics of agricultural planning (N. S. Carey Jones), management performance (E. Clayton), and alternative approaches to project implementation (A. Baird). Stephen Sandford has also been producing a series of newsletters and network papers relating to the design and management of pastoral development in arid and semi-arid areas. Those interested in becoming members of the Agricultural Administration Network should write to John Howell and those interested in the Pastoral Network to Stephen Sandford.

Besides the Network papers, ODI has also published two Occasional Papers, based on earlier network activity:

No.1, 1976: Stimulating Local Development

No.2, 1977: Extension, Planning and the Poor.

Priced at £1.00 each, they are available from ODI Sales, Montagu House, High Street, Huntingdon, Cambs., England.

A further Occasional Paper, on the appraisal and evaluation of management and institutions in agricultural development, is due to be published shortly.

A notice about ODI's latest publication, <u>Agriculture and the Rural Poor</u>, is enclosed.

Anthony Bottrall

November 1978
SFW

QUESTIONNAIRE ON FUTURE OF ODI

IRRIGATION MANAGEMENT NETWORK

1. In what aspects of irrigation development are you most interested?

2. Should the Newsletter be expanded? Yes/No
   If Yes, in what way?

3. Do you like discussion papers to be descriptive/analytical/both?
   In what way could they be made more useful to you?

4. Would you like to see more contributions coming from network members? Yes/No
   If Yes, what form should this contribution take? Items for the Newsletter? Preparation of discussion papers? Comments on discussion papers? Will you contribute yourself? If so, what?

5. Do you have any other suggestions or comments?

Name:

Address:

Please return to: Anthony Bottrall, Overseas Development Institute, 10-11 Percy Stree
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Irrigation Management Network 1/78/2
November 1978

2b

COMMONWEALTH WORKSHOP ON IRRIGATION MANAGEMENT, HYDERABAD

(17-27 October 1978)

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

A. PLANNING

1. Objectives: All governments have multiple objectives in their irrigation programmes, but it is rarely possible to achieve all of them simultaneously. Governments must be clear about the priority they attach to each objective and give explicit instructions to the planners and managers of irrigation projects on what they should aim at. Otherwise major problems are likely to be created by conflicting objectives.

2. Planning for management: Projects should not be planned without careful assessment of the financial resources and management skills required to operate them. To avoid repetitions of past mistakes, close study of the performance of existing projects is essential. In many cases, the establishment of small pilot projects may also be highly desirable.

3. Design of water delivery systems: Co-ordination between agronomists and engineers should begin at the project preparation and design stage. Systems must be so designed as to be capable of delivering water according to crop requirements; the method of water distribution (eg continuous, 'on-demand', or by rotation) should also be clearly defined in advance.

B. MANAGEMENT OF LARGE-SCALE IRRIGATION

4. Organisational framework: The logical basis on which to organise the management of large irrigation projects is the canal command area. There should be the closest possible co-ordination at the national, state and project levels between the activities of agricultural planning, water distribution and agricultural extension. The most effective form of co-ordination is likely to be provided by a unitary agency, or Command Area Authority.

5. Farmers' Organisations: For some activities the most effective unit for a farmers' organisation may be the village, but water users' organisations are likely to be most effective if they are channel-based. Their main initial concern should be with operating and maintaining the watercourse but, if successful in that, they are also likely to provide convenient focal points for contact with the official administration and sharing common resources. A precondition for their initial success is that reliable water supplies be delivered to the watercourse outlet.

6. Operation and Maintenance: Much of the poor performance of many irrigation schemes can be traced to weaknesses in operation and maintenance. Laxity in water distribution creates a very inefficient and inequitable pattern of water use. Water is usually a scarce resource and operating staff must therefore be firm and fair in rationing it. Effective legal sanctions are required to enable them to operate the system according to the established rules and swift disciplinary action is required against offenders. Operation and maintenance are specialised professional tasks, quite different from those of design and construction, and they require special training.

7. Agricultural extension: An effective agricultural extension service is of central importance to ensure the adoption of agricultural techniques which make the best use of water available. The Training and Visit system of extension now being applied in many countries is recommended as particularly suitable in irrigated conditions. The key areas on which extension workers must focus are agricultural advice and water management.

8. Small farmers and landless labourers: Small farmers and landless labourers have special needs and therefore require special attention. Financial assistance through loans, subsidies and grants should be made to them. In areas where new irrigation projects are being constructed, preference may be given to these groups for settlement; where redistribution of land is possible, land may be allotted from that rendered surplus from the holdings of larger farmers.

9. On-farm development (development of watercourses, farm drainage, land shaping and levelling, farm roads, etc): Adequate on-farm development is essent for efficient use of irrigation water supplies. The best unit of operation for on-farm development work is the watercourse command and assured water supplies to the watercourse outlet are a prerequisite for undertaking it. The costs of the irrigation, drainage and farm access works should be borne by the project, whilst land development costs in individual farms should be recovered from the owners.

10. Drainage: The need for drainage is often seriously underestimated at the planning stages and major problems occur as a result. Water distribution and the drainage of excess water are equally important. They should be considered for planning simultaneously and be executed in stages.

C. MANAGEMENT OF SMALL-SCALE IRRIGATION

11. Many of the problems and costs of large irrigation projects can be avoided where topography and hydrological conditions allow small, village-level irrigation schemes to be developed, using shallow wells, small reservoirs, or river diversions. Many small schemes suffer, however, through lack of access to technical supervision and advice. A rural engineering service is required, with field staff attached to local government organisations. Other forms of intensified extension support are also required, though care should be taken not to kill the farmers' incentive for self-reliance.

D. MANAGEMENT OF GROUNDWATER IRRIGATION

12. In most cases groundwater development should be left to the private sector. In some conditions, however, particularly where aquifers are limited, uncontroll competition between private well users can have very harmful consequences. Sinc large farmers generally take the lead in well development, special assistance is needed for smaller farmers, particularly subsidised credit and the developmen and dissemination of appropriate smaller capacity pumps. Public tubewells are not greatly favoured except where the major purpose of groundwater extraction

is drainage. The operation and maintenance of public tubewells often leaves much to be desired and there is a need for much closer supervision of tubewell operators by senior management staff. Where public tubewells are located within a canal command, they must be operated by the same agency which is responsible for operating the canals.

E. FINANCE, STAFFING, MONITORING AND EVALUATION

13. Finance: Irrigation projects require adequate recurrent finance to cover the costs of services to farmers. Where it is not the policy to recover a substantial proportion of these costs from farmers, government funds must be supplied but these are nearly always inadequate. With the object of ensuring adequate finance, project managers should prepare detailed budgets for discussion with government. The level of fund allocation should be determined on a project by project basis, in accordance with variations in local conditions.

14. Water charges: Since water is a scarce and costly resource, reasonably high water charges are desirable: (a) to encourage farmers to use water more economically; (b) to increase government revenue, part of which could be expected to come back to irrigation projects in the form of increased recurrent finances; and (c) to tax the relatively privileged section of the agricultural community which is benefiting from irrigation water.

15. Staffing: The duties of irrigation project staff need to be very clearly defined, especially where they are seconded to a unitary Authority from a line Department and where they have to work with an interdisciplinary team. Motivati of staff is of great importance, especially in the case of lowest-level staff members, who are generally poorly paid, under-supervised and have few opportuni for advancement. Real prospects of promotion should be offered to staff at all levels.

16. Training requirements: For the promotion of an integrated approach to irrigation management and development, substantial changes are required in the present pattern of academic training. The aim should be to develop courses designed to enable specialists in each discipline to become conversant with the broader implications of irrigation development as a whole. Similar lines of training and education should be adopted for lower level staff. Much more attention should also be given to in-service training programmes.

17. Monitoring and evaluation: On most irrigation projects there is a serious lack of adequate manuals and written procedures. Detailed job descriptions are similarly lacking, and the information systems on which most managers have to rely are quite inadequate. These are essential tools of good management and priority should be given to their development. Periodic external evaluations are also needed. They should be carried out by an interdisciplinary team, whose members are fully conversant with the problems of irrigation management. They will be of value not only as a means of improving the performance of the project concerned but as a feedback to the planners and designers of new projects.

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Irrigation Management Network 1/78/3 (2c)

November 1978

Evaluating the Organisation and Management of Irrigated Agriculture

Anthony Bottrall

(Paper to Commonwealth Workshop on Irrigation Management, Hyderabad, India, 17-27 October 1978)

Accompanying Note

I should greatly welcome comments from network members on the enclosed paper, particularly with regard to the following points:

1. Methodology: Are there any major logical weaknesses? Any major omissions? Any ways of simplifying the analysis without impairing the quality of the results?

2. Are there any good reasons why this kind of analysis of management and institutions should not be made a regular and obligatory component of project appraisal and evaluation, alongside conventional economic and financial analysis?

3. The development of 'norms' for the funding and staffing of projects with different characteristics (para 8(b) and footnote 4): If you have any information on criteria/formulae which may be used by governments or have been recommended by researchers and consultants for determining adequate levels of funding and staffing, I should be most interested in it. I have recently come across an article by I. Haissman ("Generating Skilled Manpower for Irrigation Projects in Developing Countries: a study of Northwest Mexico", Water Resources Research, 7, 1, February 1971), which is clearly relevant. If networkers are interested in exploring this topic, it could be made the subject of a network discussion paper in the near future.

4. Monitoring project performance (paras 9-10): In my experience the need for project managers to monitor environmental factors (waterlogging, salinity, etc), cost and cost recovery is usually recognised by government and, although these aspects may not always be well monitored, procedures have been developed for the purpose. However procedures for monitoring productivity and equity are usually very inadequate. I should be interested to know of any project management which regularly collects the following information: (a) water losses, in the main system and/or within selected watercourses; (b) production levels for all crops (including accurate yield estimates); (c) comparison of quantities of water supplied and/or cropping intensities and cropping patterns between head and tail reaches of a canal system. If this information is not regularly collected, are there any good reasons why it shouldn't be? Network members may also feel that there are other important factors which project managers should monitor (eg health, nutrition), in which case it would be helpful if they

5. Weaknesses in planning for project management (para 12(i)): My own researches in Asia have led me to conclude that in many countries project managers and their staff are often less to be blamed for weaknesses in management than the higher-level planners and administrators who have failed to provide them with the necessary tools to do their jobs adequately (cf para 28). Only when they are given these tools - when it is made clear what they are supposed to be managing and how they should be managing it - is it reasonable to regard them as "managers", in the proper sense of the word, and to hold them largely responsible for the quality of project and staff performance. Are networkers' experiences elsewhere similar or were the projects I studied untypical?

6. Project objectives (para 16): It is surprising how often project objectives are unclear, particularly in rice-growing areas, where there is often a conflict between the objective of growing more rice (in the interests of increased food production), and those of maximising returns per unit of water and/or spreading the benefits of irrigation, which are much more likely to be achieved by the cultivation of less water-demanding crops (some of which may also of course be food crops). Examples would be welcome of cases where governments have consciously favoured the pursuit of the latter objectives at the expense of the former. In these cases what have been the consequent costs and benefits?

7. Manuals, procedures, job descriptions (para 17): I should be most interested to learn about irrigation project manuals etc which network members regard as being of high quality. If you know of any, it would be helpful if you could indicate how copies of them may be obtained.

8. Identifying causes of poor performance (paras 19-20): The first sentence of para 20 has already been misconstrued by one reader, so it evidently needs clarification. It is not intended to imply that the attribution of weights to different causes is not important - clearly, it is extremely important, for the reasons given in para 19. What I was referring to was the total impracticality (in my view) of trying to assign quantifiable weights to each cause through some sort of process of multivariate analysis (which might attempt to show that, eg, 23.7% of poor performance was attributable to technical design deficiencies, 18.4% to inappropriateness of organisational structure, 27.1% to bribery of irrigation officials by influential farmers, etc, etc). This seems to be the sort of approached beloved by some of the people - particularly economists - who are currently influential in the field of project appraisal and evaluation and it was primarily with them in mind that I made the comment. I apologise to all my academic friends for using 'academic' in its pejorative sense of 'useless' and assure them that I am most anxious to have their advice on the extremely important and complex subject of identifying causes - particularly social and institutional causes, many of which are interdependent and therefore very difficult to disentangle.

9. Resources required for evaluation (para 21): Please comment. I am not confident that my estimate is realistic.

10. Single Command Area agency (para 23(i) and Appendix B, 1.A): Is it generally agreed that this is the best organisational framework for large-scale irrigation projects? Counter-examples, in addition to the one from Taiwan (para 26) would be interesting. Where Irrigation and Agriculture have different administrative boundaries, how can problems of data collection and analysis with regard to crop production be overcome? And what are network members' views as to the desirability of a coordination of Agriculture and Irrigation within the same Ministry at national or provincial levels?

11. System operation as a separate function (para 25): Information would be welcomed on cases other than Taiwan where there are separate cadres for operating the water distribution system on the one hand and for design, construction and maintenance on the other (cf Appendix B, 1.B). In Taiwan, civil engineers are

employed only for the latter functions; water distribution is in the hands of agricultural/irrigation engineers and/or people who, through long experience and in-service training, have become specialists in system operation. If there are examples from elsewhere, how are operating staff recruited and trained? How well do they perform? And what kind of career structure do the civil engineers have? (Ie, do they specialise in design, construction or maintenance, or are they expected to move from one activity to another in the course of their careers?)

12. Promotion prospects (para 25): In most countries the scope for making substantial changes in salary structures for irrigation staff may be rather limited. If this is accepted as a likely constraint, one of the best hopes for improving the motivation of staff, particularly at the lowest levels, may be to provide better opportunities for promotion by rewarding local knowledge and experience (combined with in-service training) as well as academic qualifications. Again, I should be interested to hear of cases where such an approach has been adopted and to learn what sort of response it has evoked.

13. Communication between irrigation staff and farmers (para 27(g)): On many irrigation schemes even quite simple information about present and future patterns of water delivery is not conveyed to farmers. Examples of effective techniques for transmitting such information would be welcomed. So too would ideas about possible ways of improving farmers' capacities to communicate their needs and views to irrigation staff (eg through the development of some kind of federation of water users' groups - Appendix B, 2).

14. Neglect of water allocation (para 30): Is this fair comment? If not, do you know of any recent cases where improvement in water allocation practices has figured prominently in a programme for improving project performance?

15. Main system management v. watercourse management (para 32): I have quite often heard it argued that the major deficiencies of management must be below the watercourse outlet <u>because</u> that is where most of the water losses occur and that <u>therefore</u> that is where most investment needs to be concentrated. I think the argument is a false one, for the reasons given in the paper. I also believe that the only way to determine where the major deficiencies lie is to examine management practices both on the main system and within the watercourse in each case and not to prejudge the issue. Does anyone disagree?

16. Benefits of 'on-farm development' (para 33): I should be interested to learn of evaluations which have been carried out on the costs and benefits of on-farm development programmes (improvement of watercourses, farm drainage, land levelling, farm access roads and in some cases land consolidation).

17. Water users' organisations (Appendix B, 2): Since reading Coward's paper (referred to in the text) I had assumed it be axiomatic that water users' organisations should be channel-based. However Robert Wade (at IDS, Sussex) has recently being doing some studies on a large canal system in Andhra Pradesh, India, which have revealed the existence of spontaneously-formed <u>village</u> organisations whose principal functions are to obtain and distribute irrigation water. If you have encountered similar examples please let us know soon. I have discussed with Robert Wade the possibility of using his findings as a basis for a forthcoming network discussion paper.

Bottrall input – Part of N-1/78/3

Evaluating the Organisation and Management of Irrigated Agriculture

Anthony Bottrall

Introduction: evaluating management and evaluating performance

1. Comprehensive and systematic evaluations of the organisation and management of irrigation projects are very rarely undertaken. In certain countries it is common practice to carry out regular evaluations of project performance, but these tend to be fairly strictly limited to technical and economic analysis: present performance is measured against past performance or against targeted goals, in terms of input : output and cost : benefit ratios. Such evaluations usually contain some general - largely descriptive - observations on organisation, management and local institutions, but their central focus is on the results of management, not on the management (or decision-making) process which has contributed to the achievement of those results. In other words, they record what has happened but provide only limited evidence as to how it happened and why it happened in that way (1).

2. For the past three years I have been engaged on a study, commissioned by the World Bank, with the objective of developing a framework of analysis which could be generally applied to the evaluation of irrigation organisation and management (2). Its conclusions are based on evidence collected through an initial desk study of relevant literature from Asia, Africa and Latin America and four subsequent field studies, all in Asia (N.W. India, Pakistan, Indonesia and Taiwan). The project areas studied in the field were all dependent on large or largish publicly-operated canal systems, and in two cases these were substantially supplemented by groundwater (deep tubewells, also publicly-operated).

3. The study was judged necessary on the grounds that the performance of many large irrigation projects was widely recognised as disappointing and much of this poor performance was thought to be attributable to weaknesses in project management; but the precise nature of these weaknesses and the kind of measures which might be most effective in remedying them were not fully understood. It soon became clear, however, that there would be major difficulties in trying to evaluate 'project management' (ie the management of the development process

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(1) "Evaluation" is used in this paper to refer to the process of 'ex-post' analysis of a project already in existence, as opposed to "appraisal", which is used to refer to 'ex-ante' analysis of a future project. Akin to "evaluation" is "monitoring", but this is a process of regular checking of past achievement carried out within the project, whereas evaluation is a discrete, periodic exercise, usually carried out by an agency external to the project. But the comments made here on evaluation apply equally to internal monitoring.

(2) Views expressed in this paper are entirely the author's, and not necessarily those of the World Bank.

from project or area headquarters to the farm) in isolation, since there were numerous other factors influencing project performance - eg technical design characteristics and aspects of government policy - which were beyond the powers of project management to control; it could therefore be highly misleading to use performance indicators (output levels, cost : benefit ratio simply as indicators of the quality of management. As a result, it was decided that the analytical framework must take account of the whole context in which project management was being carried out, so that all the major factors capable of influencing project performance could be given due consideration and the degree of influence specifically attributable to aspect of project management could be assessed with greater confidence.

The evaluation process

4. Before discussing some of the opinions I have formed about problems in irrigation management in the course of my researches, this paper will outline the main features of the evaluation system which I have been trying to develop. This is done not as an academic exercise but in the hope that it may stimulate participants to consider the practicability of using a similar approach to evaluation in their own countries. It is also expected that many participants will have comments and criticisms to make, on the basis of their own extensive experience, which will help to improve the system as it now stands.

Questions to be answered

5. The system starts from the premise that the immediate objective of any project evaluation should be to find out, with respect to the particular proje being evaluated, answers to the following questions:

(a) What are the characteristics of the project area and its administrati resources?

(b) How well has the project performed?

(c) What factors (including organisation and management) have contribute most significantly to shortcomings in performance?

and (d) How can the shortcomings best be remedied?

At the same time, evaluations should be carried out with the intention of generating results which will be useful in two other important respects. They should be capable of providing lessons for managers of other existing projects and planners of new projects; and, through their addition to the general stock of knowledge about projects and their management, they should aim to contribut to the improvement of the techniques and criteria used in future evaluations.

Understanding the local context

6. As is implied by the questions listed above, it is seen as an essential first step in the evaluation process that the evaluators should familiarise themselves as fully as possible with the local environment (the context in which management has to be performed) and with the administrative and other resources which the project managers have at their disposal. The local environment or context can be defined in terms of the physical characteristics of the project area (climate, soils, etc.) and the nature of its crops and cropping patterns; the technical characteristics of the irrigation system; the

social characteristics of the farming community (population density, social structure, land tenure, agricultural experience, local groupings, etc.); and the economic environment (level of economic development, prices, subsidies, taxes, etc.). The administrative resources can be defined in terms of organisational structure (with particular reference to inter-agency coordination and the extent of centralised control over farmers' decisions) and the numbers, salaries, qualifications etc. of project staff. Other important resources of management include supporting services (transport, telecommunications) and, of course, finance.

7. A good basic picture of the local environment and its administrative resources can be built up through the collection of essentially descriptive and factual information. Much of it should be available from project reports or files, though certain essential information on the social characteristics of the farming community usually has to be sought elsewhere (eg agricultural censuses, other socio-economic surveys, sociological or ethnographic studies)(3).

8. This information is important not only for the obvious reason that one must understand what exists before suggesting how it should be improved, but also because it can have valuable contributions to make to subsequent stages of the evaluation. For example:

(a) It can be very helpful in selecting the focus of subsequent investigation. Eg, from an examination of the context, hypotheses can be made about the key activities likely to merit particularly close attention in the analysis of the management process. If the project's water supplies are frequently scarce in relation to demand, water allocation is likely to be one key activity. If water supplies are relatively abundant but the project has been recently completed, with newly-settled farmers who have no previous experience of irrigated agriculture, the most important activity is likely to be agricultural extension. And so on.

(b) Fairly detailed knowledge of a particular context is also needed to help determine the extent to which inadequacy of financial and administrative resources may be contributing significantly to shortcomings in project performance, since what is 'adequate' will vary from context to context. Eg, an area with heavy rainfall, heavy clay soils, extensive weed infestation, numerous canal structures and a relatively unskilled farming population will have much higher O & M and staff requirements per ha. than another area with opposite characteristics. Local context can also often be an important determinant of 'appropriateness' of organisational structure (4).

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(3) A fuller list of the kind of information required is given in Appendix A, Part I. If a significant proportion of the information proves difficult to obtain from project records, this is in itself likely to be an indicator of management weakness.

(4) It should in theory be possible to develop 'norms' for the funding and staffing of projects with different characteristics. For further comments on organisational structure, see paras 14-15 below, and Appendix B.

Evaluating performance

9. The next step in the process is an evaluation of project performance. In the case of irrigation projects, some of the most important criteria by which performance should be judged are:

- productivity (especially of water)
- equity (especially of water distribution)
- environmental stability
- cost
- cost recovery

Other criteria might well be added, depending on the objectives and priorities of the country concerned. The basic logic of the evaluation of project performance is fairly straightforward and well understood. There is no doubt often considerable scope for improving the analytical techniques used in evaluating performances, but this need not be discussed here.

10. Information required for the analysis of project performance is again largely factual and much of it should be obtainable from project records (5). However, calculation of the more sophisticated indicators of productivity may often be quite a time-consuming process and it may be necessary to use simpler proxy indicators. Information on water losses is often not readily available, though estimates of main system losses can be made from an inspection of the records by comparing water deliveries at the headworks with the sum of deliveries to the watercourse heads (or wherever the lowest measuring points may be). In most cases evaluators will have insufficient time in which to carry out their own independent measurements of water losses at watercourse and field levels; but if any other experimental research happens to have been done on this subject in similar conditions elsewhere in the country, it can serve as a useful pointer to the watercourse and field efficiencies likely to be found in the project area. The criterion of equity is likely to be of critical importance wherever water supplies are scarce in relation to demand. Indicators of equity of water distribution between different parts of the main system should often be obtainable from project records, though they will need to be examined in disaggregated form. A random selection of watercourses towards the head and the tail of the system can be made and the canal flows, cropping intensities and cropping patterns in the different areas compared. Visits to the selected watercourses should also be made so that farmers' views on water availability can be obtained. In rice-growing areas where water supplies in the dry season are insufficient for 100% rice cultivation, local variations in rice cropping intensities provide easily identifiable indicators as to the equity of water distribution. The same applies to other crops with high water requirements, such as sugarcane. For information on equity of water distribution within watercourses or between larger and smaller farmers, interviews with farmers may give some insights, but a more objective assessment would require a detailed farm survey.

Identifying the reasons for shortcomings

11. The next step is to try to identify <u>why</u> the project has performed as it has. Apart from hazards of climate, the factors likely to contribute most to

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(5) See Appendix A, Part II

shortcomings in the performance of an irrigation project fall into three main categories (6):

(a) Deficiencies in technical design, eg:

- inadequate watercourse layouts
- insufficient provision for drainage
- absence or shortage of measuring devices
- mechanical weaknesses in pump design

(b) Financial, economic and legal constraints, eg:

- insufficient funds for recurrent expenditure
- low water charges
- unfavourable input : output price ratios for farmers
- lack of effective legal provisions for enforcing irrigation rules
- lack of effective legislation for controlling groundwater exploitation
- anomalous legislation concerning prior water rights

and (c) Weaknesses in organisation and management.

12. The third category, in which we are particularly interested, can be further sub-divided as follows:

(i) Weaknesses in higher-level planning for project organisation and management, eg:

- inappropriate organisational structure (poor lateral coordination within or between agencies; insufficient centralisation or devolution of functions and responsibilities between management, field staff and farmers; wrongly balanced 'mix' between engineering, agricultural and other skills)
- staff salaries and promotion policies offering limited incentive and motivation
- limited staff training facilities
- failure to establish clear or consistent objectives for project management
- failure to develop well-designed project manuals, job descriptions, procedures, information and control systems.

(ii) Weaknesses in the implementation of project management, eg:

- failure to pursue clearly-defined objectives or to seek ways of improving the definition of unclear objectives
- failure to adhere to well-designed project manuals, procedures, control systems, etc., or to seek ways of improving deficient ones
- failure to seek ways of motivating or training staff within the limits of externally-imposed constraints.

(iii) Weaknesses in farmer organisation and management at the watercourse and field levels.

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(6) The emphasis here is on negative influences and shortcomings because, inasmuch as the evaluation is being done for the benefit of the particular project concerned, the main concern of the evaluator is to identify possible ways of improving present deficiencies in performance. However, inasmuch as the evaluation is also intended to improve general understanding of the principles of good irrigation planning and management, the evaluator should be as interested in identifying positive influences as negative ones.

13. Factors falling within categories (a), (b) and (ci) are beyond the capacity of senior project management to control or remedy. Those falling within category (cii) are clearly the responsibility of project management and, since it should be an important function of project management to assist and supervise watercourse and farm-level activities, the same applies to those falling within category (ciii). Significant technical deficiencies ca usually be identified fairly readily in the course of field inspections; the most serious will in any case almost certainly be pointed out by project management. Most of the items falling within the second category are also quite easy to identify, though a well-based estimate of recurrent funding requirements might often take some time to prepare. The analysis of organisation and management is, however, a relatively complex task (7).

14. The most common question which arises in connection with organisational structure is whether responsibility for different activities in irrigation management should be divided between several different departments or closely coordinated within a single unified agency. Together with other questions of organisation (eg the extent to which responsibilities should be devolved within each department or agency), this is something over which project manag themselves have little or no influence. The organisational structure forms part of the 'given' framework in which the management process is carried out and, if it is inappropriate to the requirements of the project concerned, it can impose serious constraints on the quality of management performance.

15. In its more extreme manifestations, inappropriateness of organisational structure is not hard to identify (as, eg, where responsibility for the manag ment of canals, groundwater, surface drainage and agricultural extension is divided between four separate agencies, each with a different territorial jurisdiction). Broad answers to most major questions about organisation can usually be obtained by reference to certain general principles and to the bas characteristics and requirements of the local context, without a great deal of special empirical research. Telling indicators of organisational weakness will often be encountered in the course of more detailed investigations into the management process. Further comment on organisational structure is contained in Appendix B.

The management process

16. Investigations designed to obtain an understanding of the management pro are inevitably time-consuming and a large proportion of the total time spent on evaluation in the field will need to be devoted to them. Their purpose is, first, to discover what the objectives of each unit within the project administration are; whether they are clearly stated (eg in an Operational Manual or Annual Plan); whether they are well understood at different levels within the unit concerned; and whether they are consistent with those of government, other closely associated units and farmers. Where objectives are clearly stated or inferrable, the management performances of each unit can be assessed against them; otherwise it will have to be assessed against hypothesised objectives. In theory, a comprehensive evaluation would require the management of each unit to be analysed with respect to performance in each of its major activities. However, while attempts should be made to obtain some information on each of the activities listed in Appendix A (Part III), it

(7) Some checklists for use in the identification of factors affecting projec performance are contained in Appendix A, Part III.

is clearly impractical to carry out detailed analysis on more than a few selected activities which are expected to be of key importance. In each case, answers should be sought to the questions:

(a) What basic aids to the performance of the activity exist (Operation or Maintenance Manuals, job descriptions, maps) and what is their quality?

(b) What are the procedures according to which the activity (and its component elements of planning, implementation and monitoring) is supposed to be performed? (8)

(c) Are these procedures being followed at various different administrative levels?

and (d) If not, why not?

17. Where the answers to the first question are strongly negative (eg if there are no O & M Manuals or written job descriptions or procedures are badly designed), it will be immediately apparent that if management performance is found to be deficient, much of the responsibility for it should be attributed to planning deficiencies in agencies at a higher level than the project. Often, however, the allocation of responsibility for deficiencies in performance will only emerge clearly during more detailed analysis of the management process.

18. The methods used to collect and analyse information concerning the management process differ substantially from those used in conventional evaluation. The purpose of conducting interviews with staff and consulting their records is only partly to obtain information about facts (eg What are the objectives of Unit A? What are the procedures for Activity X?) Their primary purpose should be to obtain information which may be of no value at all in terms of factual accuracy but which nevertheless provides important insights into attitudes, motives and technical and administrative capabilities within the project organisation. For example, it may often be very revealing to repeat the question 'what are the procedures for Activity X?' to several different people involved in that activity, even when the interviewer already knows the correct answer. Similarly, records which can be seen to contain errors or falsifications may seem of little value to someone who would like to use them as a means of discovering 'what the facts are', but they can offer valuable evidence of the extent to which procedures are not being followed and of the effectiveness of the project's control and monitoring procedures. Much of the most valuable information about management performance is thus obtained through indirect inference from the questions asked and the documents inspected. The need for a tactful, oblique approach to information-gathering becomes particularly obvious when one is wishing to discover the possible causes of divergence between precept and practice (eg in a case where water is being misallocated, are the reasons technical ignorance, negligence or response to attractive inducements offered by the farmers?)

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(8) Eg, in the case of water allocation, what are the procedures for calculating the expected seasonal, monthly or 10-day patterns of supply and demand on which water scheduling is planned? What are the procedures for implementing or modifying the schedules? What techniques are used to monitor plan implementation?

Drawing conclusions and making recommendations

19. Once the various possible reasons for shortcomings in performance have been investigated, conclusions will need to be drawn as to their relative significance. This is a crucial part of the evaluation, calling for careful judgment, since different conclusions will imply very different kinds of remedial action. For example, if the technical deficiencies of a project are judged to be so great that any immediate attempts to improve management would bring only marginal benefit, the priority would clearly be for a major capital investment programme as soon as possible. It might be found in the case of another project that it was operating well below its technical potential but was being hampered by an inappropriate organisational structure and an absence of well-designed management procedures; the organisational problem would imply a need for far-reaching policy changes requiring very careful thought and preparation, while the answer to the management problem might be to initiate a substantial research programme designed to develop improved procedures and manuals on a nation-wide basis. In a third case, it might be decided that the main problem was a failure on the part of management to follow well-designed procedures and that the only requirement was for closer external monitoring and supervision, better incentives and/or more in-service training.

20. The largely academic problem of how to assign weights to different causal factors need not concern us here. In practice, what matters is that policy-makers should be presented with a comprehensive review of observed weaknesses, backed by telling circumstantial evidence. An evaluation which is carried out on the lines suggested here should be able to produce a considerably fuller and better balanced picture of reality than is available to most of them at present when they are asked to make decisions on the improvement of irrigation projects. In particular, the provision of detailed evidence on organisation and management should have the effect of drawing governments' attention to numerous opportunities for improvement through low-cost investments which are at present being largely overlooked.

Resources required for evaluation

21. The number of people and the time required to carry out this kind of project evaluation will depend on the amount of recorded information already available on the project; on the extent of the evaluators' knowledge of the local environment; and on the depth of the investigation which is contemplated. On the basis of my own field studies (which were not strictly intended as evaluations but rather as means of testing the evaluation system), I would expect it to be possible for a team similar to mine - one social scientist, covering the social, economic and management aspects; one technical consultant, covering the engineering, agricultural and technical management aspects; and a local research assistant - to complete a satisfactory 'identification' study of major constraints after 2-3 weeks in the project area. Further follow-up studies, designed to produce detailed recommendations on improved organisation or management methods, would require much more time and personnel, including a specialist management consultant and a farm survey team.

Some common problems in irrigation management

22. The four projects I studied were all large publicly-operated surface-water schemes, two of them with supplementary groundwater. The characteristics of each locality were very different in many respects and there were consequently significant differences in their management problems and requirements. However, all large predominantly canal-based irrigation schemes have certain fundamental features in common which set them apart from other kinds of agricultural project or programme in terms of the demands they make on administration. The most notable are:

(a) Their concern with the distribution of water as an input to agriculture. Since this water is usually a highly-valued and scarce resource, supplies have to be rationed; control and discipline are consequently central to irrigation management. The need to harmonise the patterns of supply and demand as closely as possible means that there is also a special need for good regular two-way communications between management headquarters and farmers, and for planning and management skills to develop and plan water allocation procedures.

(b) Their scale, which makes good communication and discipline more difficult. In contrast to general agricultural projects or programmes, the management units of irrigation schemes are often necessarily large because they are naturally determined by the amount of land commanded by a single dam or headworks.

(c) Their indivisibility (allied to their scale), which has especially important implications during the initial years of a project's development: once the headworks have been completed, the whole of the commanded area will be supplied with water in a very short space of time, during which a whole new management apparatus will have to be mobilised.

and (d) The special problems which large irrigation schemes present for administrative coordination, particularly between agriculturalists and engineers. These are complicated by the fact that the boundaries of a command area, which are the natural ones for an irrigation agency to operate within, rarely accord closely with those of the civil administrative units on which agricultural organisation is customarily based.

23. A well-managed large irrigation scheme might therefore be expected to have characteristics of the following kind:

(i) a single coordinating agency at command area level, giving priority to the pursuit of agricultural and social objectives and encouraging close collaboration between agricultural and engineering staff;

(ii) an irrigation wing with well-researched and explicit procedures for water allocation, in good communication with farmers and capable of enforcing legal sanctions when necessary;

(iii) a well-manned and responsive agricultural extension wing, with ready access to specialist advice on farm-level water management;

(iv) active farmers' groups at the watercourse level with clearly defined administration-saving functions (relaying information to and from the irrigation wing, acting as focal contact points for agricultural staff, mobilising local operation and maintenance activities, helping to collect water charges, etc);

and (v) adequate financial resources for operation and maintenance costs, of which as large a proportion as possible should preferably be raised locally through water charges.

The example of Taiwan

24. Of the projects I studied only the one in Taiwan came close to satisfying these conditions. Although the management of Taiwan's Irrigation Associations (average coverage 25,000 - 70,000 ha.) has, at least temporarily, come under more direct public sector control since the decision in 1975 that their Chairmen should be chosen by government rather than by an elected committee of farmers' representatives, important responsibilities continue to be delegated to farmers at the Small Group (150 ha.) level; contacts between Small Group leaders and Association staff are frequent; and official attention to local detail is apparent in the often ingenious ways in which small additional water sources are harnessed to supplement the main canal supplies. The water allocation procedures have been built up from detailed field research on crop water requirements; though they could be criticised for being too rigid, they are not difficult for field staff to apply and the disciplines they entail are well understood by farmers: in areas where supplies are insufficient for all to grow rice (the most water-demanding crop), water is rationed between 50 ha. blocks in such a way as to encourage farmers within each block to follow a uniform crop rotation pattern, in which rice features in only one or two years out of three. Within the constraints imposed by the need to respect prior water rights in certain areas, water appears to be distributed very equitably. Infringements of the irrigation rules are promptly and severely punished.

25. Interesting features of the Associations' organisation are that the responsibilities for operation and maintenance are divided between separate sections and that, especially on the operations side, depth of local knowledge and experience have been considered quite as important in the selection and promotion of personnel as level of academic qualification. In the Associations I visited the senior management positions were held by agricultural engineers. Promotion prospects for lower-level staff are unusually good and great importance is attached to regular in-service training. Farmers' membership fees are high and so too is the average level of their recovery; one reason for this is undoubtedly that all the revenue is retained by the Association and, provided it uses its funds wisely, farmers can see a direct connection between the amount of fees they pay and the level of service they get in return from the Association's staff.

26. Responsibility for agricultural extension work lies outside the Irrigation Associations, with the separately constituted Farmers' Associations. These have different administrative boundaries from the IAs and contact between the two bodies is not particularly frequent. In principle, this division of responsibilities would appear to be a weakness, but its significance is much reduced by the very heavy emphasis which governments in Taiwan have been giving to agricultural extension work for more than fifty years. Its impact

The administration of both irrigation and agricultural extension was strongly authoritarian in character during the Japanese colonial period (1895-1945). Management styles are now more flexible and more responsibilities have been devolved to farmers and their representatives, but government is still closely concerned with directing and supervising the IAs' and FAs' activities.

South and South-East Asia

27. Outside Taiwan, none of the projects visited came near to satisfying the conditions listed in para 23 in more than one or two respects. Common weaknesses encountered were:

(a) Responsibility for irrigated agriculture split between two government departments, Irrigation (headed by civil engineers) and Agriculture, each with different administrative boundaries; and in groundwater areas, responsibilities for canal and tubewell operation split between two agencies within the Irrigation Department (9).

(b) Within the Irrigation Department (much the more prestigious and prosperous of the two) a preference among many civil engineers for design and construction work rather than operation and maintenance; and with respect to the latter a tendency to concentrate more on maintenance than operation.

(c) Within the Agriculture Department extremely inadequate resources of finance and personnel, and no access to specialist expertise in water management extension.

(d) An absence of up-to-date Operation and Maintenance manuals; water allocation procedures which, if codified at all, are based on old-established conventions and formulae rather than recent research on crop water requirements; and a generally 'laissez-faire' approach to system operation which places senior Irrigation staff under little obligation to monitor closely the reasons for discrepancies between planned and actual distribution patterns.

(e) Inadequate funds for operation and maintenance, the funds received from government being generally unrelated to the amount of revenue collected from water charges (the rates for which tend to be very low).

(f) Junior staff in both departments poorly paid, with very limited promotion prospects, and therefore poorly motivated and, in the case of Irrigation staff, susceptible to often powerful pressures from within the farming community to permit misappropriation of water.

(g) Farmers badly informed about likely variations in the pattern of their water supply and with no clearly defined responsibilities for operation and maintenance within the watercourse; group activity, eg for watercourse maintenance, often limited and sporadic, in the absence of support and advice from either Irrigation (with responsibilities traditionally ending at the watercourse level) or Agriculture (with responsibilities limited to the individual farm level).

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(9) The exception here was the N.W. Indian project, which is one of those where a unified agency has been established under the Command Area Development programme.

28. In the course of my studies I met many senior officials engaged in irrigation management who were well aware of these weaknesses and were trying to combat them to the best of their ability. However, it was clearly beyond their powers, at project level, to provide effective and lasting remedies to the more deep-seated difficulties with which they were faced. Organisational changes to improve inter-departmental coordination, substantial revisions in the employment conditions of junior field staff, investigations into alternative water allocation techniques, the strengthening of legal powers to penalise serious infringements, changes in policy with regard to water charges and the financing of operation and maintenance costs: all these are measures which could almost certainly contribute very significantly to the improvement of project performance, but only policy-makers at the highest level are in a position to decide on the feasibility of implementing them.

Currently favoured remedies

29. During the past 5-10 years, governments and external aid agencies have been showing increasing awareness of the need - and the potential - for greatly enhancing the performance of existing irrigation schemes, through improvements not only in their physical infrastructure but also in their organisation and management. Most of the strategies they have adopted have certain common features. The most comprehensive package of remedial action of the kind currently favoured would probably contain the following elements:

(a) amalgamation of Irrigation and Agriculture Ministries at national level;

(b) formation of single coordinating agency at command area level;

(c) strengthened agricultural extension;

(d) larger budget allocations for operation and maintenance;

(e) higher water charges;

(f) remodelling/rehabilitation of main canal system;

(g) technical and institutional changes at the watercourse and farm levels ('on-farm development').

Most governments have adopted only parts of this package so far: India is one of the few countries to have accepted the radical changes implied by (a), (b) and (c), under the new Command Area Development programme; the main emphasis elsewhere has tended to be on (d), (f) and (g).

Neglect of water allocation

30. The introduction of measures such as these undoubtedly constitutes a majo step in the right direction. Nevertheless, there is one central aspect of man which has been neglected in all cases; and, very largely because of this, ther still appear to be serious imbalances in many of the programmes. Conspicuousl missing from the list of improvements is any set of measures specifically dire at reforming or revising water allocation practices within the publicly-operat section of the canal (or canal-cum-tubewell) system. Yet my own studies and

those of several other independent researchers have concluded that this is one of the areas of greatest weakness on large irrigation schemes (10).

31. There is little detailed quantified evidence at present to indicate the extent to which deficient allocation practices may be contributing to poor performance, but a recent experiment in the Philippines suggests that it is often very substantial. In this experiment, carried out by members of the International Rice Research Institute on a selected canal-irrigated command area of 5,700 ha, it was found that the introduction of quite modest changes in water distribution procedures was associated with a 97% increase in rice production on the system overall, and a 1494% increase in the tail section of the system, over a two-year period. Before the researchers' intervention there had been a familiar pattern of over-irrigation at the head, with insufficient supplies remaining for the tail; official control over water appropriations had been minimal and there was widespread uncertainty among all farmers about the likely timing and quantity of water supplies. The experiment was carried out without the introduction of any technical improvements (11).

32. By contrast, there is no good evidence at all to support the belief, apparently widely held by planners, that most of the problems on the main systems are technical ones, soluble by technical means alone, and that the major deficiencies of management are concentrated within the watercourse and on the farm. Certainly it is true that water losses are generally much higher below the watercourse head than above it (12). But this proves nothing on its own: it is perfectly consistent with poor management higher up the system, leading to unpredictable patterns of water supply to farmers and consequently high losses within the watercourse and on the farm.

33. Certainly, there are often serious shortcomings to be remedied at the watercourse and farm levels: for example, on many projects of the kind now being rehabilitated under India's CAD programme, a whole range of physical improvements may be required (eg land levelling, installation of field drains and watercourses, possibly land consolidation) as well as measures to encourage the emergence of stronger local institutions; and detailed water management studies in Pakistan have demonstrated that in the Indus Basin there is great scope for raising standards of watercourse maintenance and of water application techniques in the field. However, it is essential to recognise that 'on-farm development' programmes are capable of dealing with only one part of the problem.

(10) See, eg, R. Chambers and J. Harriss, chapters 22 and 23 in B.H. Farmer (ed.), Green Revolution?, Macmillan 1977 (Sri Lanka and South India); R. Reidinger, "Institutional rationing of canal water in North India: conflict between traditional patterns and modern needs", Economic Development and Cultural Change (23, 1) October 1974 (North India); R. Wade, "Rationing water: principles and practice in South India", and A. Valera and T. Wickham, "Management of traditional and improved irrigation systems: some findings from the Philippines", both papers to ODI Workshop on Choices in Irrigation Management, September 1976.

(11) See paper by Valera and Wickham cited above.

(12) See, eg, M. Bos and J. Nugteren, On Irrigation Efficiencies, Wageningen 1974.

Unless simultaneous - or prior - action is taken to strengthen main system management, the benefits obtainable from such programmes will almost certai: be much diminished. And in certain cases - particularly where physical conditions below the watercourse head are not exceptionally problematic - careful evaluations of main system management might well reveal some featur of a recommended 'on-farm development' package to be more ambitious and costly than is immediately necessary.

34. The tendency for present programmes to neglect such a central element i the irrigation management process can be partly explained by the sensitivit of some of the issues likely to be touched upon in the course of any detail investigation into water allocation practices. In this connection it shoul be emphasised that detailed evaluations of the kind described in this paper are not intended to be 'finger-pointing' exercises: the object is not to apportion blame to particular groups of people (still less individuals) but to identify weaknesses in the present <u>system</u> of organisation and management and suggest appropriate remedies.

35. Another reason why water allocation questions have been neglected is, no doubt, that project planning and evaluation teams are conventionally give somewhat restricted terms of reference which require them to concentrate mainly on technical and economic performance rather than on the management process. It is hoped that this paper will have demonstrated not only that a comprehensive approach to evaluation is an essential prerequisite for well-informed decision-taking; but also that it could be adopted and applied by most existing evaluation agencies without great difficulty.

APPENDIX A

CHECKLIST OF INFORMATION REQUIRED

PART I - THE RESOURCE BASE

The local environment (the context in which management has to be performed)

1. Physical characteristics of the area

   1.1 Rainfall
   1.2 Temperature
   1.3 Soils
   1.4 Topography

2. Technical characteristics of the irrigation system

(i) Canals

2.1 Size of net command area (NCA)
2.2 History of system: date of construction; original objectives; subsequent changes.
2.3 Storage facilities (million m^3 per year)
2.4 Maximum design capacities of canals (main canal to watercourse head), in lit/sec/ha.
2.5 Number and length of canals (primary, secondary, etc.)
2.6 Number, length and average command areas of watercourses
2.7 Length of canal and watercourse lining
2.8 Number and type of canal regulators and measurement structures (main canal to watercourse head)
2.9 Number and type of other structures
2.10 Cropping pattern/cropping intensity for which system has been designed
2.11 Monthly canal discharges in selected years (m^3)
2.12 Canal roads (and public roads)
2.13 Workshops

(ii) Wells*

(a) Public tubewells

2.14 Number of wells
2.15 History of well development (as in 2.2 above)
2.16 Design characteristics
2.17 Average command area per well
2.18 Maximum pumping capacity - total (cumecs) and per well (lit/sec)
2.19 Maximum permitted/planned annual pumpage (million m^3)
2.20 Maximum permitted/planned water availability per ha (lit/sec)
2.21 Actual annual pumpage in selected years (m^3)
2.22 Watertable depths (pre-project and in selected years since project completion)

(b) Private wells (and low-lift pumps)

2.23 Numbers, design characteristics, pumping capacities, actual pumpage, etc.

(iii) Surface drainage

2.24 Number and length of channels (primary, secondary, etc.)
2.25 Number and type of structures
2.26 System capacity (lit/sec/ha of NCA of catchment area)

3. The farming system(s)

3.1 Cropping patterns and cropping calendars (in selected years):

Crop	ha cultivated	Irrigation dates	
(1)		from	to
(2)			
(3)			

(broken down by localities)

4. Social characteristics of the farming community

4.1 History of human settlement in project area
4.2 Population:
(i) in project area (per ha/male/female/ages)
(ii) % of total population engaged in agriculture
(iii) distribution of occupation among those engaged in agriculture (farm operators, family labour, landless labourers)
4.3 Social structure:
(i) Powers and characteristics of local leaders
(ii) Propensity to collaborate within local communities (cohesive or divisive effects of caste, kinship groups, etc.)
4.4 Economic indicators:
(i) Farm sizes (% of farms in different size categories)
(ii) Land tenure pattern (% of farms in different size categories which are owner-operated, tenant-operated; characteristics of tenancy arrangements)
(iii) Estimated annual farm incomes and total incomes (by farm size; and by groups - landowners, tenants, landless labourers)
4.5 Literacy levels and other social indicators
4.6 Length of farmers' experience of:
(i) agriculture
(ii) irrigated agriculture
4.7 Farming practices and levels of technical knowledge (methods of land preparation, sowing/planting and water application; knowledge of crop water requirements, use of improved seeds, fertiliser applications, etc.)
4.8 Local organisations and groupings, both 'indigenous' and introduced by government (village councils, cooperatives and, especially, water users' organisations):
(i) period of existence
(ii) declared functions
(iii) average size (membership, area)
(iv) linkages, if any, with higher-level (secondary, apex) organisations.

5. Economic environment

5.1 Past and present levels of economic development (as indicated by eg, proportion of total working population engaged in agriculture, proportion of GNP derived from agricultural production)
5.2 Past and present policies of government towards agricultural sector (as net contributor to, or net benefactor from, government funds)
5.3 Farm-gate or rural market prices of principal inputs (selected years)
5.4 Farm-gate or rural market prices of principal crops (selected years)
5.5 Rates of government taxation and subsidy on items 5.3 and 5.4
5.6 Water charges:
(i) level of charges (selected years)
(ii) method of charging (volumetric, per cropped area, flat rate, etc)

Administrative and financial resources of project management

6. Administrative resources

6.1 Structure of project organisation - horizontal:
(i) Agency/agencies principally concerned with development of irrigated agriculture in project area
(ii) Their areas of jurisdiction
(iii) Means of coordination (eg single Area Commissioner, coordinating committees)
6.2 Extent of agency/agencies' legal powers to control farmers' decisions, eg:
(i) Selection of farmers
(ii) Control over farmers' tenure of land
(iii) Choice of crops
(iv) Timing of cultivation operations
(v) Enforcement of rules against misappropriation of water
6.3 Organisational linkages between agency/agencies at project level and agencies at Province/State and Central Government levels
6.4 Principal activities assigned to each agency
6.5 Structure of project organisation - vertical (for each agency):
(i) Organisation chart (including indication of points of contact between project staff and farmers)
(ii) Numbers of staff in each job category (eg Section Engineer, Agricultural Field Assistant)
(iii) Brief description of principal functions of each job category
(iv) Salary scales for each job category
(v) Qualifications of staff in each job category
(vi) Length of experience of staff in each job category (on project concerned; on irrigation projects elsewhere)
(vii) Location of offices and residence of staff in each job category (centralised/dispersed)

7. Supporting services

7.1 Transport facilities:
(i) Number and type of vehicles owned by project agency/agencies
(ii) Number and type reserved for use by staff members (by job category)
(iii) Number and type of vehicles privately owned by project staff

7.2 Telecommunications: Number and location of telephones or other methods of internal/public communication

8. <u>Financial resources</u>

8.1 Expenditure by project agency/agencies on new capital works (selected years)
8.2 Expenditure on reconstruction, major rehabilitation (selected years)
8.3 Recurrent expenditure (selected years)
(i) operation and maintenance
(ii) staff

(In the case of the irrigation wing, to be expressed in terms of cost per ha, per canal km, per control structure; in the case of agricultural and other wings, to be expressed in terms of cost per farmer and cost per ha)

8.4 Sources of finance (Central/Provincial government funds; revenue from local taxes, etc)

PART II - INDICATORS OF PROJECT PERFORMANCE

9. Productivity

   9.1 Changes in crop areas and yields over time
   9.2 Quantity/economic value/nutritional value of output per units of water delivered (and of other major inputs)
   9.3 Water losses (overall; main system; watercourse; field)

10. Equity

   10.1 Variations in cropping patterns/cropping intensities/yields/ water availability between upstream/downstream commands on same river system
   10.2 Do. between upstream/downstream sections of a single command
   10.3 Do. between groundwater/non-groundwater areas
   10.4 Do. between areas with different water rights
   10.5 Do. between heads and tails of watercourses
   10.6 Do. between large and small farmers

11. Environmental stability

   11.1 Area of waterlogging (over time)
   11.2 Area of salinity, alkalinity (over time)
   11.3 Water-table levels (over time)
   11.4 Erosion of upper catchment areas

12. Cost

   12.1 Capital costs
   12.2 Annual costs (new construction, rehabilitation, O & M, etc) see 8.1-8.3

13. Cost recovery

   13.1 Total annual revenue collected from local taxes - water charges, land tax, etc (selected years)
   13.2 Rate of recovery (% collected:% assessed)
   13.3 Total revenue recovered as proportion of total project costs
   13.4 Proportion of total revenue retained by project agency/ agencies; proportion passed to Central/Provincial government
   13.5 Local taxes as proportion of farmers' incomes

14. Other criteria eg

   14.1 Level of nutrition: effect of cropping pattern on farm families' diets
   14.2 Incidence of waterborne diseases
   14.3 Effects of irrigation on fisheries, wild-life ecology

PART III - IDENTIFICATION OF CAUSES

15. Deficiencies in technical design, eg:

    15.1 Deficiencies in watercourse layout (eg incapable of conveying water to all parts of watercourse command; channels insufficiently large to convey all water delivered at watercourse head)
    15.2 Insufficient provision for drainage (reflected in low levels of production attributable to waterlogging)
    15.3 Absence or shortage of water measuring devices (at all control points down to watercourse head)
    15.4 Mechanical and other weaknesses in tubewell pump design

16. Financial, economic and legal constraints, eg:

    16.1 Insufficient funds for recurrent expenditure, limiting staff numbers, equipment and other inputs (compare actual expenditure - 8.1-8.3 - with 'norm' associated with 'good performance' on project with similar characteristics)
    16.2 Low water charges (limiting revenue available to project, discouraging farmers from economising in water use)
    16.3 Unfavourable input:output price ratios for farmers
    16.4 Absence of, or ineffectiveness of, legal provisions for enforcing rules against misappropriation of water
    16.5 Absence of, or ineffectiveness of, legislation for controlling groundwater exploitation
    16.6 Obligation to adhere to anomalous legislation concerning prior water rights

17. Other exogenous factors outside control of project management, eg:

    17.1 Climatic hazards
    17.2 International factors (world inflation, shortages of imported materials etc)
    17.3 Domestic factors (eg failure of another agency to deliver electricity, construct roads, etc)

18. Weaknesses in higher-level planning for project management: (A) Organisat structure*

    18.1 Structure inconducive to establishment of good lateral coordinatio within agency or between agencies principally concerned with development of irrigated agriculture in project area (cf 6.1)
    18.2 Structure/legal framework permitting insufficient centralised control or devolution of functions and responsibilities between management, field staff and farmers, in relation to requirements of project area (cf 6.2)
    18.3 Structure with wrongly balanced 'mix' of engineering, agricultural and other staff, in relation to requirements of project area

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* See Appendix B

19. Weaknesses in higher-level planning for project management: (B) Policies governing staff recruitment, training and motivation

19.1 Academic qualifications the prime determinant of recruitment or promotion of staff to different job categories, rather than length of experience/past performance
19.2 Senior staff posts within each agency or wing tied to people trained in a particular academic discipline (eg in Irrigation wing, posts assigned to Civil Engineers only)
19.3 Low salaries for junior staff, combined with very limited promotion opportunities
19.4 Few opportunities for in-service training
19.5 Absence of financial bonuses or merit awards for staff judged to have performed well

20. Weaknesses in higher-level planning for project management: (C) Establishment of objectives and procedures

20.1 Absence of clear or consistent views at levels higher than the project with regard to:
(i) Overall national objectives of agricultural and rural development
(ii) Overall national objectives of irrigation projects
(iii) Specific objectives of irrigation project concerned (and other projects with similar characteristics)
20.2 Absence of, or deficiencies in design of, basic aids to project management*:
(i) Project manual , or manuals relating to specific project activities
(ii) Job descriptions
(iii) Maps
(iv) Procedures for performing project activities
(v) Information systems (for monitoring project and staff performance)

21. Weaknesses in implementation of project management

A. List major activities of each leading agency, eg:

Agency I (Irrigation Department):

- water allocation
- canal maintenance
- tubewell maintenance
- supervising and training farmers in watercourse operation and maintenance
- enforcement of discipline according to irrigation rules
- assessment and collection of water charges
- finance and budgeting
- personnel management and training

Agency II (Agriculture Department):

- agricultural research
- general agricultural extension
- provision of specialist advice on field-level water management
- formation/supervision of farmers'/water users' groups
- liaison with input supply agencies
- collection and analysis of agricultural statistics
- finance and budgeting
- personnel management and training

B. Select activities likely to be of key importance. With regard to each of these activities:

(a) Identify project management's objectives in performing it (either stated or inferred)
(b) Identify procedures according to which it is supposed to be performed and responsibilities of each person involved in its performance
(c) Assess appropriateness and adequacy of procedures as means of attaining desired objectives*
(d) Identify extent to which procedures are being followed at various different administrative levels
(e) Identify or infer reasons for divergence between recommended procedures and actual practice
(f) Assess performance against objectives

Less detailed assessment should also be attempted in the case of all other major activities, as far as time permits.

The kind of pattern which a detailed assessment might take can be illustrated by the following example:

Activity: Water allocation

(a) Management objectives: In period of water scarcity, to provide all farms within project area with sufficient water to cultivate certain designated crops with low water requirements; expected surplus to be allocated for rice cultivation in a few selected areas.

(b) Established procedures:

Planning: estimate seasonal supplies; estimate total water requirements of less water-demanding crops; calculate area of permissible rice cultivation; establish location of rice areas according to accepted criteria (eg equity, soil characteristics)
Implementation: calculate expected water supplies in next 10-day period; rotate canals according to established formulae, once supplies fall below certain levels; inform ditchtenders and farmers' representatives; water allocations for each watercourse calculated by ditchtenders on basis of actual cropping patterns and total water availability (unpermitted rice to receive no more water than less water-demanding crops); ditchtenders' calculations checked and approved by immediate supervisors; watercourse gates set to approved level
Monitoring: Ditchtenders' records of cropping patterns and actual water allocations for each watercourse in previous 10-day period submitted to immediate supervisors; aggregated information submitted to project's senior engineer; main system water losses calculated by comparing supply level at system head with sum of all supplies at watercourse heads.

(c) Appropriateness and adequacy of procedures: Basis of estimates of crop water requirements technically unsound. No provision for monitoring accuracy of ditchtenders' estimates of actual cropping patterns. Otherwise a system which, if adhered to, should be conducive to productive and equitable water use, though the complexity of its procedures suggests that it is unlikely to be appropriate unless project staff are technically and administratively well-trained.

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* Refers back to para 20.2

(d) Adherence to procedures: Criteria for location of permitted rice areas unclear and inequitable. Interviews with ditchtenders and farmers reveal tendency to treat unpermitted rice, once planted, as permitted rice. Ditchtenders' records show errors in calculations of water requirements of estimated cropped areas; also major inconsistencies in amounts of water recorded as delivered in relation to estimated requirements of each watercourse. No evidence that errors and inconsistencies in ditchtenders' records checked and investigated by superior officers or corrective action taken. Evidence that calculations of main system water losses are bogus: actual head measurements are not used; instead values are imputed to head supplies based on the sum of all watercourse supplies plus a constant (assumed) factor for conveyance losses.

(e) Reasons for divergence: Lack of clarity of objectives with regard to relative priority of rice and other crops. Absence of reliable measurement structures at watercourse head. Lack of technical expertise on part of ditchtenders. Also (almost certainly) pressure from influential farmers or farmer groups on ditchtenders to misallocate water. Failure of superiors to monitor and correct misallocation suggests that payments being passed 'up the line'. Manipulation of system losses calculations may be partly attributable to the same reason.

(f) Examination of records of cropping patterns and cropping intensities in selected upstream and downstream watercourses shows large concentrations of rice cultivation (permitted and unpermitted) in head reaches and substantial areas of unirrigated land in tail reaches. Objectives not fulfilled, largely for reasons indicated in (e) above.

C. In the course of studying activities, attention should also be given to assessment of abilities and attitudes of 'agents'. In the case of each job category:

(a) Obtain job description (if available)
(b) Ask staff to discuss own functions and responsibilities; check their perceptions against job description
(c) Assess staff satisfaction with present job and future prospects
(d) Enquire about perceived obstacles to performing job satisfactorily
(e) Assess frequency of communications with superiors, junior staff, and laterally with other agencies or wings
(f) Ask staff to assess extent to which they are under - or over - loaded with functions and responsibilities; and to suggest alternative solutions
(g) Ask staff to estimate proportion of total working time spent:
(i) on different activities
(ii) on planning, executing, monitoring or correcting - in the case of each activity
(iii) in the office/in the field

D. Throughout the assessment of activities and agents, particular attention should be paid to the information system used by project management:

(a) What recorded information is available (in reports, files, etc)?
(b) How reliable is it?

x

(c) For what purpose has it been collected (merely as a record of past activities, or as a means of monitoring project and staff performance)?

(d) Is it analysed and presented in a suitable form for monitoring purposes?

(e) What information required for monitoring purposes is not available?

A review of the information system is valuable not only as a means of assessing the character of the present management but also as an indicator of the amount of additional information likely to be required in the event of establishing improved methods of monitoring. In many cases more than enough information is already being collected but much of the staff time spent on analysing and collating it is wasted because it is not being processed into forms which allow it to be used as an effective management tool.

22. <u>Weaknesses in farmer organisation and management at the watercourse and field levels</u>

The principal activities to be investigated here are farm management (with particular emphasis on methods of water application) and watercourse operation and maintenance (cf paras 4.8 and 4.9). Some assessment of farm management abilities will be possible through observations in the field and discussions with farmers (about frequency and depth of water applications, etc); independent studies may also be available for consultation. In the case of watercourse O & M, certain procedures are likely to have been established. Aim to establish:

(a) The nature of these procedures
(b) Whether they are being followed
(c) If not, why not.

Where easily identifiable local institutions exist for watercourse O & M (either 'indigenous' or government-created), office-holders can be interviewed about their functions and responsibilities and their perceptions of what these entail. Elsewhere, individual farmers will usually be able to discuss how O & M is supposed to be organised within the watercourse. In both cases, relationships with government officials (frequency of meetings, information flows, etc) can also be discussed.

An afternoon's inspection of a single watercourse will often reveal practices which are contrary to established procedures. Where they are not obvious, discreet enquiries can be made about the reasons for these 'irregularities' (they will not necessarily be discreditable). For more than an impressionistic assessment, however, longer studies would be required.

APPENDIX B

APPROPRIATE ORGANISATIONAL STRUCTURE

1. Lateral inter-agency coordination

A. Irrigation and Agriculture: The fundamental objectives of irrigation schemes are agricultural and social: water is being supplied as an input to agriculture, not as an end in itself. It follows therefore that the following organisational structure, commonly found in many large continuously-irrigated areas, is likely to be 'inappropriate' (or sub-optimal) with regard to the attainment of those objectives:

> Two separate Departments responsible for irrigation activities (water allocation, maintenance) and agricultural activities (agricultural extension), of which Irrigation is much the more powerful and prestigious; the influence of Agriculture being further reduced by the fact that its area of jurisdiction (based on civil administrative boundaries) is not coterminous with that of Irrigation (the command area).

In these circumstances, a more appropriate structure (ie one more favourable to the attainment of agricultural and social objectives) is likely to be a single coordinating agency at command area level: it should provide better opportunities for promoting a desirable balance of influence between Irrigation and Agriculture; and problems created by absence of common administrative boundaries (eg in data collection and analysis) are removed. The problems associated with such a structure (division of loyalties of seconded staff between parent Department and Project: difficulties of coordination and division of functions between Project Authority and civil administration - law and order, social services, etc) are likely to be outweighed by its advantages.

Where the agencies responsible for Agriculture are relatively influential and effective and/or the agencies responsible for Irrigation have been trained to be 'agriculture-oriented', the need for a unified structure is less great (cf Taiwan - para 26 of Paper), though the absence of common administrative boundaries may still be a disadvantage.

A 'command area' approach poses difficulties in conditions where there are numerous relatively small, discontinuous irrigation commands interspersed with unirrigated land. Here a 'catchment area' approach would, ideally, seem to be most appropriate: it would allow the establishment of unitary area agencies; it would normally require agriculturalists to be in overall administrative control; it would encourage equitable treatment of rainfed and irrigated areas; and it would make it possible to manage the land and water resources of a particular catchment area as an integrated whole - a matter of particular importance where encroachment by cultivators on higher hill slopes may be causing erosion.

B. Canals, groundwater and drainage: Hydrological conditions are often such that public tubewells are installed over an area which cuts across the boundaries of two or more canal commands. During the survey and construction stages it is logical that a separate agency (other than the canal command agencies) should be responsible for tubewell development in the area concerned. However, where the tubewells have been installed for the purpose of providing groundwater for irrigation in conjunction with canal supplies (and not merely for the purpose of drainage), the need for integrated planning and implementation of water scheduling demands that responsibility for their operation be transferred to those canal command agencies within whose administrative boundaries the tubewells are located.

The areas of surface drainage commands normally conform closely to those of canal commands and there should therefore be no particular difficulties in bringing responsibilities for their management under a single command area authority.

Whether they are combined under a single agency or not, separate lines of command are often set up for (a) canal operation and maintenance; (b) tubewell operation and maintenance; and (c) surface drainage operation and maintenance. However, operation (particularly when it concerns water allocation) requires different skills and training from maintenance; and tubewell maintenance requires different skills and training from canal and drainage maintenance. Logic and experience suggest that activities are likely to be better performed if responsibilities and functions are allocated on the basis of specialisation of skills. It might therefore be more appropriate to have an organisational structure like this:

a) Water allocation wing, responsible for combined operation of surface and groundwater (requiring skills in irrigation planning and scheduling);

b) Canal and surface drainage maintenance wing (requiring civil engineering skills);

c) Tubewell maintenance wing (requiring mechanical engineering skills).

C. Coordination at sector and sub-sector levels: Particularly within large project areas it is essential in the interest of good vertical communication (supervision of junior field staff, accessibility to farmers) that the offices and residences of senior executive officials be located within the sectors or sub-sectors for which they are responsible, and not at headquarters. And it is clearly in the interest of good lateral communication between wings (agriculture, operation, maintenance etc.) that officials from each wing should work together from the same sectoral and sub-sectoral offices.

This decentralised, coordinated pattern is found in Taiwan, where the Irrigation Associations have Management Offices at the 20,000 ha/40,000 farm level and Working Stations at the 1500 ha/3000 farm level, each containing staff with responsibilities for a number of different activities. It is uncommon elsewhere, however: coordination at sector or sub-sector

levels is unlikely to occur except where there is coordination at headquarters; and even where coordinated offices have been established, their location is often not decentralised because of the reluctance of senior executives to live in small rural settlements which lack the educational facilities and other amenities of the cities or major towns.

2. Water users' organisations

There are strong reasons for arguing that water users' organisations should be channel- (or well-) based, not village-based. Research has shown that wherever farmers have combined to construct, operation and maintain their own "indigenous" irrigation systems, the organisational structures they have adopted have been based on the channel rather than the village. This is because, as far as the activities of water allocation and maintenance are concerned, the farmers' natural interest is to collaborate most closely with their immediate neighbours on the same channel (1). On larger publicly-operated schemes, there are obvious advantages to the operating agency as well as to the farmers in having channel-based water-users' organisations, since its irrigation field staff are also organised on a channel basis: thus a ditchtender responsible for supplying water to ten watercourses will have only ten groups of farmers to deal with and responsibility for operation and maintenance within each watercourse can be clearly delegated to a single group and/or its representatives. By contrast, if the organisation is based on the village, its boundaries will usually cut across several watercourse commands, in which case the ditchtender may have to deal with two or more groups on each watercourse, responsibilities will be more difficult to establish and conflicts are more likely to arise.

The federation of water-users' groups at higher levels (e.g. at the level of the secondary canal command and the project) is sometimes advocated as a means of enabling disadvantaged groups, particularly at the tail of a command, to bring pressure to bear on the operators of the main canal system to allocate water more equitably. Such federated structures are rarely found, however. In Taiwan, all the members of an Irrigation Association were until recently entitled to elect a committee to represent them at the project level (para.24 of Paper), but the members of this committee were not selected from among the Small Group leaders at the 150 ha level; it was therefore not a federal structure. Nor - unlike the Small Group leaders - were the committee members primarily interested in the details of water allocation or maintenance. Their main concern was with the Association's financial management; questions of technical management were left to the Association's professional employees.

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(1) See, e.g. E.W. Coward, "Irrigation Management Alternatives: themes from indigenous systems", Agricultural Administration (4,3), July 1977.

3. Centralisation v. devolution of management control

A comparison of the agencies used in different parts of the world to manage irrigation schemes will show that there are wide variations in the degree of centralisation or devolution of management control over decision-making. At one end of the spectrum come settlement schemes such as Mwea in Kenya, where the project management has full control with regard to all five items listed in Appendix A, Para.6.2:

a) initial selection of farmers

b) land tenure (land owned by the State; farmers' tenancies annually renewable and subject to termination if farmers' performance deemed unsatisfactory)

c) choice of crop (monocrop rice only, which is sold through a single marketing channel controlled by the management)

d) timing of cultivation operations (management organises mechanised land preparation according to pre-planned schedules; irrigations to each field are organised by project staff, not the farmers)

e) enforcement of irrigation rules.

At the other end of the spectrum are irrigation schemes such as those found in North India and Pakistan, where management has no control over any of the items except the last.

In the first of these extreme cases management can be typified as highly 'authoritarian' or 'interventionist' in character; in the second, as loosely controlled or 'laissez-faire'. This prompts the question: in what circumstances is more or less management control likely to be appropriate?

The question is complicated by the fact that there are at least two different kinds of reason why it may be appropriate to impose a substantial degree of central control over the management of an irrigation scheme. The first is technical. For example:

- shortage of water may entail restrictions on the proportion of a total command area permitted to cultivate crops with high water requirements, in the interests of equity (e.g. rice in parts of Taiwan and Java; sugarcane in Maharashtra);

- soil characteristics (low or high permeability) may determine the nature of crops permitted to be grown in different areas (e.g. rice and 'irrigated dry' crops in Southern India)

- other agronomic reasons may lead to an insistence that farmers cultivate according to a prescribed large-block crop rotation system (e.g. maintenance of soil fertility - Sudan; efficiency of pest control on cotton - Egypt).

The second kind of reason has to do with the level of farmers' experience of irrigated agriculture. On a recently established settlement

scheme (such as Mwea) it is clearly appropriate that in the early stages of development farmers should be closely supervised with regard to their cultivation and irrigation practices. And it can be argued that in these early stages project management needs to be able to exercise a large degree of influence over the production process in order to produce rapid returns which will help to justify the high capital costs of project construction. The experience of Mwea has shown that this kind of highly-controlled management system is capable of stimulating high levels of production within a very short period. This does not necessarily mean that it is desirable or politically feasible for management to exercise the same degree of centralised control in all other cases where irrigation has been recently introduced. Nor does it mean that similarly centralised control is likely to be appropriate at later stages of a project's development: as the experience of farmers (and junior field staff) increases, it should be possible for central management to delegate more and more responsibilities to them, allowing greater flexibility of decision-making at the farm level and releasing scarce administrative resources for more profitable use elsewhere. This pattern (close supervision, control and discipline externally imposed on farmers in the initial stages, leading to increasing self-control and self-discipline by farmers' groups over time) has been the one followed in Taiwan (1).

The general principle - that there should be close supervision in the early stages, followed by an increasing devolution of responsibilities - applies in all circumstances, whether there happen to be technical reasons why cropping patterns must be controlled (as in Taiwan, Maharashtra etc.) or not (as in North India and Pakistan). Movement along the spectrum over time should not therefore be thought of as a simple progression from almost total control (Mwea) to almost total 'laissez-faire'. It is probable that a management system which imposes strict limitations on farmers' choices of cropping pattern but nevertheless gives them substantial responsibilities in other respects (e.g. with regard to watercourse operation and maintenance; group training in watercourse affairs; collection of water charges; voting rights concerning level of water charges) will be much more appropriate to the needs of a relatively advanced farming community than one which allows them a free choice of cropping patterns but gives them very few other responsibilities. In other words, the question of devolution of management responsibilities needs to be considered independently of the question of technical control over water allocation.

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(1) Where the mechanisms for management control are particularly strong in the initial stages (e.g. high degree of insecurity of land tenure, obligation to grow cash crops for sale through a single marketing channel), experience has shown that there is a danger of institutions failing to develop over time, with consequent social and economic stagnation. Insecurity of tenure becomes a particularly inhibiting factor, since farmers have no long-term interest in investing in their land. A system whereby farmers are allowed to purchase their land over (say) a 30-year period provides a similar degree of management control in the initial stages but allows increasing devolution of responsibility over time.

4. Appropriate 'mix' of management and technical skills

A more detailed picture of appropriate organisational structure (both with respect to lateral coordination and vertical control) can be built up by considering a project's physical, technical, economic and social characteristics and drawing conclusions about the required 'mix' of management and technical skills which these characteristics imply. The widely different mixes of skills required on different types of irrigation project are illustrated in Tables 1-3. In Table 1 eleven factors are listed which seem likely, on the basis of observed experience, to have a significant bearing on the type of skills required on any large surface irrigation project, with particular reference to the activities of water allocation, maintenance and water management extension. In Table 2 the characteristics of two highly contrasted project "types" are shown, in terms of the eleven factors. And in Tables 3A and 3B, the very different implications for skill requirements in each case are brought out (and in the case of Project A, possible changes over time are also indicated).

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TABLE 1

Principal characteristics of irrigation projects likely to affect skill requirements

1. Technical assumptions, design criteria and characteristics of main water delivery system (e.g. high technology/low technology; controllability and capacity for flexible operation; night storage/24-hour flow).

2. Physical characteristics and parameters (e.g. climate, soils, topography).

3. Drainage requirements and other ancillary works and components.

4. Cropping intensities for which water delivery system is designed (e.g. extended system with fewer options in choice of cropping pattern; or compact system with more options).

5. Characteristics of watercourse command (e.g. 'rationalised'/consolidated or irregular/unconsolidated holdings; extent of physical control structures; regularity/irregularity of micro-topography).

6. Water availability in relation to demand.

7. Reliability/variability of water supply.

8. Degree of management control over farmers' choice of cropping patterns (for agronomic or other reasons).

9. Level and method of water charges.

10. Local socio-political factors (social cohesion of farmers at village/channel level; access of local pressure groups to higher-level political support; skewness of farm size/incomes; proportion of owner- and tenant-operated farms).

11. Level of farmers' agricultural and water management skills.

TABLE 2

Two projects with contrasting characteristics

Project A (Years 1-5):

1. High technology water delivery system (e.g. automated downstream control).
2. Low rainfall, light soils, even topography.
3. Adequate drainage installed.
4. Compact system, designed for high cropping intensities.
5. Regular layout; control structures to field level.
6. No water scarcity.
7. Predictable supply.
8. Control over cropping patterns: monocrop rice.
9. High water charges (levied indirectly at point of crop sale).
10. Farmers are short-term tenants on government land; plot sizes equal.
11. Farmers' technical knowledge low.

Project A (Years 5-10):

The same as in Years 1-5, except for the following changes:

6. Greater water scarcity, owing to increased demand (increased intensity of water use).
10. Pressure from tenants for greater autonomy of decision-making (including, e.g., diversification of cropping pattern).
11. Increased technical knowledge.

Project B:

1. Low technology water delivery system (e.g. up-stream control, rotational distribution, capable of limited flexibility).
2. High rainfall in concentrated peak periods, heavy soils, broken topography.
3. Drainage required but not installed.
4. Extended system, designed for low cropping intensities.
5. Irregular layout; irregular topography; facilities for water control poor.
6. Water scarcity, especially at times of peak water requirement.
7. Significant variations in patterns of water supply from year to year.
8. Free choice of cropping.
9. Low water charges (based on area irrigated, not volumetric).
10. Poor social cohesion; farm sizes/incomes highly skewed; powerful local political factions.
11. Farmers' technical knowledge low.

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AGRICULTURAL ADMINISTRATION UNIT

ORGANISATION AND MANAGEMENT OF IRRIGATED AGRICULTURE

Irrigation Management Network 1/80

May 1980

NEWSLETTER

1. The Network: future plans

Once again there has been far too long a gap between issues. The last appeared in November 1978, so there has been an interval of almost eighteen months. In the meantime, there has been a lot of bilateral correspondence between the AAU and individual networkers; draft summaries of my final report to the World Bank (on the organisation and management of large irrigation schemes) have been circulated to some of the most active network members for comments; and numerous lunchtime discussion meetings have been organised for British members at ODI. But production of this issue has been delayed for at least six months for various reasons which it would be tedious to go into. I shall not be so rash to make any promises about the regularity of future issues but I do promise that they will be more frequent. The writing-up of my marathon study for the World Bank was completed last November and, although I have plenty of other things to keep me busy, it should be much easier from now on to block off time specifically for networking activities.

The last Newsletter contained a short questionnaire in which networkers were asked for their views about the kind of character they would like to see this Network take on in future. 27 people replied. Although this is only a small proportion of the total membership (now probably well over the 400 mark), many useful suggestions and comments were offered. The main points were these:

(a) Subject-matter: Respondents' interests were very varied but all fell within the boundaries of the subject of Irrigation Management as originally conceived here at ODI. As we see it, this Network is intended for people from a wide range of backgrounds and disciplines who have a common interest in promoting a better understanding of the human, organisational aspects of irrigation development. It should not be concerned with the discussion of relatively narrow, unidisciplinary, technical issues such as (for example) methods of dam construction, plant-soil-water relationships, techniques of cost-benefit analysis or kinship patterns - except in so far as they may have an important bearing on the central subject. There are plenty of other forums in which single-discipline interests can be pursued.

A particular criticism of earlier Network papers came from Tina Wallace, who complained that there was too much emphasis on the management (and especially bureaucratic management) of established irrigation schemes and not enough on the planning of new schemes and their impact on the societies into which they are introduced. This is a fair criticism and one which has been echoed by other networkers, especially those associated with new irrigation development in Africa. The bias has arisen because my own study has been focussed on the management of well-established projects, mainly in Asia; and issues arising from this study (and others in similar fields) have tended to dominate the discussion papers. In future this Network will aim to give due prominence to discussions about how planning, design and construction decisions are made in practice; why they are so made; what the often very adverse social, economic and environmental consequences are; and what might be done to improve the quality of decision-making. Discussion Paper 1/80/2 should help to start this ball rolling.

Several respondents rightly pointed out that there is a danger of overlap between this Network and the Asian Regional Irrigation Communication Network distributed by the Asian Development Council in Bangkok and coordinated by Don Taylor (20 Jalan Cangkat Damansara, Kuala Lumpur 10-05, Malaysia). We shall try to avoid this as much as possible, though some overlap is inevitable. The ADC's regional network is predominantly research-orientated and provides valuable progress reports and summaries of research studies, nearly all in South, South-East and East Asia, as well as extensive bibliographies. A recent survey of the research studies covered by the ADC network showed that only about 20% fell clearly into subject area categories with which the AAU/ODI network is mainly concerned (sociology/anthropology 12.5%, management/administration 6.3%). 12.5% were described as 'multi-disciplinary'; 26.2% were on technical subjects; and 41.3% on economics.* This network, by contrast, is concerned specifically with questions of irrigation organisation and management; it aims to attract participation from practitioners as much as from academics; it is not regional in character; and one of its most important objectives (still far from being attained, admittedly) is to provide a forum for an inter-disciplinary exchange of ideas and experiences - a sort of postal seminar. We therefore feel that there is plenty of room for both the Networks to continue together, on a complementary rather than competitive basis. The same applies to Irrinews, the newsletter of the International Irrigation Information Centre (P.O. Box 8500, Ottawa KIG 3H9, Canada; and Volcani Center, P.O. Box 49, Bet Dagan, Israel),

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* Asian Regional Irrigation Communication Network, Newsletter No 8, March 1979, p.7.

which is wide-ranging in its subject-matter but tends to be predominantly technically-oriented. As Colin Leakey observed, "we need many sources of information and many fora to exchange ideas".

(b) Newsletter Almost half the respondents thought the Newsletter should not be expanded ("There are dangers in sending out too much, since it tends to get put at the bottom of the pile - shorter matter gets read at once", Ian Simpson).

Others had specific requests for more contributions from network members, particularly in the form of current work, problems, queries ("Members should be prepared to 'ask for help' as well as provide purely informative reports", David Seddon).

There were also requests for select annotated bibliographies and for progress reports and summaries of completed research studies, many of which remain unpublished and/or difficult to obtain. There could be a danger of overlap with the ADC Network here. Many networkers would probably support Robert Chambers's suggestion of "a running annotated bibliography - very select - with a practical bias". However, rather than offer brief summaries of research studies (which the ADC Network does very well) I would prefer to see researchers using this Network as a vehicle for disseminating short discussion papers based on their work (see below).

Further suggestions included critiques of published reports and papers (Chris Dixon), a correspondence section (Raymond Apthorpe) and a list of institutions/individuals in developing countries interested in research/evaluation of irrigation management (A.T.R. Rahman).

(c) Discussion papers A large majority of respondents favoured both descriptive and analytical papers. One of the few who favoured analytical papers only suggested that authors' full addresses should be given, enabling readers to write to them for descriptive information if they wanted to (Deland Welsch). P.D. Goedhart however emphasised the usefulness of detailed information about the way organisations work.

Several people wanted more papers, more regularly(!), though Colin Leakey was kind enough to suggest that informality and irregularity were "probably a good thing!" Raymond Apthorpe seemed to be alone in wanting papers to be longer. Several others emphasised brevity: "short reports on projects" (Tina Wallace, Chris Dixon), "brief accounts of good and bad experience" (Gilbert Corey), "very brief summaries of useful experience" (Robert Chambers).

Robert Chambers had the following specific recommendation: "Put forward a very few provocative propositions and solicit responses, allowing anonymity to anyone who requests it. These responses where possible should cite experience. Concentrate on issues from which people tend to shy away, or on which they have difficulty in focussing, eg:

(i) how to make it rational for irrigation staff to deny water to those who want it.

(ii) whether water rationing by pricing is a red herring (ie impracticable in terms of incentives).

(iii) how to assess the unrealised potential of an irrigation system from improved water allocations".

These issues are taken up in Paper 1/80/1.

There was general approval of trying to get more contributions from network members, both in the form of comments on papers and of discussion papers themselves. Don Taylor saw the generation of a two-way flow of information (not only from writer to readers but from readers to writer) as "ideal for a really productive newsletter undertaking" but, from his own experiences in running the ADC Network, he recognised the difficulties of getting such a system to operate in practice. Nevertheless, several respondents did offer papers, of which some are publicised in this issue and others will appear later. Indeed, an increasing flow of interesting, but still unpublished, papers has been coming to us at ODI over the past year (see Section 4C below) which should provide a lot of very suitable material for discussion papers for several issues to come. We would however strongly echo A.T.R. Rahman's request for more contributions from researchers in developing countries and from administrators associated with irrigation management.

We are particularly interested in 'semi-finished' papers which have not yet been published or had wide circulation. By converting them into discussion papers we should be able to provide a twin service: to the other network members, by enabling them to see otherwise inaccessible material, and to the authors, by giving them an opportunity to receive comments and criticisms from a large inter-disciplinary audience in advance of possible publication elsewhere. One of their main objects, it must be emphasised, is to stimulate discussion: we are not in the business of running a journal. "Once a paper reaches a certain point, it is better published in a journal" (David Bradley); yes indeed, but we are looking for open-ended, questioning papers which have not yet reached that point.

Conclusions There will be at least two sets of Network papers issued every year, each containing one or more discussion papers. Members are encouraged to contribute items to the Newsletter, not only information but requests for help. Most discussion papers will be fairly brief and designed to provoke responses from network members; and a large proportion will be by network members. Though most papers will be quite narrowly focussed, the range of subjects which could be covered is very wide. It includes:

A. Large schemes - planning, design and construction

- The planning process - theory and practice
- Irrigation system design - theory and practice
- Management of construction
- Social impact of new irrigation

B. Large schemes - management

- Division of functions between officials and farmers
- Main system operation (water distribution)
- Water users' organisations
- Water charges
- Maintenance
- Water management extension (at both field and watercourse levels)
- Motivation (of officials and farmers)
- Horizontal structure - coordination of functions
- Social impact (changes in land, income distribution: landlessness, etc.)

C. Small surface schemes

(a) Indigenous - diversion; (b) Indigenous - reservoir/tank;
(c) Government-initiated

- Planning, design, construction
- Internal (farmers') organisation and management
- Organisation and management of external services

D. Groundwater/small lift schemes

- Choice of technology
- Private v. public ownership
- Groundwater legislation/government control over water extraction
- Planning and scheduling for conjunctive use of surface and groundwater

E. Environment/Health

- Management (of soils, people) in upper catchment areas
- Planning and management of drainage against waterlogging, salinity
- Planning and management of irrigation and drainage systems against health hazards.

The new format, which has also been adopted by the other AAU networks, is designed to reduce production and mailing costs. We hope that readers also find it satisfactory.

2. AAU work on irrigation management

The final report of my study on the organisation and management of large irrigation schemes was submitted to the World Bank last November. The text is now being edited within the Bank and there are plans to have it published in the next 3 - 4 months.

During the past year I have also spent two months in Egypt as a part-time consultant on organisation and management to a team from Hunting Technical Services/Binnie & Partners (U.K). The team has been studying past Egyptian experience of land reclamation (ie the extension of irrigation beyond the old Delta lands) and making recommendations for new development in the Salhiya region (between the Delta and the Suez Canal).

Now that the World Bank study is finished, I am beginning to branch out into new areas. I am planning to transfer the focus of my comparative research activities to the management of small-scale irrigation, and the management of soil-and-water conservation in rainfed areas. I also hope to have opportunities to participate in the planning of action research work on large irrigation schemes, as a follow-up to management evaluation studies (see Paper 1/80/1). Other activities will include dissemination, training and consultancy work as well as a possible contribution to a handbook on irrigation planning and design.

Clare Oxby, a social anthropologist who has recently joined the AAU in place of Janice Jiggins, has started working on the social organisation of irrigation. She is looking particularly at various forms of cooperation among farmers in relation to agricultural activities and their involvement in decisions about the building and maintenance of canals; the allocation of water; and the resolution of conflict over water. Clare's work will greatly enhance the AAU's capacity to extend the range of its work in the irrigation management field.

3. Recent/forthcoming meetings

a) A symposium on the performance of the Kosi Project was held in Patna from 22 to 25 January 1979 (for information write to Dr T. Prasad, Bihar College of Engineering, Patna University, Patna 800005, Bihar, India).

b) A workshop on irrigation management was held at IRRI from 26 to 30 March 1979 (for information write to Dr S.I. Bhuiyan, Box 933, Manila, Philippines).

c) A workshop on the management of water resources for agriculture in the Bhavani River basin was held in Coimbatore on 21 April 1979 (for information, write to Professor R.K. Sivanappan, Dean, College of Agricultural Engineering, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India).

d) The 6th Nigerian Irrigation Seminar was held in Zaria from 26 to 28 September 1979 (for information, write to Dr. O.C. Onazi, Acting Director, DALST, Ahmadu Bello University, PMB 1044, Zaria, Nigeria).

e) An international conference on 'Agricultural Production: Research and Development Strategies in the 1980s' was held in Bonn from 8 to 12 October 1979, at which one of the four working groups focussed on water resources (for information, write to German Foundation for International Development, Food and Agriculture Development Centre, Stadionweg 6, 8133 Feldafing/OBB., West Germany).

f) A study seminar on groundwater development, lift irrigation and rural poverty in South Asia was held at Sussex University in November/December 1979 (for information, write to Dr. R. Chambers, Institute of Development Studies, University of Sussex, Brighton BN1 9RE, UK).

g) A workshop on 'Water Bureaucracy and Performance' was held at Sussex University on 29 - 30 November 1979 (for information, write to Dr R. Wade, Institute of Development Studies, University of Sussex, Brighton BN1 9RE, UK).

h) A meeting of a working group on schistosomiasis and water resources development was held at Southampton University from 21 to 24 April 1980 (for information, write to Dr. Jewsbury, Senior Lecturer, Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA, UK).

j) The 3rd Afro-Asian Regional Conference on Management of Water for Irrigation Systems will be held from 23 to 29 October 1980 (for location and details, write to International Commission on Irrigation and Drainage, 48 Nyaya Marg, Chanakyapuri, New Delhi 110021, India).

4. Recent publications, reports, etc.

Many relevant publications and reports have come our way since the last Newsletter was issued. These are listed below, under three categories: (a) books and published articles; (b) papers which are not commercially published but are obtainable from universities or research institutes on request; and (c) unpublished papers. All the papers from the third category and many from the second category have been sent to us by network members. It is from their ranks that much of our material for discussion papers will come. Please continue to send us more. We would particularly welcome more short accounts from practitioners - what W.J. Griffith calls "we did it this way" contributions.

A select, annotated, bibliography of particularly useful works will start in the next issue.

(a) Books, articles

General/Inter-regional

M.G. Bos et al., "Standards for the Calculation of Irrigation Efficiencies", ICID Bulletin, 27,1, January 1978 (Also Reprint No. 8, ILRI, Wageningen, Netherlands)

D.W. Bromley, D.C. Taylor and D.E. Parker, "Water Reform and Economic Development: Institutional Aspects of Water Management in the Developing Countries", Economic Development and Cultural Change, 28,2, January 1980.

I. Livingstone and A. Hazlewood, "The Analysis of Risk in Irrigation Projects in Developing Countries", Oxford Bulletin of Economics and Statistics, 41, 1, February 1979.

W.J. Staub and D.G. Green, "A performance management unit for irrigation agencies", in Proceedings of a Workshop on Implementing Public Irrigation Programmes, East-West Center, Hawaii, 1977.

Peter Stern, Small Scale Irrigation, Intermediate Technology Publications Ltd., International Irrigation Information Center, 1979.

Ludwik Teclaff, Legal and Institutional Responses to Growing Water Demand, FAO Legislative Study No. 14, 1977.

Jaw-Kai Wang and Ross E. Hagan, "Manageability considerations in irrigated rice-production system design", in G. Honadle and R. Krauss (eds), International Development Administration: Implementation Analysis for Development Projects, Praeger, 1979, pp. 112-126.

Carl Widstrand (ed.), Water and Society, Conflicts in Development, Part 1: The Social and Ecological Effects of Water Development in Developing Countries, Pergamon, Oxford, 1978.

Sub-Saharan Africa

Adrian Adams, "The Senegal River Valley: What kind of change?", Review of African Political Economy, 10, September - December 1977, pp. 33-59.

Tony Barnett, "Why are Bureaucrats slow Adopters? The Case of Water Management in the Gezira Scheme", Sociologia Ruralis, 19, 1, 1979, pp. 60-70.

A. Hazlewood and I. Livingstone, "Complementarity and competitiveness of large- and small-scale irrigated farming: a Tanzanian example", Oxford Bulletin of Economics and Statistics, 40, 3, August 1978.

P.P. Mbawala, "Irrigation Development in Mainland Tanzania: the Issue of Farmer Local Organisation - a suggestion", Agricultural Administration, 6, 2, April 1979, pp. 99-109.

J.R. Tuckett, "Vuvulane Irrigated Farms, Swaziland: a Report on the First Ten Years", Agricultural Administration, 4, 2, April 1977, pp. 79-97.

H.H. Walker and W. Graf zu Castell, "The Contribution of Organisation Analysis to the Appraisal of Development Projects - the Example of the Ahero Pilot Irrigation Scheme, Kenya", Zeitschrift für Ausländische Landwirtschaft, 18, 1, 1979, pp. 49-68.

North Africa/Middle East

Fred Scholz, "Irrigation and Nomadism in Baluchistan", Applied Sciences and Development, Vol. XI, 1978 (published by Institute for Scientific Cooperation, Landhausstrasse 18, 7400 Tübingen, West Germany) pp. 90-111.

J.C. Wilkinson, Water and Tribal Settlement in South-East Arabia: a study of the Aflāj of Oman, Oxford, 1977.

South Asia

B.U. Ahmad and E.W. Coward, Jr., "Village, Technology and Bureaucracy: Irrigation Development in Bangladesh", Journal of the Bangladesh Academy for Rural Development, 7, 1, July 1977.

Paris Andreou, "Economic Appraisal of Irrigation Cooperatives in Agricultural Development in Ganges-Kobadak project, Bangladesh", Agricultural Administration 6, 2, April 1979, pp. 111-122.

A.K. Bhattacharya, "Irrigation and water management in the Damodar Valley Corporation", Journal of Development Studies, 15, 1, 1978, pp. 34-58.

Charles Clift, "Progress in Irrigation in Uttar Pradesh: East-West Differences", Economic and Political Weekly, Bombay, 12, 39, September 24, 1977.

M.A. Hamid, S.K. Saha, M.A. Rahman, A.J. Khan, Irrigation Technologies in Bangladesh, a study in some selected areas, Rajshahi, Bangladesh, 1978 (Department of Economics, Rajshahi University, Rajshahi, Bangladesh).

Henry C. Hart, "Anarchy, Paternalism, or Collective Responsibility under the Canals?", Economic and Political Weekly, Bombay, 13, 51/52, December 23-30, 1978.

T.K. Jayaraman, "Peoples' Participation in Command Area Development Programme", in R.K. Arora (ed.), Peoples' Participation in Development Process, HCM State Institute of Public Administration, Jaipur.

Sam H. Johnson III, Alan C. Early and Max K. Lowdermilk, "Water Problems in the Indus Food Machine", Water Resources Bulletin, 13, 6, December 1977.

Sam H. Johnson III, W. Doral Kemper and Max K. Lowdermilk, "Improving Irrigation Water Management in the Indus Basin" Water Resources Bulletin, 15, 2, April 1979.

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V.M. Rao, "Linking Irrigation with Development", Economic and Political Weekly, Bombay, 13, 24, June 17, 1978.

N.D. Rege, "Efficient Management of Canal Irrigation - Need for Hard Decisions", ARDC News, 6, 2, 1977 (Agricultural Refinance and Development Corporation, Bombay).

Ikbal Singh and A.S. Sirohi, "Optimization of Water Resource of Upper Ganga Canal in Western Uttar Pradesh", Indian Journal of Agricultural Economics, 32, 1, January-March 1977, pp. 92-107.

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South-East Asia

Fung Chung-yue, "Alternative methods of implementing irrigation water management" (in Taiwan) in W.J. Staub (ed.), Implementing Public Irrigation Programs, East-West Center, Hawaii, 1977.

J.E. Nickum, "The organisation of water resource development in the Peoples' Republic of China", Agricultural Administration, 6, 3, 1979, pp. 169-186.

Dibyo Prabowo, "Allocation of Farm Resources in the Solo River Basin", Bulletin of Indonesian Economic Studies, 14, 1, March 1978, pp. 45-62.

Donald C. Taylor and Thomas H. Wickham (eds), Irrigation Policy and the Management of Irrigation Systems in Southeast Asia, Agricultural Development Council, Inc., Bangkok, 1979.

Latin America

D. Craig Anderson, Irrigation Institutions and Water Users in Ecuador, USAID, 1977 (153 pp.)

Economic Commission for Latin America, Water Management and Environment in Latin America, Pergamon Press, Oxford, 1979.

Anthony L. Hall, Drought and Irrigation in North-East Brazil, Cambridge University Press, 1978.

North America, Europe

Giulio Cesarini, "Consolidation, Irrigation and Joint Management of Fragmented Small Farms in Southern Italy: a Case Study", Agricultural Administration, 5, 2, April 1978, pp. 145-151.

Arthur Maass and Raymond L. Anderson, ...and the Desert Shall Rejoice: Conflict, Growth and Justice in Arid Environments, MIT Press, 1978 (with case studies from Spain, USA)

Robert Wade, "Collective Responsibility in Construction and Management of Irrigation Canals - case of Italy", Economic and Political Weekly, Bombay, 14, 51/52, pp. A-155-160.

(b) Research Publications

V.N. Asopa et al., "Irrigation system, on-farm development and extension service in Chambal Project, Rajasthan", 1978 (Indian Institute of Management, Vastrapur, Ahmedabad - 380015, Gujarat, India).

Eric Clayton, "A comparative study of settlement schemes in Kenya", December 1978 (Occasional Paper No 3, Agrarian Development Unit, Wye College nr Ashford, Kent, UK).

Colorado State University, "Improving Irrigation Water Management on Farms", Annual Technical Report, June 1977, 650 pp. (Publications Office, Engineering Research Center, Colorado State University, Fort Collins, CO 80523, USA).

W. Clyma, M.K. Lowdermilk and G.L. Corey, "A Research-Development Process for Improvement of On-Farm Water Management", June 1977 (Water Management Technical Report No. 47, Colorado State University, Fort Collins, CO 80523, USA).

H.G. Farbrother, "Water Management in the Gezira and Managil, February 1976 (Technical Notes on Water Use No. 8, Task Force on Water Use, Gezira Research Station, Wad Medani, Sudan).

Sylviane Fresson, "Public Participation on village-level Irrigation Perimeters in the Matam Region of Senagal" April 1978, (Occasional Paper No. 4, OECD Development Centre, 94 Rue Chardon Lagache, 75016 Paris, France).

Richard Heaver, "Planning and management problems in the implementation of a major scheme: a case study of Mahaweli (Sri Lanka)", 1979. (Agricultural Administration Network Paper No. 1, ODI, 10-11 Percy Street, London W1P OJB, UK).

Robert C. Hunt, "The Comparative Method and the Study of Irrigation Social Organization", March 1979 (Bulletin No. 97, Dept of Rural Sociology, Cornell University, Ithaca, New York 14853, USA).

K.P. Kannan, "Socio-Economic and Ecological Consequences of Water Control Projects: the case of Kuttanad in Kerala (India)", March 1979, (Working Paper No. 87, Centre for Development Studies, Ulloor, Trivandrum 695011, Kerala, India).

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Max K. Lowdermilk, Alan C. Early and David M. Freeman, "Farm Irrigation Constraints and Farmers' Responses: Comprehensive Field Survey in Pakistan", September 1978 (Water Management Technical Report No. 48 (6 vols.), Water Management Research Project, Colorado State University, Fort Collins, CO 80523, USA).

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R. Sivanappan and P.K. Aiyasamy, "Water resources of Coimbatore District", 1978 (Tamil Nadu Agricultural University Press, Coimbatore 641003, Tamil Nadu, India).

Norman T. Uphoff, John M. Cohen and Arthur A. Goldsmith, "Participation in Water Management", January 1979 (in "Feasibility and Application of Rural Development Participation: a State-of-the-Art Paper", Monograph Series No.3, Rural Development Committee, Center for International Studies, 170 Uris Hall, Cornell University, Ithaca, New York 14853, USA).

G.F. White (ed.), "Environmental Effects of Arid Land Irrigation in Developing Countries," 1978, (MAB Technical Notes 8, UNESCO, 7 Place de Fontenoy, 75700 Paris, France).

J.W. Wolfe, Farouk Shahin, and M. Saif Issa, "Preliminary Evaluation of Mansouria Canal System, Giza Governorate, Egypt", June 1979 (Egypt Water Use Project, 22 El Galaa Street, Bulak, Cairo, ARE)

(c) Unpublished papers

P.K. Aiyasamy, K. Palanisami and A.F. Bottrall, "Problems in the Planning and Management of Large-scale Surface Irrigation Projects in Tamil Nadu: the case of the Lower Bhavani Project", paper for Workshop on Management of Water Resources for Agriculture in Bhavani River Basin, TNAU, April 1979 (Department of Agricultural Economics, Tamil Nadu Agricultural University, Coimbatore 641003, Tamil Nadu, India).

Syed Hashim Ali, "Water Management in Command Areas of Andhra Pradesh, India", Paper for FAO Expert Consultation on Farm Water Management, Beltsville, Maryland, USA, May 13-15, 1980 (Secretary, CAD Department, Government of Andhra Pradesh, Hyderabad, Andhra Pradesh,India).

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Robert Chambers, (a)"Social Science Research on Irrigation: some priorities and challenges for the next decade", Paper for Irrigation Water Management Workshop, March 26-30, 1979, IRRI; and (b)"In Search of a Water Revolution: Questions for Managing Canal Irrigation in the 1980s", January 1980 (Institute of Development Studies, University of Sussex, Brighton BN1 9RE, Sussex UK).

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Turabul Hassan, "An overview of the Constraints and Practical Solutions of Modern Irrigation - an Indian Experiment: the Pochampad Project, Andhra Pradesh", paper to the Commonwealth Irrigation Management Workshop, Hyderabad, India, 17-27 October 1978 (Administrator, Pochampad Project, Jagtial, Andhra Pradesh, India).

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M. Falkenmark, L. de Maré, G. Lindh and C. Widstrand, Water and Society: Conflicts in Development, Part 2: Water Conflicts and Research Priorities, final manuscript (Nov 1979), to be published by Pergamon Press, 1980.

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George Honadle, "Farmer organization for irrigation water management: organization design and implementation in Bula and Libmanan" (Philippines), Report to USAID, August 1978, (Development Alternatives Inc., 1823 Jefferson Place N.W., Washington, D.C. 20036).

S.K.S. Hussain and N. Seethamaraiah, "Water Use Concept as Design Criteria for Irrigation Systems: case study of Nagarjunasagar Right Canal", paper for the Commonwealth Irrigation Management Workshop, Hyderabad, India, 17-27 October 1978 (SKSH: Chief Engineer, Medium Irrigation and Design, Errum Manzil, Hyderabad 500481, India).

Sam H. Johnson III, "Major Policy issues in the Development of Irrigation in Thailand" Paper for Annual Conference of the Agricultural Economic Society of Thailand, December 13-14, 1979 (Ford Foundation, P.O. Box 436, Bangkok, Thailand).

A.M.H. Kango, M. Ashraf Akhtar and Manzur Ahmed, "On Farm Water Management in Pakistan", August 1979, (Water Management Wing, Ministry of Food, Agriculture and Cooperatives, Govt. of Pakistan, House No. 27, Street No. 17 F-7/2, Islamabad, Pakistan).

Hamidur Rahman Khan, "Water Management Problems in Bangladesh", paper to the Commonwealth Irrigation Management Workshop, Hyderabad, India, 17-27 October 1978 (Professor and Head, Department of Water Resources Engineering, Bangladesh University of Engineering and Technology, Ramna, Dacca, Bangladesh)

E.E. Kikaho, "Mombo Irrigation Scheme" (Tanzania), paper for the Commonwealth Irrigation Management workshop, Hyderabad, India, 17-27 October 1978 (NAFCO, PO Box 903, Dar es Salaam, Tanzania).

Roberto L. Lenton, "Towards Improved models for field experimentation in irrigation management", Paper for Ford Foundation meeting, November 1979 (Ford Foundation, 55 Lodi Estate, New Delhi, India).

Gilbert Levine, (a)"Hardware and Software: an Engineering Perspective on the Mix for Irrigation Management", paper for Irrigation Management Workshop, IRRI, March 1979; and (b)"State of Knowledge Report for the Water Resources Task Group", paper for International Conference on Agricultural Production: Research and Development Strategies for the 1980's, October 1979, Bonn - draft (Water Resources Institute, Center for Environmental Research, Cornell University, 468 Hollister Hall, Ithaca, NY 14853, USA).

Douglas J. Merrey, "Reorganizing Local Level Water Management in Pakistan: a case study", paper for symposium on Desertification and Anthropology, 10th International Congress of Anthropological and Ethnological Sciences, Delhi, December 1978 - draft (c/o Department of Rural Sociology, Faisalabad, Pakistan).

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Tina Wallace, "Rural Development through Irrigation: Studies in a Town on the Kano River Project", draft (since revised), Centre for Social and Economic Research, Ahmadu Bello University, Zaria, Nigeria, November 1978 (Research Unit on Ethnic Relations, University of Aston, St Peter's College, College Road, Saltley, BIRMINGHAM B8 3TE).

5. News and queries from networkers

News

(i) A proposal for a new international centre for research on irrigation was discussed at a meeting of the Technical Advisory Committee of the CGIAR (Consultative Group on International Agricultural Research) in Rome during February 1980. The proposal is for several regional centres in different agro-climatic zones, with one centre responsible for overall programme coordination. A strong case is made in the proposal for making the programme interdisciplinary (engineers, agriculturalists, social scientists) and focussing it on problems of system operation. The proposal is reported to have been well received at the Rome meeting and is due to be discussed further at another meeting of the TAC this summer. Network members who (a) wish to learn more about this initiative and/or (b) would like to express their support for it, should write to me at ODI. Letters of support will be forwarded to the Secretary of the TAC.

(ii) The Area Development Commissioner, Chambal Project, Kota, Rajasthan, India, reports that two mobile water magistrates have been provided to the Command Area on an experimental basis with the object of reducing water stealing and wastage offences. An interdisciplinary committee has also been set up to consider improved methods of main system water scheduling.

(iii) Professor R.K. Sivanappan (Dean, College of Agricultural Engineering, Tamil Nadu Agricultural University, Coimbatore 641003, Tamil Nadu, India) reports the initiation of a pilot 'action research' project designed to improve water and farm management practices in a 545 acre area commanded by a branch distributary of the Lower Bhavani canal system. The pilot project involves collaborative action between the TNAU, the State Department of Agriculture and the State Irrigation Department.

(iv) K. Palanisami (Department of Agricultural Economics, Tamil Nadu Agricultural University) is engaged in evaluating the performance of the PAP canal system in Tamil Nadu; and also in helping Dr. Sivanappan to prepare an Operational Manual for the Lower Bhavani system.

(v) Dietrich Gebauer (an engineer with the GTZ, Eschborn, West Germany, at present at the Agricultural Extension and Rural Development Centre, University of Reading, UK) has been working on the 220 ha. Mombo scheme in Tanzania and is interested in possible ways of introducing water users' groups and common irrigators into the scheme.

(vi) B.V. Nimbkar (Phaltan 415523, Satara District, Maharashtra, India) is president of an independent agricultural research institute. Among its studies has been one of the performance of lift irrigation schemes in the Nira valley. The schemes have had serious problems, partly because of eroded soil but also because of inadequate and uncertain water supplies: "Shortage of water was a problem common to all the lift schemes. The pumping capacity of each lift is planned so that crops planted under it should get one irrigation every fifteen days, but in practice this never happens. There are many reasons for this - planting unauthorised extra acreage, giving more than the stipulated quantity of water to influential members, interruption in the electricity supply, closure of the canal , the pumping mechanism going out of order, etc. The result is delays in irrigation, which is received once every 20 to 25 days, sometimes even once a month, instead of every 15 days. Under these conditions crops, not just in shallow soils but even in medium soils, dry up and their yield goes down." A familiar story. The institute is investigating possible ways of improving the situation.

(vii) Ir. H. de Zeeuw (Project group "The Small Farmer and Development Cooperation" P.O. Box 211, Wageningen, The Netherlands) has reported on the progress of the work of his group, which is studying small-scale irrigation projects. The group has been reviewing relevant literature and developing evaluation criteria. Its field study evaluations of project organisation and management will probably be mainly in Africa. There are plans to follow the field studies with a workshop and the implementation of experimental projects. The group is very interested in cooperation with other institutions concerned with evaluating irrigation management and organisation.

(viii) Rod Ryman (Agricultural Economist, Proyek Pengembangun Air Tanah, Kotak Pos 55, Kediri, East Java, Indonesia) is a member of Hunting Technical Services working with a team led by Sir M. MacDonald and Partners, Consulting Engineers, on the Kediri-Nganjuk groundwater project. Farmers' water management practices have been monitored in some detail and Ryman has attempted to correlate the efficiency of farmers' water use with the effectiveness of their water users' associations (particularly as reflected in the extent to which farmers pay water fees to these associations). Ryman has also written a paper on alternative farm-level irrigation strategies and their implications for irrigation channel losses,which is being circulated to selected network members for comment. A summary of any discussion that emerges will be given in a later Newsletter.

Queries

(ix) Mike Long (agriculturalist with the Tank Irrigation Modernisation Project, District Agricultural Extension Office, Anuradhapura, Sri Lanka) writes: "At present open channels supply traditional rice paddy lands, with all the problems of tail-end users and satisfying demand. My own view is the inescapable need for a disciplined approach." An engineering colleague has recently been trying to set up pilot areas served with low-pressure pipes, for the supply of surface irrigation through orchard valves. The object behind this is to provide farmers with a "limited rate demand schedule" which, it is believed, will remove the need for discipline among users. The technique is said to be "gaining popularity in the States and worldwide". Long, however, is sceptical; his view is that "it may be all right for a high value, low water demand crop where the supply is metered and chargeable, but it simply will not work here at this time".

Some comments on this issue have already been offered by Melvyn Kay (National College of Agricultural Engineering, Silsoe, UK) and Roberto Lenton (Ford Foundation, New Delhi, India), but further reactions from network members would be welcome. Correspondence should be addressed to Mike Long direct, with copies to us if possible. The discussion will be reviewed in the next Newsletter.

In addition to correspondence on this particular issue, we should be very interested in other contributions (in the form of letters, draft papers) on experiments in irrigation technology designed to overcome (or at least reduce) the problems of water allocation and water conflict which are found on most irrigation systems with a large number of small-farm users.

(x) Asit K. Biswas (76 Woodstock Close, Oxford OX2 6HP, UK) has been asked by ILO to prepare a report on the "application of labour-based methods for executing large irrigation works: scope and limitations". The report will be based on existing literature. We have already suggested the names of several networkers who might be able to give him information about relevant papers and reports, but there are no doubt many others who could help. Please write direct to Dr. Biswas.

(xi) David Seddon (School of Development Studies, University of East Anglia, Norwich NR4 7TJ, UK) would like to see a discussion developing within this Network about water pricing, with comparative empirical material from different irrigation projects. In particular, he asks: "If 'reasonably high water charges are desirable' (Irrigation Management Network Paper 1/78/2, para. 14), how to determine what is reasonable?" Network members who have comments (or perhaps papers) to offer on this issue should write to Seddon, with copies to us if possible. These could well form the basis for a future discussion paper. Discussion Paper 1/80/1 contains some observations on water charges and incentives, which should have some relevance to Seddon's concerns.

6. Lunchtime meetings at ODI

The following lunchtime meetings have been held at ODI since the last Newsletter was circulated:

a) 9 January 1979: Dr. James Nickum, "The Chinese approach to water resource development and management" (Center for Chinese Studies, 12 Barrows Hall, University of California, Berkeley CA 94720, USA).

b) 17 September 1979: Professor R.K. Sivanappan, "Problems of water management in Coimbatore District, Tamil Nadu (Dean, College of Agricultural Engineering, Tamil Nadu Agricultural University, Coimbatore 641003, Tamil Nadu, India).

c) 29 January 1980: Syed Hashim Ali, "Critical issues in irrigation utilisation and command area development" (Secretary, Command Area Development Department, Government of Andhra Pradesh, Hyderabad, India).

d) 14 March 1980: Linden Vincent, "Efficiency in design, underutilisation in practice: a study of water use in the Medjerda irrigation scheme, Tunisia" (School of Development Studies, University of East Anglia, Norwich NR4 7TJ, UK).

e) 25 March 1980: Jennie Dey, "The socio-economic organisation of farming in the Gambia and its relevance for agricultural development planning" (Pineacre, Church Brampton, Northampton, UK).

f) 29 April 1980: Herbert Farbrother, "Irrigation operations: the need for new career structures and training courses" (7 The Lanes, Over, Cambridge).

7. Other AAU activities

AAU Occasional Paper 3, Institutions, Management and Agricultural Development, was published in 1979. It is concerned with developing methods of assessing organisational and management factors which could be incorporated into regular appraisal and evaluation of agricultural projects and programmes in developing countries. It contains the following papers:

"Institutions and Culture: Problems of Criteria for Rural and Agricultural Development Projects" (Janice Jiggins and Guy Hunter).

"Assessing Management and Organisations for Agricultural Development Projects (John Howell).

"Monitoring Management Performance in Agricultural Projects" (Ian Carruthers and Eric Clayton).

"The Appraisal, Monitoring and Evaluation of Agricultural Extension Programmes" (Deryke Belshaw).

"Evaluating Organisation and Management: A Proposed Methodology for use on Large Irrigation Projects" (Anthony Bottrall) - a revised version of Network Paper 1/78/3.

Price £2.00. Available from ODI Sales, Montagu House, High Street, Huntingdon, Cambs PE18 6EP, UK.

Members in developing countries may be interested to know that Policy and Practice in Rural Development (ed. Guy Hunter, A.H. Bunting and Anthony Bottrall, Croom Helm, 1976, 512 pp.) is now available in the Educational Low-priced Book Series (ELBS) for £2.35 (as against £14.95 for the original hardback edition and £6.95 paperback). This book contains the major papers from the second International Seminar on Change in Agriculture, which was held at Reading University in 1974 and focussed on issues in agricultural administration and management. ELBS editions can be obtained in developing countries only. They may be ordered at any bookshop within these countries. Bookshops can obtain the volumes from the publishers, Croom Helm Ltd, (2 - 10 St. John's Road, London SW11, UK) provided they state that the ELBS edition is required.

Two recent issues of the Agricultural Administration Newsletter (produced by John Howell and Clare Oxby) came out in November 1979 and March 1980. Each was accompanied by a discussion paper (Alan Kingshotte on agricultural extension in Botswana; and Clare Oxby on rural development and traditional institutions in Hausaland); several further papers are available on request from Angela Street, AAU, ODI.

Further papers in the Pastoral Network series, organised by Stephen Sandford, were issued in March, July and December 1979.

8. An Invitation

Networkers from overseas who plan to visit the UK are cordially invited to come and see us in London. For those who would like the opportunity to talk to an interdisciplinary group of people about their work in the field of irrigation planning and management, we would be glad to organise lunch-time discussion meetings at ODI. The organisation of these meetings takes time, however, and in such cases we would appreciate at least six weeks' advance notice, if possible.

9. A Last-minute Request

The Food Production & Rural Development Division of the Commonwealth Secretariat helped to sponsor a workshop on irrigation management in Hyderabad, India in 1978 (See Network Paper 1/78/2). Subsequently several countries have sought assistance in planning and managing large scale and small scale irrigation schemes, and in training their staff for these functions.

Although there are no definite vacancies just at the moment, the Secretariat is anxious to build up a roster of irrigation engineers, agronomists, administrators and trainers with practical experience in irrigation management who would be interested in short or long term assignments in developing countries of the Commonwealth. Applicants should have considerable experience of planning, managing and training staff for irrigation schemes in a range of situations. They must have a multidisciplinary approach.

Any member of the Network who feels he or she fits into this category, and is interested in undertaking such an assignment, is requested to write to: Antony Ellman, Food Production & Rural Development Division, Commonwealth Secretariat, Marlborough House, Pall Mall, London SW1Y 5HX. The Secretariat may also wish to sponsor trainees from developing countries of the Commonwealth for relevant courses in other countries. If any member of the Network runs or can recommend appropriate training courses, he or she is also requested to write to Antony Ellman.

May 1980 Anthony Bottrall

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AGRICULTURAL ADMINISTRATION UNIT

Irrigation Management
Network Paper 1/80/1
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MORE ON EVALUATING ORGANISATION AND MANAGEMENT

This is a follow-up to my (Anthony Bottrall's) paper "Evaluating the Organisation and Management of Irrigated Agriculture", with particular reference to the questions raised in the accompanying note (Network Paper 1/78/3). It contains two sections. The first reports network members' views on points raised by the earlier paper; the second consists of my own reactions to three central questions in the evaluation of irrigation management on which Robert Chambers suggested our attention might usefully be focussed.

I Comments on Network Paper and Note 1/78/3

Not many people sent in substantial comments, but those who did had many valuable things to say and I am most grateful to them for the time and thought they gave to the matter. I found them very helpful when working on my final report to the World Bank and many of their ideas have been incorporated or subsumed into other papers written since. A revised version of the original paper has been published in AAU Occasional Paper No. 3 (Institutions, Management and Agricultural Development); and some themes were further elaborated in a paper called "Evaluation and Action Research as Tools of Management Reform", which has been issued as Agricultural Administration Network Paper No. 5 (available on application to ODI). The report for the World Bank, which contains much detailed case study material and runs to about 300 pages, should be published this autumn as a Bank Staff Working Paper.

These comments should, of course, have been relayed to other network members a long while ago. However, most of them are fairly timeless and are as relevant now as when they were written. So, better late than never.

Respondents' Experience and Perspectives

Two people pointed out that my approach to evaluation had been based on exclusively Asian field experience, whereas their own experience had been mainly in Sub-Saharan Africa, where large-scale irrigation almost always implies settlement schemes and a more tightly co-ordinated management structure. N. S. Carey-Jones, previously an administrator in Kenya, commented on "the need to make a distinction between what are irrigation settlements in new areas, when the whole system, both water supply and agriculture, can be worked out together and what are essentially water supply schemes for already settled areas, with their own customs and ways, and where the supply of water is intended to *influence* farmers' practices or, perhaps no more than improve their output."

Similarly Christopher Swan, a civil engineer: "My comments are made from rather a different background of experience than that from which you quote - the Sudan rather than Asia. The difference is that in the Sudan the irrigation schemes developed on virgin land for people who were not originally agriculturalists - and it has a profound influence on the initiation and the subsequent operation of a scheme. I was engaged on operation and maintenance on the Gezira Scheme for some years and also on a much smaller scheme - the Gash scheme in the Eastern Sudan. You should bear this background in mind when considering my comments."

Another respondent whose experience appears to have been mainly in Africa, but also perhaps in Latin America, is P. J. Slabbers, of the International Institute for Land Reclamation and Improvement, Wageningen, Holland. Nigel Lloyd on the other hand, wrote that his comments were based on six months' experience in Indonesia, working as an engineering adviser on irrigation service operation and maintenance. The only other respondent quoted here, Birnie Evans, writes from the perspective of an industrial management consultant who has developed an interest in irrigated agriculture.

1. Methodology

Slabbers: "I agree in general with your methodology but get the feeling that your approach is completely based on a "top-down" management approach. Additional insight into the performance of an irrigation project could be gained by a "bottom-up" approach, taking into account aspects as: what was the target group at the time of initiating the project? How has co-operation and solidarity among this group been promoted by the project? Was its dependency (and therefore risk) increased or decreased? What was the effect of the project on intra-family situations? It is becoming increasingly evident that in changing from traditional dryland to irrigated agriculture the role of the farmer's wife has often been neglected leading to serious social stresses. I consider the above aspects as important criteria (or indicators) for evaluating the organisation and management of irrigated agriculture. The factor risk and dependency could, at least partly, be included in your productivity indicator (stability of production). The indicator equity could be expanded by evaluating "equity" among sexes, and group solidarity. Also here the management (or group's) reaction to water shortage could be included as an indicator of solidarity and equity.

"A second field of interest could be to evaluate present performance of the project versus the planned performance. There is a need to incorporate experience of existing irrigated agriculture into the planning of new projects. As an example: with what accuracy do we need to "know" the water requirements of crops at the planning and design stage when compared to actual irrigation practice? To what extent is it justifiable to spend resources in refining estimates of crop water requirements for the purpose of planned irrigation, particularly in the case of small schemes?"

(Several others, including participants in the Hyderabad workshop at which the paper was first presented, have criticised it for taking too "top-down" an approach. This arose partly from my focus on the activity of water distribution on large gravity systems and the role of the professionals who inevitably have an important part to play in that activity and from the fact that water flows downhill. However, I acknowledge that there was not sufficient emphasis in the paper on the importance of trying to find procedures and institutions which would help farmers put pressure on management to be more accountable to them.)

Carey-Jones: "I would have given more emphasis to the farm economics aspect, since the returns to the farmer, large- or small-scale, will ultimately decide the fate of the project. As soon as one moves into this side, one is also concerned with marketing arrangements, prices, etc."

And he adds, more in the context of regular internal monitoring by management than in that of an external evaluation: "It might be useful if you could pick out some vital questions which, if answered favourably, would avoid the necessity of a comprehensive investigation but, if answered unfavourably, would require further specific investigations into other questions - rather in the form of a "logical tree". If the farmers are doing all right, no further questions. If they are not, then why, and proceed to question 2, 3, 4, until one finds the answer. This would be more practicable, as a continuing management process, than your checklist."

Swan: "It seemed to me that your checklist in Appendix A was rather over-concerned with civil engineering works. Such essential engineering aspects as evaporation, infiltration rate, available moisture range, salinity, leaching requirement are absolutely fundamental and should be included. Also Appendix A makes no mention of plant, both heavy engineering plant and agricultural equipment, nor of stores. The workshops, stores and administrative set-up required to handle and maintain these items is one of the most important wings of an irrigation organisation."

Lloyd: "A fundamental problem is the selection of variables by which O & M can be measured and its progress monitored. These variables should be objective indicators of the performance of O & M tasks, enabling comparison between different areas and time periods. The efforts of individuals and local offices should have a discernable effect on the variables, so that success and failure can be measured. Ultimately it is the crop yields that measure the success of irrigation. However so many other factors also influence crop yields that additional indicators are needed. For the Irrigation Service the success of its O & M should be reflected in the variables mentioned in Appendix A (productivity, equity, environmental stability, cost and cost recovery).

"The lack of good indicators hampers project management as they do not know how well they are performing, and this is reflected in disagreements as to the goals towards which they are working. For the irrigation service it would seem to me that the goals for operations should be:

a) to minimise water losses

b) to distribute the water as planned (the plan may be either to maximise equity or to maximise production, the two being potentially conflicting aims)

c) to supply the water reliably so that farmers may depend upon it and make full use of it.

"Maintenance is a subsidiary role, ensuring that operation goals can be achieved. My experience here (*in semi-humid predominantly rice-growing Java*) has been that the biggest single obstacle to good maintenance is the absence of any concept of what the perfect state of a particular irrigation system should be. Maintenance work therefore tends to be continual expedients to try to maintain the supply of water, and the control of water becomes less and less possible. For example, most downstream areas now receive their supplies from dammed drains. The dams were built with Irrigation Service permission after the losses in the conveyance canals were so large that downstream areas were no longer in command. The losses were high because upstream farmers had no need to maintain channels to ensure an adequate supply of water to their fields and downstream farmers were too distant from the point of loss to perform the necessary maintenance. The drains run full because upstream farmers take excess water. By damming the drains the downstream farmers once more acquire water and the source is now close to their land. However the system has become too complex for the Irrigation Service to control and it is no longer possible (even theoretically) to distribute water equitably between upstream and downstream farmers. The situation is also retrograde as water losses are increased and the drains no longer perform adequately during the rainy season.

"The omission of any measure of the complexity/controllability of an irrigation system seems to be a shortcoming in your methodology. It is inherent in irrigation systems that the more complete the integraion of the different water resources and the greater the degree of control, the more potentially efficient will be the use of those resources. The erosion of the central authority, and the increased self-reliance of the villages - each building its own headworks and only maintaining the local canal system - leads to an overall loss of irrigation water and crop production."

2. Are there any good reasons why this kind of analysis of management and institutions should not be made a regular component of project appraisal and evaluation?

Slabbers: "No". Carey-Jones: "Yes, lots. To deal with your checklist would be a major exercise and could not be a regular thing. (Your estimate of a team of three to do it in three weeks ignores the burden of work this would put on all those on the job who would be required to dig out and supply them with information. I know very well the enormous amount of distracting work that staff has to put in to meet the demands of investigators. There was recently a complaint published in Development Dialogue about this by an economist-planner from Botswana.) Where it is useful is to give anyone looking at a project an idea of the kind of questions that he should be asking."

Swan: "I can think of many reasons why the kind of analysis you describe could be made to fail. Such evaluations are very difficult and unless the authorities concerned and the management really want to know the truth and are prepared to discuss their problems frankly, they are better not attempted. I can visualize such an enquiry, agreed to under pressure from a financing agency, ending in disaster. However, where the enquiry can be carried through with candour it would be invaluable to the entire profession. What a pity such reports are nearly always confidential."

3. Development of norms for project staffing and funding

Carey-Jones: "I am very doubtful about the realism of trying to establish staffing norms. Of course, in planning, one often has to do this. I have done it in settlement schemes, since in formulating a project to obtain funds one has to provide staffing figures. This however, is not really done on a carefully worked out basis, since one does not have the necessary information. One knows that one will do better with more and better staff, and one pitches the figure as high as one thinks those financing the project will stand. One does not expect the figures to be adhered to, neither area by area nor function by function, and one expects the field staff to re-deploy them accoring to the needs that arise."

Evans: "On the parallel of industry, staffing norms are exceedingly difficult to establish. Even where plant is identical, different set-ups seem to manage to need different staffing. But this should not discourage the attempt: at least it gives a starting point from which to ask questions."

(I agree. Planners always want simple yardsticks about optimum levels of staffing for their cost calculations. But the amounts of finance and staff required to manage a project efficiently depend critically on other factors - skills, motivation, operational procedures, organisational structure - which should be closely examined in the course of evaluation. An important function of any action research programme concerned with irrigation management should be to identify more accurately the quantity and quality of staff required for good management - see Section II below.

Lloyd and Slabbers referred to a paper for ICID by Bos and Storsbergen on "Irrigation Project Staffing" (ILRI Reprint No. 9, Wageningen). Lloyd described it as "very simplistic... but a useful yardstick which one may use to help press for more resources to be devoted to O & M." A methodologically sounder approach to the issue is taken by I. Haiseman, "Generating skilled manpower for irrigation projects in developing countries: a case study of Northwest Mexico", Water Resources Research 7, 1 February 1971).

4. Examples of procedures used in practice for monitoring water losses, levels of crop production, and equity of water distribution between head and tail reaches.

Swan: "Information of this kind should be available for the Gezira scheme. It certainly used to be. Monitoring of health and in particular bilharzia simply cannot be overemphasised.

"On a technical point, you say in para 10 that "estimates of main system losses can be made from an inspection of the records by comparing water deliveries at the headworks with the sum of deliveries to the watercourse heads". I think that would be a very difficult thing to do, for two reasons: firstly you would have to integrate a fluctuating flow over a season at as many watercourse heads as are on the system, and secondly because the calibration of canal gates is often very inaccurate. On the Gezira we knew the calibrations were faulty but never tried to adjust them because our water control was not direct - so many cubic metres - but always an adjustment - such and such a gate opening a centimetre up or down. On the other hand the minor canal offtakes were all accurate. I think you would get a more reliable estimate by comparing estimated consumptive use of the crops with the headgate delivery, which might be the one gate with an accurate calibration.

"This leads me on to Appendix A Part III 15.3 where you discuss the need for measuring devices at all control points down to watercourse head. I would like to suggest that accurate measurement is needed at one level as far down the system as is administratively possible. Given such measurement, more approximate methods (such as gate calibration or pump ratings) are appropriate at all other levels of the system."

Lloyd: "Indicators 9.1 (Changes in crop areas and yield over time), 9.2 (Output per unit of water delivered) and 9.3 (Water losses) are easily measured (with the exception of watercourse and field losses). Measures of equity are more difficult as they involve measuring variation and in my opinion the standard statistical parameters are too abstracted from every day experience to be meaningful to most personnel. It is also difficult to arrive at a measure of equity for one canal system that can be compared with that for another, particularly for 10.4 (variations between areas with different water rights), 10.5 (variations between heads and tails of watercourses) and 10.6 (variations between large and small farmers). It is hard to avoid the arbitrary choice of representative areas. Indicators of environmental stability are easy to define and measure (except perhaps for 11.4 (upper catchment areas). Cost figures are of great importance but it is the efficiency with which it is spent which is of real significance and that is very difficult to measure.

"We are hoping to introduce the routine reporting of:

a) percentage conveyance losses for each irrigation system between water sources (head works, etc.) and tertiary canals.

b) the variation (measured as a mean difference from the average) of both the water supplied per ha. and the water provided per "polowijo relative area" (the nominal basis for water distribution in East Java).

"It is difficult to collect production figures for irrigated crops other than rice and sugar cane. Even for these crops the sampling techniques lead to gross systematic errors. I am not sure that it is realistic to expect to gather reliable data for such a wide variety of crops (some intercropped) grown in such small land parcels, no matter how desirable it might be."

Carey-Jones: "All the water information that you mention is, I am sure, necessary, but I would emphasise (a) "visits... so that farmers' views on water availability can be obtained" (but this should be the responsibility of the irrigation manager), and (b) "a detailed farm survey". The point being that when these two show up something wrong, then the other things need to be investigated."

5. "<u>Project managers are rarely given the necessary tools by higher-level planners and administrators to do their jobs adequately.</u>"

Swan: "I see a number of references in the paper to limitations on the power of project management. In para. 13 you say that deficiencies in technical design and in high level planning are beyond the capacity of senior management to control or remedy. Again in para. 17 it is suggested that basic aids (O & M manuals, maps etc.) are the responsibility of an agency of higher level than the project. In para. 28 you list a number of activities that can only be decided by policy makers "at the highest level". I am sure you are reporting what you found but it seems an inherently weak system. My own experience has been happier. For example in the Gash, the Board met twice a year at the project headquarters with the Manager and Chief Engineer in attendance. They met at no other time; and all decisions on finance and policy were hammered out there. All other decisions were left to management."

Carey-Jones: "I suspect that the projects that you studied were typical! You are here at the crux of administration. Responsibility cannot be given, or taken, unless there is agreement between giver and taker on both ends and means. This, however, is an ideal situation; in practice, people are promoted to posts with insufficient resources. If they complain, the answer is that there are no more resources. But they do not ordinarily resign. In effect, when this happens, neither the giver nor the taker really gives or takes responsibility and administration is weakened. (Nevertheless, some people can achieve twice the results of others with the same resources.)

"I was somewhat unhappy about the emphasis you put on formalised procedures and their being followed. Obviously there will be kinds of activity for which these are necessary, but there will also be kinds where they will not. The responsibility for preparing these lies with the very local managers, so that they are adapted to the needs of their situation. You cannot really give someone responsibility for doing a job and then tell him precisely how he is to do it. If you do then you are taking the responsibility, not he."

(Some others have also expressed unhappiness about the emphasis on formalised procedures. The reasons for this emphasis were two: a) the astonishing absence of even the most basic guidelines on some Asian irrigation systems; b) the particular need for procedures and rules to govern the distribution of as scarce and valuable a common resource as water. Clearly one must guard against rigid procedures which give the manager no choice or responsibility, but a prototype framework/guidelines worked out by a higher-level research/planning body seems an essential precondition for good irrigation management.)

Evans: "The industrial parallel of "middle management" is striking. They always feel - and are - crushed between the weight of top management and the unyielding bed of the work force; and generally feel that their tools are inadequate. But they are very much "managers", with or without handicaps."

Slabbers: "I agree with your conclusion. I have had the same experience in Chile and Tanzania and similar observations have been made for irrigation projects in Kenya."

6. Examples of cases where governments have consciously favoured pursuing the objectives of maximising returns per unit of water and/or spreading the benefits of irrigation, by cultivating less water-demanding crops.

Slabbers: "An example of aiming at spreading of the benefit of irrigation on a small scale is the Kibirigwe Irrigation Project in Kenya, which is now coming into production. Water is supplied to 230 acres for 265 farmers. The average farm size per farmer is about 8 acres (of which about 0.9 acres thus is irrigated). The extra cost of irrigation (sprinkler) layout is made for the purpose of spreading benefits."

Don Taylor (working in South-East Asia) has given considerable thought to the competition for water in the dry season in many parts of South-East Asia between rice and other less water-demanding irrigated crops (sometimes called 'upland crops'). He emphasises the greater degree of water control required for upland crops than for paddy rice; and indicates the importance of carrying out economic analyses of (1) alternative methods of irrigating upland crops, e.g. check-basin, furrow, alternate furrow, sprinkler and trickle; and (2) producing upland crops versus paddy on land which is suitable for both types of crops. He has written a paper on "The management of irrigation water for, and the economics of, producing upland irrigated crops in East Java, Indonesia" (paper for National Seminar on Upland Irrigation in Malaysia, Cameron Highlands, October 1978).

7. Information about good project manuals, etc.

Lloyd: "An O & M manual has been produced for use in East Java. It was written initially in English and translated into Indonesian. The purpose was to provide a manual outlining the tasks of irrigation workers at the 3 lowest levels (irrigation scheme, sub-section and section (there are 36 sections in East Java)). The manual is necessarily general, since it covers all irrigation schemes in the province. We are at present working on an "Irrigation scheme manual" which will be for a particular scheme and will act as a model for the preparation of one for each major scheme in the province. These manuals are far from perfect, but are nontheless useful."

8. Identifying causes of poor performance - dealing with the unquantifiable

No comment.

9. Resources required for evaluation

Swan: "The resources you estimate for the evaluation seem to me to be reasonable provided the staff employed are very highly experienced in this particular form of enquiry. If they are not, the enquiry would not be worth while anyway, so probably you are about right. But the experience needs stressing. Obviously a great deal of tact is also essential."

Evans: "Your numbers seem reasonable; but can the engineer really cover agriculture?"

Carey-Jones: "The real problem here is not so much the evaluation resources needed (in the terms given by you) but the quality of the evaluators. Quis custodiet ipsos custodes?[1] Who evaluates the evaluators? Who will, alas, bring their own preconceptions (good or bad) to the evaluation? There seems to be an assumption here that the evaluators will be some sort of archangel or demigod, not subject to the human frailties of the managers. My own experiences suggest that they are somewhat less than that, and some evaluations can be so much rubbish. And interests will determine approval or disapproval of the evaluation or parts of it."

Lloyd: "From my experience it is essential to collect information oneself, as even (especially?) the maps and organisation charts that one is shown are grossly incorrect and misleading. We are about to distribute a questionnaire and will check its validity by completing the questionnaire ourselves for five irrigation schemes. I fear that the validation exercise will merely prove its lack of validity."

10. Single Command Area agency: universally desirable?

Swan: "I agree with you fully on the need for unified management. On a small scheme, career structure demands that engineers, agriculturalists and others should be seconded; but if that is for a fixed period, the man in question should be able to give his full loyalty to the project provided the project is truly autonomous."

Carey-Jones: "The Command Area seems both desirable and necessary, but under the Ministry of Agriculture, please. Then the appropriate administrative boundaries can be arranged.

"There are obvious advantages in not loading a Ministry of Agriculture with a lot of high grade hydraulic engineers,etc. and of contracting out major construction work to an engineering organisation such as a Ministry of Works, which will have other technical branches besides water that it can call upon (and which another ministry cannot so readily call upon). But after construction, the operation and maintenance of the system should be the responsibility of the agriculturalists. This is because the object of irrigation is to improve the farmers' lot and this responsibility lies with the Ministry of Agriculture."

Lloyd (writing with the Javanese context in mind, which differs greatly from the African context): "The problem of boundaries is surely fundamental and intrinsically insoluble: boundaries for different purposes will not be coterminous. The best partial solution is to ensure that the basic areal units, either for responsibility or for data collection, do not cross boundaries. Data can then be aggregated in different ways for

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1 "Who will guard the guards?" (Juvenal, Roman satirist, 1st Century A.D.)

comparison with data collected by other bodies."

Slabbers: "This is a much debated and studied issue in many developed and developing countries. A number of UN (FAO) and IBRD missions have made recommendations to governemnts on this subject, especially on organisation at Ministry level. Some Central and Latin-American countries (Peru, Mexico) have evolved co-ordination through the establishment of irrigation (or soil and water conservation) districts where Agriculture and Irrigation join in operating irrigation projects. The subject is too complicated and broad to elaborate on in this letter."

(Slabbers is right: the degree of horizontal co-ordination between engineering and agricultural specialists which is appropriate or feasible in a particular case is contingent *on several factors. Of these, the most important appear to be the size of the project; the nature of its objectives and key activities; and the capabilities and background training of the specialists concerned. This point is discussed in detail in my report for the World Bank.)*

11. <u>System operation as a separate function from maintenance, requiring a separate cadre of water distribution specialists</u>

Lloyd: "Among the recommendations being implemented in East Java, is the separation of design from O & M in order to boost the prestige of O & M and prevent the majority of effort going into the design of new work."

(This separation of functions is different from the one advocated in my paper. As a short-term measure designed to increase the prestige of O & M (and particularly O) it appears to have merit. The two cadres I had in mind were: a) water distribution specialists, solely responsible for operation but also involved in system design; and b) construction and maintenance specialists, who would similarly be involved in design work. One question which concerned me was whether the civil engineers, if deprived of operation work, could be found another mixture of activities which would sustain their interest in taking up field management posts.)

Swan: "It is only natural that civil engineers should prefer design and construction work to operation and maintenance. But I think the average civil engineer would be perfectly happy with fairly small scale works, provided the conception, design, budgeting and execution were all his own responsibility. That is an uncommon opportunity. In the Sudan each maintenance engineer had two budgets; current and capital. Extensions of area, drainage works, additional structures and modifications to layout as found necessary, were all budgetted for and finally executed by the maintenance engineer who was, of course, best qualified to judge what was needed."

12. Promotion of junior irrigation staff and other incentives

Carey-Jones: "There is much more to motivation than staff salaries and promotion policies. I imagine that in this case devolution of clear responsibility would be the chief motivator."

Lloyd: "We (the advisory team in East Java) shall probably suggest the introduction of incentives in the form of annual competitions between sub-sections and sections."

Swan (on the motivation of senior staff): "The disinclination of senior staff to live out on the scheme is a very difficult problem, to which a lot of attention should be paid. Since it is vital that senior staff should live on the scheme, presumably financial inducements must be offered?"

13. Communication between irrigation staff and farmers about water supply and demand

No examples were given of effective techniques of transmitting supply and demand information. Prof. A. Sundar (Indian Institute of Management, Bangalore, India) has written in a recent letter: "I believe that many of the problems between head and tail reaches can be minimised, if sufficient public pressure is brought about. If information on the availability of water at different minors and sub-areas are known to all irrigators or at least to a large number of irrigators, there are chances of public pressure being brought on the authorities."

(Agreed; but could we have some reports about specific cases where improved information systems have been introduced, please?)

14. Examples of efforts to improve main system water distribution practices

Lloyd: "I would agree that redistribution of water between head and tail farmers will probably lead to the greatest single increase in cropping. We are hoping to carry this out on a pilot basis in the forthcoming dry season, but will have nothing like the resources available to Valera and Wickham (in the Philippines). Again it seems to me to be partly a problem of not having an easily measured and understood variable for the inequality of water distribution. Below the tertiary head, the Irrigation Service here has no control and little influence."

15. Need to examine management practices both on the main system and within the watercourse rather than within the watercourse alone.

No disagreement.

16. Evaluations of 'on-farm development' programmes (watercourse and drainage improvement, land levelling,etc)

Swan: "My own experience is that it is often very difficult to provide an economic justification for on-farm development of an existing scheme. By the time allowance has been made for benefits resulting from additional or more secure supplies of water, for improved farming methods and increased inputs, the further increase in yield to justify the very costly work of development seems rather unlikely."

Lloyd: "You may be interested in the following rice yield figures for a three sample plots in a single irrigation scheme in Mojokerto. One sample plot was in a Pilot Tertiary Project where division structures were provided below the tertiary head, and the quaternary canalisation rationalised. The PTP construction was completed in August 1976 and a colleague, Martin Burton, took a close interest in its operation until November 1977."

Year	Wet Season (April-October) PTP	Other sample plots		Dry Season (October-April) PTP	Other sample plots	
1973/74	66	61	55	46	45	47
1974/75	68	60	61	53	62	57
1975/76	66	60	57	45	60	59
1976/77	0*	15*	20*	75	56	61
1977/78	86	68	63	52	46	47

* Attacked by brown hopper (wereng) March 1977.

(The three sets of figures underlined relate to the period after completion of new construction in the PTP tertiary area. A longer series of figures is needed before any clear conclusions can be drawn. And results would also have to be weighed against costs, of course.)

Slabbers: "In the period 1970-1974 a large program of on-farm irrigation and drainage development was carried out in Chile by a special Government Service for this purpose (DICOREN) The Dutch Government has been financing on-farm development in the Chao Plain in Thailand, which is now being expanded through World Bank financing. The Dutch engineering bureau EUROCONSULT (22 Beaulieustraat, Arnhem, Holland) has been and is implementing this work."

17. Water-users' groups: channel-based or village-based?

No comment.

II Three key questions about water allocation

Robert Chambers (Institute of Development Studies, University of Sussex) has suggested that our search for realistic solutions to many of the central problems of management on large irrigation schemes could be advanced by focusing debate on three key questions about water allocation:

(a) How to make it rational for irrigation staff to deny water to those who want it;

(b) Whether rationing water by pricing is a red herring (ie impracticable in terms of incentives to farmers);

and (c) How to assess the unrealised potential of an irrigation system for improved water allocation.

I offer some brief comments of my own below to start things moving.

1. How can it be made rational for irrigation staff to deny water to those who want it?

This is probably the most important single question in irrigation management. Wherever water is scarce, there will always be powerful pressures on staff to misallocate it; and they will find it rational to comply with these pressures - thereby destroying the quality of water service provided to other less well placed users on the same system - so long as the unofficial rewards obtainable from misallocation outweigh the official rewards of operating the system efficiently and equitably.

The combination of measures which might be contemplated in any particular situation will depend on the nature of the present official system of rewards and sanctions, the structure of power among the water users, and the degree of management reform which is administratively and politically feasible. But whatever the room for manoeuvre which can be identified, two things are likely to be generally true: (a) major changes in salary and promotion patterns will not be possible in the short term (assuming that the staff are officials of a government department and are therefore locked into a national system of public service pay and promotion regulations); and (b) procedural changes alone will not be enough.

Whereas with an activity like agricultural extension, procedural changes can by themselves bring greater job satisfaction (by doing his job well, the field-worker will generate a demand for his services from his farmer clients instead of being regarded as useless, and will thereby gain in local status), it is not so with water distribution. In doing their job well, field staff will inevitably make themselves unpopular with many of the locally influential water users and will stand to lose an often substantial source of unofficial income. A package of remedial action will therefore almost certainly be required. In the short term, the following components are likely to be the most feasible, because the least controversial.

(a) Procedural reforms: Clear definitions of responsibilities within the water distribution agency and between it and the farmers; improved information systems (information on water availability, planned distribution schedules, modifications in schedules to farmers; information on local variations in water demand from farmers); increased farmer participation in decision-making (discussion of seasonal water distribution plans; monitoring of day-to-day supply patterns); increased consultation with, and monitoring of, junior staff; effective legal sanctions against malpractices, both by farmers and officials.

(b) Training: In-service training to senior irrigation staff in techniques of water distribution (with particular emphasis on the agricultural, demand side of the equation) could bring major benefits, not only in terms of improved technical performance but greatly enhanced morale. Instead of being seen as a routine, low-status activity, system operation would be shown to be a complex task requiring a unique combination of specialist skills. Increased pride in their work among senior staff would raise the morale and status of the service as a whole. Junior staff could also no doubt profit from training, but this would need to be combined with some relaxation in present promotion rules if the training was to be an incentive rather than a source of frustration.

(c) Formation of effective farmers' groups at the watercourse level: not only to carry out operation and maintenance work within the watercourse area, but to monitor the performance of the water distribution agency. For the latter purpose, a hierarchy of representative committees would subsequently need to be established at higher levels - eg for each distributory command and at the project level. In many societies group formation will be a difficult and time-consuming task (and one might wonder why irrigation staff should have much incentive to perform it enthusiastically). If the system of farmer representation is to be representative of all interests, and not only of the most powerful and well situated, special provision will need to be made for the compulsory inclusion of tailenders and small farmers at all levels of the organisational hierarchy. *(Suggestions are invited as to how this might be done, with reference to particular examples if possible).*

More far-reaching changes in the organisational structure of the service agency would usually be possible to contemplate only in the longer term. A particularly interesting innovation which might be considered in the longer term, perhaps initially on an experimental basis, would be the introduction of measures designed to increase the financial autonomy of irrigation agencies at the project or Command Area level. In place of the present pattern found in many countries whereby the proceeds of farmers' water and land taxes are entirely absorbed into general government revenue, a substantial proportion might be retained by the field irrigation agency for local reinvestment in improved physical infrastructure and services. Such a pattern of payment, which is a feature of the Irrigation Association in Taiwan, can make it possible (where it was not possible before) to establish a direct link between the amount of money farmers pay and the quality of service they are given in return. It provides an obvious incentive to staff to provide a better service to the farmers and increase their accountability to them, through the creation of the cycle: bonus payments to staff - better service to farmers - increased payment by farmers - increased bonus payments.

2. Is rationing water by pricing a red herring?

In my view, it has been a red herring, at least on large surface irrigation systems. Many economists have expended a great deal of effort and ingenuity on advocating various different methods of marginal pricing, volumetric charging, etc. in the apparent belief that these measures, and these measures only, will persuade farmers to use water sparingly and economically. But their proposals have been beside the point. Not only is strict volumetric charging practically impossible on large canal systems with huge numbers of small-holdings, but arguments in favour of marginal pricing presuppose a free market in water. This is not the case on most large systems, nor does it seem desirable on equity grounds that it should be. Most large canal systems in developing countries are inevitably fairly inflexible in their pattern of operation and are supposed to be run on a strict rotational basis: the object is to ration scarce water as efficiently and equitably as possible among a multitude of users. If water has been made scarce to all users through such a process of strict rationing and they are regularly informed about the timing and quantity of deliveries, each user should be strongly motivated to use it as sparingly as possible, whatever he pays for it. The potential *value* of the water, rather than its cost, will be his main criterion.

This does not mean to say that the pricing of water is not an important issue. Charges for water (or for the service of providing water) are important for two main reasons: (a) as a source of revenue to government, in return (or part return) for the investment it has made in irrigation; and (b) in the interests of greater inter-regional equity, as a tax on the relatively privileged section of the agricultural community which has benefited from access to irrigation water. As a source of revenue to government the payment of water charges can also have important implications for the quality of irrigation management. The larger the revenue obtained, the more there is available to be returned to irrigation projects in the form of much needed increases in recurrent finance. If changes in the conventional manner of payment could be introduced on the lines described in paragraph 1 above, so as to give project agencies greater and financial autonomy, water charges could have a very important part indeed to play in improved irrigation management.

Most of the economists seem to me to have been asking the wrong questions, in the wrong sequence. The first requirement is satisfactory management of water distribution. If this is ensured, farmers will be relatively willing (or at any rate less unwilling) to pay water charges; and these will then help to reinforce good management, particularly if a substantial proportion is kept back from general revenue for local reinvestment. Of the two main questions which have tended to preoccupy economists, the <u>level</u> of charges paid is clearly important, but the <u>method</u> of charging seems to be less so, except where very high standards of irrigation management have already been established: some sort of quasi-volumetric charge seems the most desirable and feasible. Another very important question - <u>where</u> the proceeds should go - appears to have been largely ignored by economists.

3. <u>How can one assess the unrealised potential of an irrigation system?</u>

(In amplification, Chambers comments: The question here would be whether there is a relatively simple procedure which can be followed in examining an irrigation system, on which one could get a figure, however approximate, for potential increases in production and potential improvements in equity. If there were such a method, it could become a very powerful tool indeed for securing change in organisation and management.)

The basic logic of what one should be trying to do here, as an evaluator or assessor of a particular irrigation scheme, seems to be fairly clear. First, assess current performance (total production and the pattern of variation in production levels between different areas and categories of farmer, with a given quantity of water available). Second, assess the upper limit of what the irrigation system, as at present constituted, would be <u>technically</u> capable of achieving with the same quantity of water. Third, adjust downwards to obtain a figure of what might be <u>administratively</u> feasible under an assumed (but realistically attainable) level of improved management. This gives you the <u>potential</u> level of performance. The difference between this and actual performance is the <u>unrealised potential</u>, which could be achieved through reforms in organisation and management.

However, there are likely to be considerable difficulties in practice. The technical assessment of potential could turn out to be very time-consuming if much of the necessary data were unavailable or unreliable. *(See the comments of Lloyd and Swan in Section I above, paragraph 4. But we should be most interested in comments about the minimum data requirements on which a reasonably confident assessment of technical potential could be made.)* It would be still more difficult to attach a figure to administrative potential without any chance to test out alternative management methods in the field - although, of course, planners do make assumptions about administrative potential every time they make an assessment of project benefits!

An assessment of unrealised potential is certainly something that should always be tried in every evaluation of an irrigation project, and it could begin to have an important impact on opinion once more concrete demonstrations began to appear in the field of the benefits obtainable from management reforms. Suggestions for improving the methods of analysis involved would be valuable.

In the meantime, there seems to be a very strong case for trying to test the benefits of management reform through field experiments. There is enough evidence now to suggest very strongly that the returns to improved main system management could be very high indeed in many circumstances (including the IRRI experiments in the Philippines reported by Valera and Wickham).[1] But there is still a lot of resistance to the idea of improved main system management and many of the sceptics will require very powerful 'proof' before they begin to be convinced. The kind of action research programme I have in mind would need to be carried out on a selected section of a large irrigation system (in the manner of IRRI's experiment on a 5000 ha distributory command in the Philippines). Its principal objectives would be:

(a) To devise new procedures and institutional arrangements, of the kind discussed in paragraph 1 above, which would be tested and modified (under closely monitored but administratively replicable conditions), with a view to identifying the reform measures most likely to succeed in similar environments;

(b) To provide a visible and convincing demonstration to politicians, administrators and farmers of the precise benefits - and true administrative and financial costs - of these reforms;

(c) To provide training to officials and staff charged with responsibility for extending lessons from the experimental area elsewhere.

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1. In FAO Farm Management Notes, 5, January 1978 (or copies available from ODI).

The difficulties of designing and implementing an operationally useful action research programme of this kind should not be underestimated. There are two main problems.[1] The first concerns the way in which the programme is initially designed. It is essential that the design should be based on a correct identification of the major current impediments to better performance - so it should always be preceded by a comprehensive evaluation. This point requires particularly heavy underlining in view of the already fairly well established tradition of pilot experiments in relation to large irrigation schemes. Many of these experiments have been wrongly designed, because they have been based on unsubstantiated assumptions as to where the main problems lie. Owing to the technical bias which tends to pervade irrigation planning, all considerations of main system management have been excluded. The consequence has been a misplaced focus on exclusively technical issues on the main system and on a combination of technical and institutional issues at the watercourse and farm levels.

Anthony Bottrall

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1. On these, see Roberto Lenton, 'Field Experimentation and Generalization in Irrigation Development and Management', paper to 17th Annual Convention of Indian Society of Agricultural Engineers, New Delhi, February 1980.

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AGRICULTURAL ADMINISTRATION UNIT

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NEW IRRIGATION SCHEMES: PLANNING, DESIGN AND SOCIAL IMPACT

There is no shortage of publications by technical experts and economists which discuss how irrigation projects ought to *be planned and designed, in some sort of ideal world. However, very little detailed research appears to have been done on the way in which planning and design decisions are taken in practice.*

In a review of recent socio-economic research on irrigation Don Taylor *reported that quite a few studies of policy and planning had been carried out by economists - but most of these, we suspect, were concerned with evaluating the results of planning rather than analysing the actual processes of decision-making. He also noted that economists had done little research on design and construction (and other social scientists presumably even less). This, he believed, reflected* "the relatively late entrance of economics into the field of irrigation and perhaps also a perspective that decisions on design and construction are primarily technical in nature" *(Asian Regional Irrigation Communication Network No. 8, March 1979, p.37.) We would agree that the technical aspects of design and construction work have helped to keep social science researchers of all kinds away from this area. But when it comes to studies of the decision-making process - and this applies as much to planning as to design and construction - there is another very powerful reason for the lack of detailed research. This is the often high degree to which the process is permeated by politics.*

This should not surprise anyone. We know that those who are responsible for distributing water on already established *irrigation schemes are often subjected to powerful pressures to misallocate it: by extension, one should expect that those responsible for planning the allocation of investment in new irrigation facilities would be placed under still greater pressure. There are also large financial rewards to be gained from construction contracts, as everybody knows. In between the processes of planning and construction, the detailed design of irrigation systems is a largely technical and, in itself, unpolitical activity; but that very point can be used, in any political economy analysis, to explain the frequently poor quality of design work - lack of concern for design details being a reflection of the much greater potential for political and financial rewards associated with planning and construction.*

Although we are never likely to see much detailed formal academic research on these subjects, owing to their sensitivity and the difficulty for outsiders in gaining access to documentary and other relevant evidence, they have been receiving increasing critical attention in recent writings on irrigation.

This is a very encouraging development. Greater public discussion of weaknesses in the planning, design and construction of irrigation projects, as well as in their subsequent management, helps to increase the pressure on those responsible to account for their decisions. It also helps to demonstrate the need for a radical change in investment priorities: a shift away from an excessive preoccupation with new capital investment (which continues to dominate all macro-projections for food and irrigation requirements to the year 2000) towards investment designed to improve the quality of decision-making, through changes in present planning and design procedures and the development of new training curricula and reward systems.

This paper contains a number of excerpts from recent critical writings on the planning, design and social impact of irrigation schemes. They are grouped into two sections, the first concerned with India, the second with West Africa.

India

Much of the recent criticism in India has come from people working inside the government administration - and its impact on policy has been all the more powerful for that. In the early 1970s a series of blistering attacks on the government's current irrigation policies - priority to large new surface systems ("the disease of giganticism"*), engineering-dominated planning and design - was launched by* B.B. Vohra, *then Additional Secretary in the Ministry of Agriculture, New Delhi.* (1) *Authors of three of the four excerpts quoted here are also insiders.* A Vaidyanathan *(now at the Centre for Development Studies, Trivandrum, Kerala) has had long experience of working in the Planning Commission, New Delhi;* A.K. Sinha *is Director of Agriculture, Government of Haryana; and* Syed Hashim Ali *is Secretary, Command Area*

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(1) ODI still has some copies of his booklet Land and Water Problems in India (1975) and would be happy to supply them to network members free so long as present stocks last.

Development Department, Government of Andhra Pradesh. Only K.P. Kannan *(also at the Centre for Development Studies, Trivandrum) writes as an outsider looking in.*

1. Project formulation and appraisal *Vaidyanathan's comments were made during a review of papers presented to a conference of agricultural economists (see* Indian Journal of Agricultural Economics*, 33, 4, October - December 1978). They refer to the planning of all kinds of agricultural projects, including irrigation projects.*

Formulation: It is apparent that formulation of agricultural projects suffers from several serious deficiences. These include inadequacy of basic surveys, major changes in project scope and design after approval; incomplete coverage in the sense that all the ingredients which determine the eventual outcome of the project are not included in the project proposal; the general failure to explicitly evaluate alternative location, designs and use of resources generated by the project before its design is finalised; and the failure to view individual projects in the wider sub-sectoral/regional perspective, keeping in view the needs and possibilities of each sub-sector/region, the constraint of resource availability and the relative priorities attached by the Government to different social objectives.

The obvious question for consideration is why, after nearly three decades of planning, the concerned agencies of the State and Central Governments failed to build up organizations and procedures for eliminating these defects which everyone recognizes to be widespread. Among the possible explanations are: The rapid turnover in the leadership of the bureaucracy and at the political level generally tends to reduce the time horizons of decision-makers. The persistence of a bureaucratic set-up in which the general purpose civil servant holds sway over professionals and specialists has not been conducive to building organizations in which the latter would inevitably play a prominent role. Integrated planning of related activities and programmes, which is particularly important in agriculture, is also the more difficult to achieve because of (a) the fragmentation of planning and decision-making for this sector at the ministerial and civil service levels, and (b) the inherently difficult and sensitive questions of institutional reform which they involve. There is also the tendency for political power centres to view and demonstrate their performance in terms of the number of projects they are instrumental in getting approved and started irrespective of whether the projects are sound and irrespective of the number which can be efficiently implemented within the given overall resource constraints.

Appraisal: At the conceptual level, despite considerable advances in evaluation techniques, the prevailing practices remain crude and highly heterogeneous. There is hardly any systematic institutionalised procedure for *ex ante* project evaluation with proper consideration of alternatives; and estimates of cost and benefits are hardly subject to critical scrutiny on well-defined objective criteria ... *(Discussion of required improvements in procedure follows.)*

... At the same time, improvements in procedure cannot be divorced from the institutional setting in which they operate. It is worth considering why even where, as in large irrigation projects and rural electrification, some systematic evaluation is attempted, the results are not satisfactory...

2. Project planning in Haryana *The full text of the paper by Sinha from which the following extracts are taken is also to be found in IJAE, 33, 4, October - December 1978.*

Soon after the formation of the State of Haryana in late 1966, an increasing awareness of the necessity and desirability of augmenting irrigation facilities for agriculture, especially in the chronically drought affected areas of the State, was visible in public policy. The result of the enhanced emphasis and the reassigned priorities was the formulation and implementation of three sizable lift irrigation projects in the district of Bhiwani...

The three projects of Jui, Loharu and Sewani canal systems were formulated by the State Department of Irrigation and also implemented by it. The basic objectives were socio-economic: to prevent frequent occurrence of droughts by providing surface water irrigation facilities and to improve the levels of living of the people and the quality of their life. It was admitted that lifting water for irrigation, on account of adverse slope, was very costly, but it was also stated that this was essential to help the hitherto hapless people of the area.

(An inquiry into the performance of the projects in 1976 revealed that they were operating at levels far below those hoped for by the planners: eg, against a planned irrigation intensity of 62%, actual intensities were found to be 25% for Jui, 11% for Loharu and 9% for Sewani.)

An enquiry into *the process of formulation* showed that the objectives of the Projects lacked clarity and priority. While the social objective was not even analysed, the economic objective, expressed in terms of quantification of incremental production, was based on questionable assumptions. Even though agricultural statistics may not be very reliable, there were some Farm Studies available, as also the results of crop-cutting experiments and the district averages of crop yields and crop patterns but the formulators of the projects seemed to have been blissfully unaware of these. Thus, even as the projects were stated to be famine-protection orientated, they were projected to have a palpably exaggerated and an unbelievably high plus benefit-cost ratio (as high as 9:1 in the Jui 1 Original Project Report).

In fact, the Projects, even though they were primarily agricultural projects, were conceived as isolated irrigation projects, as ends in themselves, and they do not seem to have been conceived or formulated (or implemented) as inter-disciplinary exercises. No economist, agricultural economist or management expert participated in the process of formulation nor was any serious attempt made to collect ... or even to cross-check data or, wherever collected, to present a systematic interpretation ...

The projects also did not provide for ... field channels for distributing water carried by (the) canals ... No provision was made for such other land development works as land levelling, soil erosion, minor irrigation, etc., essential for proper utilization of water so provided. The projects also did not speak of any inputs and services such as credit, fertilisers, agricultural machinery, seeds, etc., that would be necessary for the proper utilization of the water brought by these projects and thus no linkages were provided for. Further, there was no concept of timeliness or adequacy of water cropwise nor any effort made to consider proper utilization of available water ...

A deeper investigation into the benefit-cost analysis showed that the knowledge of this concept was incomplete and the calculations made exhibited an untrained mind ... There was no attempt made at analysing the social, or even the economic cost, of the projects and only simple financial mathematical exercises were made to justify the benefit-cost calculations. The concept of optimization of water as a resource was also nowhere examined although it was admitted to be a costly input. And finally, no mention was made of the social benefits that would accrue, which was indeed an avowedly basic objective of these projects.

An enquiry into *the process of implementation* showed that while the irrigation canals were completed in record periods, which spoke of an excellent level of engineering skill, an integrated view of development was all along missing ... The programme of agricultural extension and services was left to remain a part of the general plan of the Agriculture Department, the supply and regulation of water in canals a part of the function of the Irrigation Department, credit and fertilizers largely left to the Co-operation Department and agricultural implements and machinery, seeds, storage, etc., by the State's numerous public undertakings.

Thus there was, and is, not only an absence of integrated approach at the formulation and the planning stage but also at the implementation stage. This was further complicated by the emergence of multiple specialised agencies charting their own courses, determining their own schedules and deciding their own speed. The proliferation and multiplicity of agencies without a framework and a central objective was bound to create confusion ... The problem was aggravated by the non-conformity in the territorial jurisdiction of these Agencies and the lack of adequate delegation of powers to field officers ...

An attempt *to appraise* the performance vis-a-vis the projecttions showed that the projects, inevitably perhaps, did not envisage a reporting system, an appraisal procedure, a review mechanism or an evaluation organization. No changes in the existing bureaucratic procedures of Governmental administration were conceived or proposed or attempted, except that the personal supervision was tightened in view of these projects falling in the then Chief Minister's Constituency. No format or proforma for reporting progress - failures, achievements, problems and bottlenecks - were devised nor any regular and comprehensive data feedback system proposed, except that which was already existing in the individual Departments ...

While appraisal of irrigation canal system was vigorous, perhaps due to the fact that the projects had serious political implications, no overall appraisal of the project projections and performance was ever attempted or made. Even a *post mortem* evaluation has not yet been attempted in a scientific manner ...

In the absence of a central objective, realistically quantified parameters, a concerted plan of implementation, and non-participation of agricultural economists at any stage, a meaningful appraisal or evaluation could hardly be considered feasible. This could be perhaps the story of many irrigation-oriented agricultural projects in the country and there seems to be an implicit agreement among administrators about not placing an adequate emphasis on the appraisal or evaluation of projects

3. System design in Andhra *The following extract from a paper by Hashim Ali (for the Commonwealth Workshop on Irrigation Management, Hyderabad, October 1978) focuses on deficiencies in the conventional methods of canal system design in Andhra Pradesh. One of the particular problems in Andhra, as in other parts of Central and Southern India, has been that the designers' (ie. civil engineers') calculations of canal capacities continue to be based on crude and outdated assumptions about the water 'duties' of different crops. The 'duty' concept was originally developed for the design and operation of canals in relatively homogeneous and water-abundant rice areas. It has proved totally unsuited to the conditions of more recent irrigation projects, in which water supplies are much scarcer, soils have widely varying characteristics and the cropped area is supposed to be divided into separate 'irrigated dry' (non-rice) and 'wet' (rice) zones.* (1)

The designing of projects is done in isolation by irrigation engineers, though a formal consultation is made by the Department of Agriculture. In one recent case it was observed that in a project where some disciplines were enforced on account of a World Bank loan (such as constructing separate distributaries/minors for wet and irrigated dry zones, and designating heavy soils and low lying areas as wet zones), the second stage proposals of the same project did not keep this in view; and when the Department of Agriculture was consulted on a scheme covering an area of over a million acres, comments of only a few lines were given without touching on all the modernisation which had been introduced in the first stage of the same project. The reason being that neither in the Department of Irrigation nor in the Department of Agriculture has expertise been built up to deal with problems of water management. Projects therefore continue to get designed and constructed towards the end of the 20th century with the techniques of the 19th century. While the project is still under construction or soon after its completion, modernisation proposals (which are construction proposals) are again made, without first trying to operate the system in a proper manner ...

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(1) For a detailed criticism of the 'duty' concept and its consequences in Andhra, see S.K.S. Hussain and N. Seetamaraiah, "Water Use concept as design criteria for irrigation systems: case of Nagarjunasagar Right Canal" (Newsletter, p.12).

The basic reasons for this seem to be that the syllabus for civil engineering in many Universities is a generalist course dealing with structures. There is no specialised course after the basic degree for specialisation in irrigation. Any specialisation in the form of a Master's degree does not enhance the promotion prospects except for sanctioning a few additional increments to the engineer with higher qualifications. There is no special course on canal operation. The departmental codes defining the duties of all ranks do not specify the task of operating the canal. Any suggestion for improvement in operation is followed by proposals for construction. "An Engineer is not concerned with where the water goes as long as the canal is kept open and it goes somewhere" (Robert Wade). There are very few minors in any irrigation system in which the last outlets get the designed discharge and therefore there is a tail-enders' problem in each distributary, in each minor and in each Chak (watercourse command). Supply of water to those lawfully entitled is not taken seriously. Alternative methods of scheduling water, rotation in the distributary system, insistence of night irrigation and other administrative measures are generally not thought of.

Traditionally the potential is said to be created when water is let out in the system, but in practice the potential is declared sometimes even without construction of minors, not to say of watercourse outlets. The canal system is incapable of being operated in the absence of cross regulators, control structures and the low estimation of transmission and system losses, resulting in the actual command area being much less than the original command area. Projects which started with a low financial estimate and with high command area end up with high actual expenditure and a lower command area. Even where it was known during the construction that water would not go beyond a particular mileage in the main canal system, the system was constructed along with distributaries and minors, an expenditure which could have been avoided. All these factors result in water becoming the most serious constraint in any project for anyone dealing with development. The farmers are so unsure about water reaching their outlets or fields that any effort at systematic land development is hampered by the lack of faith of the farmer as to whether the water would really reach him ...

It was therefore decided that land development should be taken up only subsequent to the release of water and irrigation engineers would see that water had reached each outlet before giving the details. Even after following this system, it was found that as the outlets were designed to operate at full supply level whether they were located at the beginning of the minor or at the end of it, the last few outlets could never get the designed discharge.

This basic miscalculation resulted in the situation that, when two minors had to be selected ... in each project for the introduction of rotation system (warabandi) below the outlet, not a single minor could be found in which each outlet was capable of discharging the designed discharge. In the two smallest minors selected for the purpose ... an expenditure of nearly Rs.10,000 (c.US $ 1300) was necessary to make the minor function as originally designed. The magnitude of the task in a project with several thousand outlets can easily be imagined.

4. Impact of a water control project in Kerala *Kannan's paper is not primarily concerned with irrigation, but his study of the socio-economic and ecological consequences of a water control project in Kuttanad, Kerala, makes many points which are highly relevant to the discussion of irrigation planning and design. The extracts below provide a brief description of the project and a summary of the study's conclusions about weaknesses in the planning process. Those interested in the detailed findings should read the full text (in Centre for Development Studies, Trivandrum, Working Paper No. 87, March 1979).*

Kuttanad is a low lying area covering 874 sq. km in the Kottayam and Alleppey districts of Kerala. About 304 sq. km are garden lands with an average elevation of one metre above sea level, presently used for paddy cultivation. The area below sea level is annually subjected to severe flooding during both the monsoon periods. About 80 km comprises the Vembanad lake and various water courses. Population density is 1,128 persons per sq km for the whole area, and effective density in the cultivated area is much higher. Nearly 40 per cent of the labour force consists of agricultural labourers. Kuttanad has a high literacy rate (72 per cent) and a high level of social and political consciousness, which has enabled the poor to organise and secure many trade union rights; but this has not been matched by any impressive measure of economic progress.

Efforts to develop Kuttanad as a rice growing area began more than a century ago. Since the flood waters carry a large volume of fertile silt, it was recognised quite early that if the flood waters were effectively regulated, much of the low-lying land could be used to grow a rich rice crop. *(Early land reclamation and flood control works, mostly carried out privately, led to the expansion of one-crop paddy areas. In the 1930s the possibility of raising two paddy crops was explored.)* Studies identified the speedy drainage of the floods during the north-east monsoon season and the prevention of saline water incursion during the summer months into the Vembanad lake as the preconditions for intensifying paddy cultivation in the region. The project however was given concrete shape only some two decades later and consisted of (a) a Spillway, meant to drain off flood waters, (b) a Regulator, meant to check the intrusion of saline water, and, (c) a 42 km long link road between Alleppey and Changanacher. The Spillway was eventually commissioned in 1955. Construction of the Regulator started in 1958 but was still incomplete when it was commissioned in 1974. The road also remains incomplete, mainly due to the non-completion of 3 connecting bridges.

The Spillway failed to discharge the designed rate of flow of 64,000 cusecs, thereby proving to be far less effective in keeping down the flood level in Kuttanad than had been expected. As for the Regulator, within four years of its commissioning, a number of unexpected adverse effects, both on farming and on the general population of the region, have come to surface. These adverse effects, which are believed to be gradually intensifying year after year, are broadly as follows:

(a) a sharp decline in the catch of shrimps and fish; these are brought into the Vembanad lake along with the incursion of saline water and grow best in saline waters mixed seasonally with fresh water in the lake;

(b) a phenomenal growth in a particular type of aquatic weed, locally known as African Payal, with serious adverse effects on the cultivation of paddy, and transportation and fishing; and

(c) the pollution of fresh water in the lake and other watercourses in the Kuttanad area caused by the African Payal; and the interruption of the natural ebb and flow of tidal water into and from the water body, with adverse effects on the health of the population in the region ...

... The water control projects in Kuttanad have affected all the sub-systems of the environment, viz., physical, biological and human. Through changes in the quantity of water in terms of level and discharge during summer and in its quality in terms of growth of nutrients and level of salinity, the physical sub-system has been affected, adversely and perceptibly. This has, in turn, interfered with the biological sub-system, affecting adversely the availability and composition of the fish population and the rapid spread of aquatic weeds like the African Payal. The changes in the physical and biological sub-systems have had their impact on the human sub-system as well; the fishermen in the region, as a group, have been the worst hit; but other sections have been affected. The general population, particularly the poorer sections, has been experiencing problems of transportation and public health. A number of factors, both technical and institutional, have contributed to such a state of affairs.

A number of technical flaws in design and construction, could be pointed out. The location and design of the Spillway, decided upon without adequate examination of the oceanographic and hydrological features of the area, is a case in point. Equally serious have been the defects in the design and operation of the Regulator, particularly the occurrence of saline water incursion at different places at different points of time in the Vembanad lake and consequent spread of water in the surrounding paddy fields. The design and execution of projects was vested exclusively with technical experts, and non-technical parameters were totally ignored. But the reasons for the neglect of non-technical parameters does not seem to be entirely accidental; it has strong institutional undercurrents and the backing of the political and economic power of the local vested interests.

Since the construction of the approach channel to the required specifications needed the acquisition of land belonging to the powerful farmers, who refused to oblige, the project authorities had to reduce the channel to a size much smaller than warranted by technical requirements. This constitutes one of the main reasons for the discharge of flood waters through the Spillway on a much lower scale than required. The neglect of non-technical parameters and the cutting down of the size of the projects to suit the convenience of powerful sections of the population takes us directly to the question of institutional constraints on developmental efforts.

So long as intensification of paddy cultivation remained remumerative, farmers, who constitute the dominant section of the local population, showed little concern for the economic and ecological consequences of the operation of the Regulator on other sections, particularly the fishermen (constituting about 20,000 families), coir workers and other small commities of workers. Once the additional crop ceased to be profitable and the ecological effects of the Regulator mounted and affected the farmers themselves, a big hue and cry ensued about the harmful consequences of the Regulator in whose construction the engineers and contractors, not to speak of the politicians, had enjoyed the full support and active cooperation of the farmers ...

While agricultural labourers in Kuttanad belong to the poorer section of the population, they are a powerful political force ... They looked upon the projects with high hopes of increased employment and earnings. Only when the adverse ecological effects of the projects surfaced themselves and began ruining the additional paddy crop were the agricultural labourers of the regi[on] awakened to the hazards and dire consequences of these projects.

The lives of the people had begun to be in danger long before the paddy crop was first affected. But the point to be emphasized here is that no attempt, even after the experience of these adverse effects, has been made to examine them beyond the routine scrutiny of engineering details. A proper perspective of development in which the broader economic, social and environmental factors play a crucial part is conspicuous by its absence. The need to go beyond engineering and narrow economics is self-evident. It is not enough to bring out the costs and returns, either private or social. That private profitability calculation is not the relevant criterion in the evaluation of public projects is accepted in principle by many, but seldom recognised in practice. Even social benefit-cost calculations which help to provide a broader framework for project analysis do not go beyond attempts at systematic incorporation into the analysis of both direct and indirect effects. On the one side, social benefit-cost analyses are beset with a number of quantification and valuation problems; on the other, they are inadequate for understanding the impact of the projects in terms of their interaction with other projects and social and economic processes at work in a given region.

Public project analysis being a crucial problem in the planning process, only an interdisciplinary approach in which the technological, economic, social and environmental factors are analysed within a common perspective of development, might help to provide a realistic picture of what is likely to happen. It is evident that the acceptability of a project would revolve round issues such as the sections of the population benefited, the sections which bear the brunt of the social costs and the different impact of the projects on the overall levels of living of the different sections of the population. These are primarily political issues the meaningful resolution of which, in the framework of a democratic pluralistic society, would require the active participation of the people. Academicians and technicians would be rendering an invaluable service to the people if they could make honest attempts to articulate properly the variety of issues involved and offer meaningful alternatives.

West Africa

The context of new irrigation development in West Africa is substantially different from that in India. For example,

(a) Large-scale irrigation has a long history in India, as in many other parts of Asia, but is only a relatively recent phenomenon in West Africa;

(b) Historically there has been a much greater degree of dualism in West Africa between the production of cash crops and that of food crops; whereas in most parts of India choice of crop is left largely to the farmer (within constraints imposed by price policies), the pattern of cash crop production in many parts of Africa has been strongly directed by external development agencies, both in the public and private sectors; and

(c) Many of the riverine areas of West Africa which have been identified by planners as suitable for new irrigation development are not only already quite densely settled (in contrast to many of the areas in which East African irrigation schemes have been located - e.g. Gezira in Sudan, Mwea in Kenya) but also have complex land tenure patterns.

These factors have had important consequences. First, much of the planning, design and construction of new large-scale irrigation has been carried out by expatriates, either in an advisory or directly executive capacity. Second, even where the principal objective of new irrigation schemes has been increased food supply, the leading crops have been given the status of cash crops and the forms of management envisaged for their production have been those traditionally reserved for cash crop projects: the favoured pattern, adapted from schemes like Gezira or Mwea, would have a powerful project agency directing the production activities of farmers (short-lease tenants to the project) through a 'closed' or 'integrated' management system (1). Third, the existence of settled agriculture and complex tenure patterns has created problems for planners accustomed to designing new irrigated settlement *schemes in less densely populated areas of Africa. Their tendency seems to have been either to try to by-pass existing customary forms of social organisation for agricultural production entirely by setting up 'modern' irrigation schemes in parallel (as in* Jennie Dey's *account from The Gambia); or to try to impose a regimented settlement-type management in an already settled area (as in the Northern Nigerian cases discussed by* Tina Wallace *and* Richard Palmer-Jones). *Both approaches are likely to bring adverse social consequences, as the extracts below show.*

For another interesting discussion of the social impact of new irrigation in West Africa, this time in Senegal, see Adrian Adams's article "The Senegal River Valley: What Kind of Change?" (Review of African Political Economy, 10, September-December 1977), where the conflict of objectives and interests between planners and peasants is clearly brought out.

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1. i.e. the project agency has monopoly control over the marketing of farmers' main cash crop; on the basis of deductions made from farmers' receipts at the point of marketing, the agency aims to finance a whole range of integrated services (extension, input supplies, credit, mechanised land preparation, etc.) to the farmers. For a description of one version of the system, see R. Chambers and J. Moris, Mwea: an Irrigated Rice Settlement in Kenya, 1973

5. <u>Rice Farming in The Gambia</u> *The extracts below are intended to outline very briefly one of the main themes of Jennie Dey's paper: the effect of new irrigation schemes on socio-economic relationships between men and women in the immediate vicinity. The full paper has been issued as an Agricultural Administration Network Paper (No. 7) and is available from ODI.*

Records dating back to 1738 show that swamp and upland rice has been almost exclusively cultivated and controlled by women in The Gambia until the present day. Since 1966 development programmes have introduced irrigated rice cultivation to men ...

Until 1966 agriculture has been confined to a single short cultivation season dependent on erratic rainfall between June and November. The main cash crop is groundnuts which, together with groundnut oil and cake, account for over 90 per cent of The Gambia's total recorded exports. The principal food crops are rice, millet and sorghum; rice is the preferred staple ... The Gambia's annual rice imports rose substantially after 1857 as men increasingly began to neglect food crop production in favour of the cash crop, groundnuts. Rice imports are currently about 30,000 metric tonnes a year. Since the balance of payments position is precarious, the Government has now set as a national policy the attainment of self-sufficiency in rice production by 1980. Priority is given to the introduction of a new system of cultivating irrigated rice in both the dry and rainy season.

Irrigated rice schemes have been developed in MacCarthy Island Division and Upper River Division by three separate programmes: the Taiwanese agricultural mission (1966 - 1974); the World Bank Agricultural Development Project (1973 - 1976); and the People's Republic of China rice mission which started in 1975. All three programmes have a similar approach. The agricultural teams design irrigation schemes in units of about 30 acres. Farmers, who have at least a quarter of an acre each, help clear and level the land, and construct the bunds and irrigation canals. Water is raised from the river by means of 5" or 8" diesel pumps. The Taiwanese provided the pumps, power tillers and threshing machines free of charge, and for the first crop farmers were given free seeds and fertilisers. The World Bank project organised farmers into co-operative rice growers' societies through which farmers were given loans for capital equipment and for seeds and fertilisers. The co-operative societies were dissolved when the World Bank project ended, largely because of non-repayment of loans. The Chinese scheme is testing a different approach: the capital equipment is provided free of charge and the farmers pay cash for seeds, fertilisers, water and ploughing by power tiller. Approximately 4,000 acres of double-cropped irrigated rice land have now been developed.

... Actual purchases of rice by (government) indicate that the irrigated rice programmes have failed in their objectives of promoting self-sufficiency in rice production by 1980 ... Since the Government is currently planning additional and very substantial investment in irrigated rice production, there is an urgent need to understand why... It is my contention that the explanation for the poor results of the irrigated rice programmes lies in the neglect, by the development planners, of the social and sexual division of labour within household units of production ... An important feature of the Mandinka farming system is a clear sexual division of labour. In rice-growing areas, women cultivate rice as both a food and a cash crop while men grow millet and sorghum (coos) and some maize as food crops and groundnuts (and occasionally coos) as a cash crop. Since 1967, men have started growing irrigated rice as both a food and cash crop also ...

(As a result of decisions made during the planning of the new irrigation schemes) men own the irrigated rice land and are institutionalising an inheritance system which will keep it under male control. It is only with considerable difficulty that a few women acquire use-rights to a plot in the dry season .. Women ... are lent the usufruct over some irrigated rice plots in the rainy season where they grow traditional varieties of rice because the land is subject to tidal flooding and is therefore unsuitable for irrigated rice cultivation. The men, quite simply, do not require the land in the rains.

The consequence of men's control of irrigated rice land and production on this land is that they are able to earn, for themselves, a considerable income additional to their income from groundnuts, particularly in the dry season ... Women are thus deprived of an opportunity to engage in this more profitable cash crop on their own account.

Women are able to supplement their incomes by doing wage labour. However, not only is this work irregular but demand for wage labour in the dry season is so high that most women only do it for a few days in the entire season. Moreover, daily wage rates are very low ...

The importance of giving women control over some of the irrigated rice land, in addition to men, is seen from the data on consumption. This should have exploded the myth that if a man gets richer through involvement in a development programme, his increased wealth 'trickles down' to his wives and children. In Saruja, where there are three rich men, their wives are no better off than other village women. It is interesting that the women who stand out as better dressed, who have more possessions in their houses and who may have small petty trading businesses, have all done this by hard work on their own without their husbands' help ...

Since women are customarily expected to pay for most of their own clothes and personal requirements and also for those of their children, it is important that this fact is recognised by development planners and that women are given the same opportunities offered men.

(The author goes on to argue that the same weaknesses in project planning which have damaged the position of women have also contributed to the projects' disappointing production performance. Although virtually 100% of the irrigated rice land is cropped in the dry season, only a little is cropped in the rainy season and the overall cropping rate is probably about 125%).

The main ... point about the low cropping rate in the rainy season concerns the development planners' failure to consider the customary sexual division of labour. Because women are skilled at rice cultivation they are almost exclusively relied on by men for transplanting and weeding, operations which they carry out as either unpaid labour or as wage labourers. In the dry season women accept these conditions because there is no alternative farming occupation, nor any way of earning money apart from petty trading ...

However, in the rainy season women have the right and opportunity to cultivate their rice fields and even the rich men can only obtain female wage labour on Wednesdays and Fridays, days on which women do not go to their swamps ... Wednesdays and Fridays are looked on as days for badly needed rest and for catching up on domestic tasks neglected on days spent in the fields ... Since few men have enough money left by the rainy season to pay wages in addition to farm inputs, they cannot grow irrigated rice. The rich men can afford these costs but they are few in number and can absorb the low supply of female wage labour. This means there is no pressure on wages to rise at this season.

I would argue that if irrigated rice plots and the whole technology of growing irrigated rice together with the credits originally given the men by the Taiwanese and World Bank programmes had been made available to women as well as to men, it is probable that double cropping of irrigated rice would have been achieved on the women's fields at least. Women are in a much stronger position than men to cultivate irrigated rice in the rains as labour demands fit in with the customary sexual division of labour and the various ways women organise labour ... Women ... already have traditional reciprocal labour groups operating for their swamp rice. These groups could easily work on the irrigated rice fields. Men do not have access to these female reciprocal labour groups, nor do they have equivalent groups for male crops ... The big advantage of these female reciprocal labour groups is that they are inexpensive, the only cost being food.

6. Impact of new irrigation in Northern Nigeria *The extracts below represent a very small part of a long and detailed study of the impact of the new Kano River Project on different sections of the local population. The study is entitled "Rural Development Through Irrigation: Studies in a Town on the Kano River Project" (Research Report No. 3, Centre for Social and Economic Research, Ahmadu Bello University, Zaria, Nigeria).*

(In her introduction, the author explains that, following policies during colonial rule which stressed the production of export crops to the detriment of food crops, there have been increasing pressures in recent years to introduce large-scale irrigation into Northern Nigeria for the prime purpose of producing food (wheat) for a growing urban population, thereby reducing food imports. Though doubts have been expressed about the economic feasibility of irrigation in the North, plans for its development have gone ahead, following the increase in financial resources made available for investment in rural areas as a result of Nigeria's oil boom. It should be noted that, for the farmers in the North, wheat is essentially a cash crop for export to urban areas - it is hardly consumed at all in rural areas. Other main crops which farmers are expected to cultivate under irrigation are tomatoes and beans.)

Kano State is the most densely populated in Nigeria, with a population of perhaps as many as ten million. In the budget of the third development plan over 80%...... of the total allocation to the crop subsector has been earmarked for infrastructure development. Of this allocation, the development of irrigation facilities will take 87%...
The decision to irrigate, using large scale construction and modern irrigation techniques, carries with it several crucial implications...

On the one hand it implies investing huge sums of money in one project. This project, which in phase I will cover 44,000 acres and in II, 56,000 acres, will actually cover only
a tiny fraction of land in Kano State and perhaps directly affect 1 or 2% of the farmers in the state...Regionally the irrigation scheme clearly skews the allocation of resources, potentially creating severe rural inequality between districts.

(Also, for various reasons - no long tradition of irrigation, little expertise in project planning and design, commitment to large scale projects, rapid rate of project implementation on the basis of available oil funds) the decision to irrigate has forced Nigeria to turn to expatriates for help at all levels, for designing the scheme, for construction and for the running of the top levels of management and the training of the lower levels...

The emphasis of the planners has been on how the scheme can ' influence the farmer and change him from a traditional rainfed agriculturalist into a modern irrigant...' (consultants' report). The key role in the scheme is allocated to the management, the farmer is just there to be persuaded or coerced into transforming his role in agriculture...

The decision to irrigate forecloses alternative approaches to improving rural productivity or rural welfare because it absorbs a huge amount of the budget. For example, efforts to build small feeder roads, improve the rural water supply, work out an equitable distribution of fertiliser, improve local irrigation methods, are all overshadowed by the enormous input into one small area, where roads, dams, canals and new houses are built: tractors, combines, lorries, irrigationists, agronomists, researchers in agriculture are all concentrated...

...The scheme is based on the creation of the Tiga Dam. Water can be carried from this dam to the scheme - about 14 kms. - entirely by gravity, through a primary canal. This feeds water into secondary canals which transport water to the blocks, and distributory canals bring the water to the field... The standard size of a field is 28 acres. Each farmer's plot then receives water directly from the field canal by means of a syphon. Each plot has a field drain at its lower end...

The farmer has little control over the flow of water into the field canal. This is controlled by the hierarchy of irrigation staff. These staff have no official contact with the farmers, the extension staff are supposed to help the farmers to regulate the flow of water on to their fields. Because the farmer has little control over the water supply water is often poorly used... Nedeco (*consultants*) recommended that farmers should be organised and should engage in consultations with irrigation staff over water needs and the correct use of water, but this has not yet happened.

(The central focus of the paper is on the impact of the project on the local rural population and their relationship to land.) The essential features of the pre-independence land situation continued after independence... Land ownership was vested in the Government but the rights to occupy,use and dispose of the rights to use land were retained by the farmers... The Government has an absolute right to remove land from the peasant for government purposes; compensation has to be paid only for crops, buildings, etc. and not for the value of the land itself.

It has proved relatively easy for the Government to introduce the Kano River Project into the densely populated area, both because legally the land belongs to the Government and because the traditional hierarchy did not oppose it. Elsewhere it has proved more difficult for the Government to exercise its right to take land away from the farmer, and at Bakolori on the Sokoto-Rima Basin Irrigation Project the army had to be brought in to force the peasants off the land...

(Before the introduction of the project) land was intensively cultivated, there was dry season farming along the Kano River. Land was increasingly individually owned and subject to several forms of temporary and permanent transfer. The sale of land was common. Farmers grew grains and food for their own needs, and also cash crops...

(The author examines the effect of the new project on four different categories of farmers: (i) those who have lost all their land to make way for the building of the Tiga Dam, the canals, the government farm, etc.; (ii) those who have lost some of their land to the scheme but have not been removed from their villages; (iii) those who have gained access to irrigated land; and (iv) those living downstream of the dam whose land use has been affected by the altered flow of the river.)

Farmers losing all land. 13,000 farmers were removed from their homes and farms to make way for the damming of the Kano River and the building of the Tiga dam. This large group of people were then scheduled to be resettled in seven new villages in surrounding areas... From preliminary discussions it appears that many have not moved to the designated villages. It is not known whether they have left farming and moved to town or whether they moved to other rural areas. Certainly those who have moved to the resettlement villages have faced serious water shortages among other problems, and it looks as if the experience at Tiga is similar to that at the Kainji Dam, where researchers found that 'desertion of villages has been resorted to where these are found to have been sited on poor land'.

A second group of people who were removed totally from their land were those whose land was to be used for government buildings, offices, housing etc. and the 1,000 acre Government farm... They were paid compensation for their farm land at the rate of ₦80 an acre 'on the assumption that the farmer can find suitable land nearby to bring it under cultivation', (consultants' report). Compensation was also paid for housing and economic trees. But... the assumption that alternative land was freely available was based on a lack of information about the land pressure in this area... It is very difficult indeed to buy farmland, which means that they can only farm on land held under temporary tenure...

Farmers losing some land. Having mapped out the whole area and assigned functions to each area, (surveyors) had to go out into the field and find out who owned each plot of land. This has proved a very complex and time-consuming task, and been a focus of much dispute and resentment against the scheme. Once the surveyors knew who owned land where, they then either paid compensation for that land if it fell within an area designated for farm stores, buildings, the 1,000 acre government farm, etc, or they reallocated the land back to the farmer if it fell within the irrigable area, minus 10% needed for roads and canals. Those who lost land received ₦80 an acre compensation, those who kept their land got irrigation facilities given to them, an input costing about ₦3,000 a hectare.

The Project made no attempt to explain to the farmers why one man lost land and his neighbour did not. No time has been spent talking with the farmers and this has caused unnecessary confusion. The whole procedure has appeared to the people as totally arbitrary, and somewhat corrupt... Farmers are unable to replace their lost land on the market because even if there is land for sale the price is far higher than ₦80... The compensation has now been raised to ₦250 an acre, a step in the right direction, though one which further incenses the farmers who originally lost their land for such paltry sums.

Farmers with Irrigated Land. (Some farmers) retained the same amount of land that they had before, though reallocated in rectangular plots and minus 10% to allow for road and canal construction. There has so far been no successful attempt to consolidate the farmers' land into units... Thus farmers have retained their fragmented plots on the scheme. They also received unequal amounts of land on the scheme, depending entirely on the size of their land holding before. There has been no attempt to impose a minimum or maximum plot or holding size on to the farmers. Consequently the scheme is made up of a multitude of small plots, many less than one acre, and one farmer may have several separate scattered plots on the scheme.

(While the management is keen to consolidate land, the farmers are less so, (a) because the scheme dictates what shall be grown in each block, so a farmer with plots in different places may be able to grow more than one crop; and (b) plots vary in productivity according to location, variability in water supplies, soils, etc.)

Initially, in the early years of the scheme many farmers were not interested in the dry season farming. But over time it has become evident that it is possible to make money by growing wheat, and particularly tomatoes and more men now want to get land on the scheme and benefit from it. Who is (renting) land on the scheme? Which farmers are renting out their irrigated farms? Who is not even attempting to get involved?...

Irrigated farming has many risks attached to it, it is expensive to undertake and given the present state of unreliable management, losses can be significant... There are strong indications that the men at the bottom of the economic scale simply cannot afford to undertake dry season farming. For those who own land on the scheme, they may try once, using credit, but if they fail they cannot afford to try again and get into debt... Those who feel financially unable to cope with dry season farming on the Project are generally men who farm one or two wet season plots, who are not self-sufficient in grains and whose alternative occupations bring low returns... One man said 'I understand this scheme is meant to give new life to this village, but it is only giving strength to those who are already strong'.

Certainly at the other extreme it is evident that the important and wealthy men in the town have been able to rent land on the scheme and profit handsomely. The first man from Chiromawa to do dry season farming comes from one of the wealthiest families in the town and he already owned a kiosk and chicken frying business when he got project land on (lease). He had money to pay for all the inputs and labour, he needed no credit and he made good profits... Besides the local elite...there is evidence that the urban elite are also moving into dry season farming, and... are able to benefit from the improvements the government has made... Some bank managers, insurance agents and businessmen in Kano now rent land on the scheme...

The farmer who owns irrigated land has had his relationship to the land altered significantly in terms of land use and control. While he may sell, rent, loan or farm his plot without reference to the Scheme, the decisions about what to grow on the land are now out of his hands. The scheme owns the technical inputs for the dry season farming and can withhold these if the farmer does not farm the land in accordance with its demands. The Scheme dictates entirely what a man can grow in the dry season; beans, tomatoes or wheat. If a man finds wheat unprofitable he may rent his land out, or leave it fallow, but he may not choose to grow tomatoes. Similarly there are constraints on wet season farming. The staple food crop, guineacorn, may not be grown on project land because it is not harvested until November, by which time wheat should already be planted... While some farmers have off-scheme land for growing their staple food on, others do not and the implications of this are serious. It leads to a dramatic break in the relationship between the farmer and his land. Instead of land being used first to provide food, and only second cash, the farmer is increasingly expected to grow wet and dry season crops for sale (maize, groundnuts, wheat) and to buy his basic foodstuffs. This drastically alters the role of land in the process of production and places the farmer in a new social and economic environment...

The issues of who will grow the extra grain to feed the scheme farmers, what will happen to those who do not make enough profit to buy all their food, what will happen in drought years, or years of grain shortage are...serious consequences of the changing relationship between the farmer and his land. As the price of grain continues to spiral upwards and the scheme expands, limiting the amount of land given over to growing rural staple foods, the issue of the farmers' subsistence is bound to become more insistent.

Farmers downstream of the dam. In Kwari, prior to the damming of the river more than 30% of the farmers had *fadama* (flood) land on which they grew particularly sugar cane as well as peppers, tomatoes, onions, and other vegetables in the dry season. A few men have retained some fadama land situated very close to the river, but for the most part they have lost their dry season farms because the river no longer floods. They can only use the land as wet season farmland now. Secondly many men in the hamlet used to earn their money from fishing in the river. Now the only fish in the river are small, with the result that the old men are tending to give up fishing altogether, while the younger men have to travel away to Tiga dam where the fishing is good. The ward head noted that in the past the people of Kwari were always busy in the dry season farming and fishing and that you could not find a man sitting idle in the daytime. Now he noted that many young men leave the hamlet on dry season migration far more than before, and that many men have little to do all day long ...

7. Why irrigate in the north of Nigeria? *was the title given by Richard Palmer-Jones to a provocative paper written for a Seminar on Change in Rural Hausaland held in Kano last February, from which the following extracts are taken. He has since written a longer paper on the history of irrigation development in the region, and the lessons to be drawn from it, called 'How not to learn from pilot irrigation schemes: the Nigerian experience'. This is due to be published in a forthcoming issue of the journal* Water Supply and Management.

Since the beginning of the colonial period the State in Nigeria has claimed that large-scale 'modern' irrigation has a crucial role to play in the agricultural development of the north of Nigeria. Furthermore the State has seen itself as playing the major role in the development of the water resources of the region for irrigation. As resources permitted and opportunities were identified the colonial government undertook pilot projects and attempted to formulate plans and collect data on the feasibility of and methods for its irrigation programme. Since independence under both civilian and military government irrigation has become the most important policy for agricultural development; the planning has gathered momentum and is coming to fruition in the present simultaneous development of three major irrigation projects (South Chad, Kano River Project, and Bakalori), numerous other minor projects, and further plans and feasibility studies.

Currently a huge proportion of the State development resources being allocated in Hausaland is going to large-scale irrigation. Many justifications and objectives have been offered for these schemes. Increased agricultural production, self-sufficiency in wheat, export of high value crops, increased agricultural employment, drought and famine relief, and rural development. Surprisingly this massive commitment of resources has taken place without detailed evaluation of the performance of previous projects...

... While agricultural production on one scheme (studied by the author) has increased due to the introduction of a dry season crop, the irrigated crops are highly subsidised. Production in the rainy season on the scheme and elsewhere off the scheme is probably lower than it otherwise would have been. An enquiry into productivity on other schemes revealed low levels of yields and high subsidies.

The causes of low productivity were investigated and found to lie in the absence of sufficient incentives to farmers to voluntarily comply with the dictates of management, and inefficient and inappropriate supplies of key inputs to farmers - particularly tractors, water and drainage. The solution often proposed by management - for greater control over farmers - repeats prescriptions made in the colonial period and ignores the failure of these strategies in the late fifties and sixties to achieve generally high levels of productivity on irrigation schemes. ... Since without exception irrigation schemes have been expensive and unproductive, and the evidence suggests that this will continue to be the case, the rationale for the emphasis given to irrigation must explain why this non-achievement of objectives has neither been remedied, nor interrupted development plans ...

(On the scheme studied by the author) the views of management explained and justified inefficiency in terms of the obstructiveness of farmers. The only solutions considered (expropriation) were impractically expensive and believed to be politically unimplementable. This situation permitted the scheme to operate inefficiently but to the benefit of scheme workers and the locally powerful farmers and, there is some evidence to suggest, rich and powerful outsiders ...

These views are functional to the perpetuation of existing inequalities, by allowing already advantaged people to monopolise direct economic benefits and diverting attention from alternative explanations and solutions to the problems of low productivity. They have an interesting history as explanations of and solutions to the problems encountered on earlier irrigation projects. They are a key to understanding the continued priority of irrigation in the face of practical agronomic, construction, economic and political problems with previous and current projects.

The history of irrigation developments in both the colonial and post colonial periods provides support for the explanations given above. The Kwarre project, just north of Sokoto, encountered major technical problems throughout its life from 1925. Returns to wet season rice production and dry season irrigated crops were generally low and highly variable. In many years the intensively cultivated rice crop was destroyed by flooding of all or the less favourable sites on the scheme. The market for dry season crops was limited as was the water available, hence limiting the area that could be cultivated. These problems led to a low uptake of irrigation farms. The colonial managers blamed the farmers. The farmers were 'apathetic', 'easily discouraged', 'lazy'; 'the general badness of the situation (at Kwarre) was due to incomprehensible lethargy'.[1] Consequently they advocated (a) taxation of potential 'economic rent' to force existing proprietors to make full use of the facilities provided, (b) expropriation of the irrigated and flood protected area, consolidation of plots and allocation to suitable farmers with revocable tenancies dependant on good cultivation.

The likely success of this proposal was, it was claimed, evinced by the success of 'unit' farmers set up in 1933 in oxen cultivation of farms of around 4 acres, on the government experimental farm. In the following years more such farmers were given loans and set up in this type of farming. They were mainly members of the Sokoto Native Authority, taking up most of the former experimental farm. Many farmers defaulted on loans, N.A. funds continued to subsidise production, and marketing was supported through subsidies to the Sokoto Rice Mill. Continuing technical difficulties and poor management (after 1936 by the N.A.) led to decline in the physical structure of the scheme. Land expropriation, enforceable tenancies and 'economic' water rates were resisted in the pre-second world war period, because it would have interfered with the policy of Indirect Rule ...

After the second world war the Land and Native Rights Ordinance was amended to allow the declaration of Settlement Areas in which the current usufruct rights could be expropriated and compensated, the land could be laid out according to technical requirements of land conservation or irrigation, and settled under enforceable tenancies. The colonial managers of the irrigation schemes urged that they be declared

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(1) Quotations are from reports in government files.

settlement areas. But, except for areas with few existing users (eg Badeggi), this was resisted, because of 'vested interests' (in the Sokoto N.A.) ...

In the late colonial period actual investment in irrigation did not advance rapidly. But the growing demand for bread, giving rise to the imports of wheat flour and the possibility of expansion of irrigated wheat growing, gave new impetus to irrigation developments after independence ... Kwarre and the new scheme at Wurno (the traditional home of many of the Sokoto elite) were now easily declared as settlement areas. Much of the land at Wurno was allocated to members of the Sokoto elite, as was land at Tungan Tudu, another new irrigation scheme near Sokoto.

A similar situation occurred on the schemes in Bornu, at Yau (Yo) and Gamboru, where at least 35% of the schemes were farmed by absolute landowners, and many farmers were (a) not dependent on agriculture - ie rich, (b) members of the Bornu or Dikwa Native Authorities. *(Further examples are given.)*

The involvement for personal gain of all these important people, and their control of resources and staff provided by the schemes is an important cause of the inefficiency of irrigation schemes. They disrupt water and tractor allocation schedules for their own benefit, they appropriate scarce fertilizer and do not play their part in the upkeep of canals, etc. Attempts to organise cooperation among farmers and communication between farmers and management break down because of these inequalities among participants of irrigation schemes, and those involved in rural administration.

The tradition of the appropriation of State resources for private gain continues at the operational level of each scheme, even though since the oil based boom in Government expenditure the main locus of personal gain has moved to the allocation of contracts for construction and operation of schemes. The elites are involved both in the allocation processes and in firms receiving contracts. But on the schemes other members of Government (beneficiaries of greatly expanded Government employment on accelerated pay scales) and rich outsiders are receiving irrigated farms and subsidised inputs for their personal benefit at the expense of the rural poor. Efficiency of the schemes as a whole is sacrificed to the interests of these people, whose continuing domination is ensured. Of course more irrigation projects will continue to provide, on an increased scale, all the old benefits, and some new ones, to the same group of people. They are too good to do without.

Final note

Much of this paper makes for depressing reading. The reaction of some networkers may be that the cases discussed are not typical, or that they reflect a general tendency among ex-post critics (and especially social scientist critics) to pick on the worst examples they can find. Others may feel that certain criticisms are unfair or insufficiently substantiated. Comments are welcome, both on the individual extracts and on the more general questions raised in all of them about common weaknesses in irrigation planning and design. How could these weaknesses be overcome, or at least reduced - or are they, as Palmer-Jones seems to imply, almost inevitable? To help point future discussions in a positive direction (as well as to provide a change of diet!), we hope that some networkers will be able to think of some conspicuous planning and design successes to write to us about.

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AGRICULTURAL ADMINISTRATION UNIT

ORGANISATION AND MANAGEMENT OF IRRIGATED AGRICULTURE

Network Paper 1/80/3 3d

IRRIGATION IN EGYPT, PAST AND PRESENT

Past

The extracts in the first part of this paper are taken from Egyptian Irrigation, *by Sir William Willcocks and J.I. Craig (3rd edition, E. & F.N. Spon, London, 1913), Chapter XV - Administrative and Legal. They bear the stamp of Willcocks' own idiosyncratic style. Willcocks (1852 - 1932) was an extraordinary man. Born in a tent on the banks of an irrigation canal in India, his first ambition was to be a missionary. However, his missionary zeal was deflected by his father into the realm of irrigation engineering. He was a brilliant student at the Thomason Civil Engineering College at Roorkee (now University of Roorkee), graduating at the age of 20, and after eleven years in the Irrigation Department of the United Provinces, went to Egypt to help reorganise the irrigation service there.*

Willcocks remained in Egypt for fifteen years (1883 - 1898) and was appointed Director-General of Reservoirs in 1890. To that date the Nile had remained unsurveyed. Under his direction, over 800 miles of the river was surveyed in no more than three years - an astonishing achievement: "Nothing was allowed to deflect him from his purpose and during the last surveying season he did not even bother to sleep in a tent. Each day he began by memorising lines from John Bunyan or the Bible (he did ultimately commit the whole of the New Testament to memory); every evening was spent writing long, detailed and careful reports on every aspect of the Nile's regime and topography".[1] *His final*

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1 Norman Smith, "Not the conventional type of man", an article on Sir William Willcocks, first published in Icon *and then reprinted in* Binnie News *(Binnie and Partners staff magazine), November 1978. This biographical note draws heavily on Smith's excellent article.*

plan was for a huge dam and reservoir at Aswan and a barrage 350 miles downstream at Assiut.

Willcocks left Egypt in 1898, the year construction on the Aswan dam began. It was completed in 1902 and subsequently heightened in 1912. In the meantime Willcocks worked in South Africa and in Mesopotamia (where he surveyed the Tigris and Euphrates in only two years "with more fervour than ever").

In his later years Willcocks' zeal declined into a tragic fanaticism. He became involved in a bitter and libellous feud with the new Director of Reservoirs and Construction in Egypt, Sir Murdoch MacDonald, wrongly accusing him and his colleagues of incompetence and dishonesty in their plans to extend Nile irrigation to Sudan. In January 1921 he was charged at a British Court in Cairo with criminal libel and sedition, and found guilty. He was now 69, and because of his age and consuming obsession was bound over for good behaviour for one year; but he was also to be deported.

In his article on Willcocks, Norman Smith concludes:

"Making the deserts bloom was for Willcocks a mission not far short of divine for the attainment of which he seems to have imagined that he alone had been appointed. Perhaps his underlying difficulty was being able to accept that any scheme but his own was, by definition, feasible or that other engineers had the right to harness his precious rivers.

At last at the end of his life Sir William Willcocks played the part of the missionary he had wanted to be and for so long had imagined he was. For ten years and at his own expense he laboured to translate the New Testament into a brand of Arabic known as Egyptian Colloquial. The task was completed only a few months before his death in Cairo on 28th July 1932".

The passages quoted below were written when Willcocks was still in his prime. As Sir Hanbury Brown observed in his Introduction to the two-volume (837-page) work, "Egyptian Irrigation has its lessons for other countries besides Egypt and for generations yet to come". The present-day reader will find a good deal of humour in Willcocks' writing, most of which seems to have been unintentional. But imbedded among his eccentricities, prejudices and colonial paternalist sentiments are many shrewd observations which still have relevance to those concerned with irrigation management today.

1. On irrigation and authority

History tells us that just as irrigation was the oldest applied science in the world, so the first civilised communities on this earth were formed in the irrigated valleys of the Nile and the Euphrates. Once people took to irrigation, they had to form laws and respect them, for disobedience and wilfulness spelt ruin not only to their neighbours but also to themselves. When the water that irrigates your field has to flow in a channel which passes the fields of all your neighbours, and cannot be maintained in a state of efficiency unless all do their duty, it is easy to understand how method, order, and obedience to a properly constituted authority very soon developed themselves. M.J. Brunhes, in his interesting work *L'irrigation dans la peninsule Iberique et dans l'Afrique du Nord*[1], explains with much skill how laws affecting irrigation have gradually been developed in the arid regions of the world according to climatic and geographical conditions. He compares the laws of Spain with those of Algeria and Egypt. He shows how the authority of the Government in an absolutely rainless country like Egypt becomes gradually more and more autocratic, and how the European mixed tribunals of the country, which are nominally independent of the Government, have gradually been forced to admit its absolute supremacy. He also explains how autocracy is introduced in a free community of irrigators on small independent canal systems in Spain. In times of difficulty the irrigators choose from among themselves a dictator for the whole period of scarcity of supply, and his orders are obeyed and respected as though he were an absolute monarch. They invariably choose a good man. M. Brunhes works out his thesis in five hundred pages, and then gives an index of close on fifty pages which contains the names of all works bearing on his subject up to the date of his work.

2. On rich landowners and poor peasants

Among the many causes which have helped in recent years to add to the wealth of the fellahin (*poor peasantry*) and to raise the rents over the whole of Egypt, the abolition of the corvée (*compulsory contributions of labour for canal and river maintenance*) and the substitution of paid for unpaid labour have held a high place.[2]....

Where extensive contiguous estates were owned by non-resident landlords, the resident population was found to be poor and the rents comparatively low. Especially was this the case where the lands were let to non-resident middle-men, who sublet to the fellahin at rack rents. Such estates have benefited far less than others from all that has been done in recent years; and not only have their own rents remained low, but they have also depreciated neighbouring properties owing to the excessive poverty of their resident population.

In the well-irrigated basins of Upper Egypt ... the fellahin proprietors who paid taxes direct to the Government were found to be possibly the most contented and prosperous agricultural community in the world. Their wants were simple, their taxes were low, and now that the canal clearance corvée had been abolished, they were more often buyers than sellers of land. It was not to be inferred from this that taxes were nowhere oppressive, for they certainly were, but on restricted areas and confined to the badly irrigated or badly drained tracts ....

Among the peasant proprietors of Lower Egypt the corvée

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1. L'Irrigation dans la peninsule Iberique et dans l'Afrique du Nord, by J. Brunhes, G. Naud, 3 Rue Racine, Paris, 1902.

2. Willcocks played a leading part in the reforms which brought about the abolition of the corvée system.

redemption has been very popular, and large numbers have readily paid. It is not so among the proprietors and owners of *Ezbas* (hamlets). Many of these are Europeans, and they look on themselves generally as a privileged class, who are entitled to all the State can give them, without rendering the slightest service in return ...

3. On the motivation of irrigation staff

I should be doing a wrong to the Egyptian engineers with whom I have worked for so many years if I were not to put on record their very substantial grievances. Government servants are expected to live on their salaries. It is always assumed that their emoluments will suffice for all reasonable expenses. Now, what are the facts of the case? Young men of from sixteen to twenty enter the polytechnic school, and, after a four years' course, if successful, are appointed to the Public Works Department at salaries of from £4 to £6 per month. Their promotion is exceedingly slow, and I know really capable men who, after ten years' service, are only drawing £8 per month. Government has all these years asked these men to live up to their position, in the districts to which they have been appointed, on salaries which are not a half of what they have to spend, and which the Government well knows that they have all along spent. These unfortunate men have been compelled, whether they have liked it or not, in almost every individual case, to take bribes and rewards, and become a byword and reproach in the country. Some, with naturally predatory instincts, have been let loose to prey on the country, and make their fortunes as quickly as they can, before they are discovered and replaced by others as bad as themselves. Others, with shame and humilation, have been gradually forced into a life of petty theft and misappropriation at first, and afterwards of open fraud and dishonesty. The salaries of these same men when they climb to the higher appointments are sufficient to enable them to live upright lives, but the habits of dishonesty which they learn at the beginning of their career cling to them to the end. There are, of course, a few absolutely upright men whom no bribes can tempt, and occasionally, of course, men are found who have married into wealthy families or who have wealth of their own, but these constitute a very small minority. There is not a man in the country from H.H. the Khedive and Lord Cromer to the smallest official in the Finance Department, who does not know that every word I say is true of very many of the departments, and especially of the Public Works Department ...

No well paid European, who is enabled to live an honest and upright life, has any right to cast a stone at his unfortunate Egyptian colleague who does not enjoy equal advantages. The history of the East Indian Civil Service is full of instruction on this point. The old Bengal civilians of the eighteenth century who received nominal salaries, and who shook the pagoda tree to some purpose, were all Englishmen who were corrupted by the fact that their honest emoluments were notoriously insufficient. It was not till Lord Cornwallis introduced his wise reforms, and trebled and quadrupled the salaries, that the public services became what they are to-day.

4. On the importance of canal law

Previous to the 12th of April 1890, there was no canal law. On that date was passed the first canal law, which was modified by the decree of the 22nd February 1894 ...

To show how necessary a law of some kind had become, I shall give two instances out of many which came under my own notice. At two regulators on irrigation canals, Greek tradesmen had built shops on the upstream wings, and practically taken possession of two important works. As they had roofs over their heads, they were protected by the capitulations, and the Government had to submit to the indignity of not being able to utilise its own works without their permission. As the law was powerless, I was only able to force them to quit by building walls round them, on land which was of course Government property, and starving them into surrender. In another instance, a small colony of Greek settlers had filled up a village watercourse about 2 kilometres long and 4 metres wide, had sown it with cotton, and were on the eve of forcing the helpless villagers to sell their land, now become valueless, for a nominal sum. Fortunately, the British occupation had caused a new day to dawn upon the country, and the villagers appealed to me. I had the cotton cut down, and the canal re-dug, while a number of Greeks, with old revolvers and firearms, threatened to shoot the contractor if he continued his work, and indeed if an Englishman had not been present they would not have hesitated to carry out their threats. These facts will give an idea of the straits into which the capitulations had driven Egypt, and from which nothing but a strong executive could have rescued it.

5. On canal administration

There is a well-known saying in Egypt today that it is neither H.H. the Khedive not the British Consul General who is the real master of Egypt, but it is the canal watchman, who bears the two massive keys which open and shut the portals of our earthly paradise. And it is Solomon himself who tells us that the earth is disquieted when servants bear rule. Owing to the enormous increase of official correspondence in recent years, the Inspectors of Irrigation are so tied down to their offices that it would be physically impossible for them to spend nearly the whole of their time in the provinces as we used to do in the early days of the Occupation...A rush round on a motor-car enables an officer to inspect his works and see that one side of his task is being well performed, but the more important side of keeping in intimate touch with the landowners and fellahin is neglected. In the old days, when we had no roads and very few inspection houses, we had in the winter to put up with village headmen, while in the rainless summers we slept on the canal banks, and during the day accepted the hospitality of the villagers. Travelling as we did, with but few attendants, and visiting the same individual once in two or three years, we were no serious source of expense to village sheikhs, while the knowledge we had of their wishes and difficulties was of the greatest value to them as well as to ourselves. It was this knowledge which enabled us to keep some check on the all-powerful watchmen on the spot and the all-powerful Arabic clerks in our head offices. Unless one frequently meets and converses privately with the village authorities, it is impossible to understand how the power of the Arabic clerks can be controlled. The whole of the correspondence is in literary Arabic, which the Inspector as a rule cannot read and which he would not have the time to read if he could. The consequence is that what he really hears is a rough epitome in ordinary spoken Arabic of long, meandering letters. Now, if the Inspector has spent much time in the district and seen many men, the Arabic clerk is afraid to take many liberties with the text of the letters, lest he stumble into a pit; but if he knows that the Inspector has scarcely spoken to anyone, he is as completely master of the situation in the office as the watchman is on the canals. Scores of rules and procedures may be invented, but the only remedy for the control of the irrigation passing out of the hands of upright chiefs into those of unscrupulous subordinates is steady and persistent inspection of the works and friendly intercourse with the village sheikhs and fellahin inside their own homes or in their fields where they can speak freely and openly.

During the two years that the Land Tax Adjustment operations lasted the Director (*i.e. Willcocks*) spent every day and slept every night in the fields and villages. He conversed with the representatives of every individual village between Wadi Halfa and the Mediterranean Sea, in the grounds of the village itself, and dispensed with most of the correspondence which more often than not darkens counsel with words. Every one of the ten commissions knew that it was liable to inspection at any minute, and this knowledge was a great spur to their keeping up their inspection to the full measure of their ability. For it must never be forgotten that if the head slackens his inspection, every subordinate does the same. "Does a fish begin to go bad at the head or at the tail?" is a sound Arabic proverb.

Inspectors today are often accused of being overbearing and having little patience with criticism. It is not easy to be patient with men whose difficulties have not been seen on the ground. Many things seem unreasonable in an office which would appear reasonable enough on the spot. It is for this reason that every Inspector of Irrigation should welcome all criticism of his works, be it by friend or by foe. It needs courage and conviction to criticise a Government so autocratic and powerful as that of Egypt in the field of irrigation. It was Mohamed Ali who said, "Give me regulators at the heads of the canals, and I am master of Egypt"; and he had reason on his side. Perpetual incense and praise do one no good. Most of it is interested. It is again Solomon who advises us to beware of the friend who wakes up early in the morning to bless us with a loud voice. He only too often encourages us to make fools of ourselves.

6. On farmers' representation

If owing to the pressure of office work, Inspectors of Irrigation can no longer be in touch with the country as they were over twenty years ago, it might be possible for the irrigation circles to be divided into zones according to their irrigation requirements. Each zone might consist of twenty or twenty-five ordinary villages, from among which the land-owners would choose a representative man for each zone, who would be in a position to converse freely and openly with the Inspector and keep him in touch with the wishes and requirement of the countryside. During the Land Tax Adjustment Operations, Nubar Pasha insisted that the landowners should choose their own representatives without any kind of official interference. It was a matter of surprise to everybody in Egypt that the men they chose were so exceptionally good. Many of them were quite poor fellahin, but they had sterling qualities which their neighbours had recognised. If the people were left to themselves to elect representatives whose tenure of office would last one year, the Inspectors might find themselves dealing with really representative men in the flesh, and not with what are only too often the Arabian Nights inventions of their Arabic clerks. We have seen above how the peasantry in the irrigated parts of Spain, in years of scarcity, choose their own Dictators whose orders are obeyed without demur; and that they seldom choose a bad representative.

7. On land reclamation and settlement

(*On the margins of the Nile Delta in Lower Egypt, new lands were being reclaimed by private companies.*) The process (of land reclamation) today is well understood, and success should be inevitable; yet very few land companies have been a success. The failures at first were due to ignorance; but today there is an established procedure, well known and easy to follow, and yet success on the ground has not been so simple as it has been on paper ...

(*Among the principal reasons for lack of success Willcocks cites excessively high land prices and technical difficulties - particularly inadequate supplies of irrigation water and drainage problems; but there were also social and institutional reasons.*) Egyptian fellahin do not readily leave the congested tracts where they live, but their presence in fair numbers on any estate under reclamation is one of the first steps towards prosperity. Sufficient inducements have not as a rule been offered to these men. The high prices paid originally for the land has been at the bottom of most of these difficulties ...

Companies which have sold half-reclaimed land to the fellahin, and extracted their pound of flesh on the instalment system, have done much harm to the cause of land reclamation. They have earned the hostility of the very men who alone can make the works a success, and they have induced the Government at times to take up an unfriendly attitude to all the companies.

And last, but no means least, speculators who have purchased land, not really to reclaim it, but to sit on it and wait for a rise and then sell it at a high price, have been a positive curse in Egypt, as they have been in every country on the face of the earth. It is extraordinary that legislation has not been introduced to brush this plague out of the country ...

(Besides the private companies, the Government was also reclaiming certain areas, using public funds for the purpose - an approach disapproved of by Willcocks.) The selected sections are levelled, provided with watercourses, drains and pumps, have villages erected on them, are divided into five-acre lots, and then handed over to the fellahin ... Of course when a government undertakes such work it is impossible to tell what such a scheme costs, as large works of construction or maintenance are always on hand in the neighbourhood and the expenses are not necessarily kept in the form in which a company is forced to keep them when it undertakes nothing but the works themselves. Moreover, the Government can and does take as much water as it pleases, is not tied down to drainage pumps of a certain size, pays prices for labour, and can use reservoir water on a scale which a company could not or would not be allowed to. Economies on this head are out of the question with Government undertakings. Logically it is scarcely fair to take part of the taxes of the community and hand them over to favoured individuals, when the very men who are paying the taxes are being injuriously affected by this procedure. It is for this reason, knowing that the principle of making the fellahin proprietors of the lands is one of the soundest in the world, ... we propose a method of procedure, by following which, the State will spend no public money; the Irrigation Department will be able to practise every reasonable economy in the distribution of water and drainage privileges; and we shall secure fellahin landowners with an influx of foreign capital into the country.

Let plots of 10,000 acres of waste land, which are worth £50,000 apiece, be handed over without payment of any kind to approved companies, to level, drain, and provide with villages and pumping installations. Let it be assumed that half the land will eventually be in the possession of the fellahin and half in that of well-to-do landowners. When reclaimed, let the company hand over a quarter of the land free of charge to fellahin from the congested districts, who will have power of option on another quarter at prices fixed beforehand. With the land taxes moderate at first, but rising slowly and assuredly, it should be possible to keep out the land speculator, who could not afford to sit idle while the taxes were rising automatically. In this way we think it should be possible to save the funds of the State for public works properly so called, to insure fellahin proprietors, and at the same time introduce foreign capital and enterprise into the country. Just as companies are not suited for the control of large public canals and drains, so Government officials who control these public works are not qualified to distribute fairly the water and drainage privileges of the State to private landowners and to estates under their own management, at one and the same time, when both are drawing from the same canal and discharging into the same drain.

Present

Although it is clear (eg from extracts 1,3 and 5 above) that Willcocks was well aware of the importance of the political and social dimensions of irrigation water control and distribution, there is one conspicuous gap in his chapter on administration. Whereas other tasks, such as maintenance, land and water taxation, pump licensing and water legislation, are all discussed at length, there is virtually nothing about methods of canal operation. There may be several reasons for this. Perhaps Willcocks never had any direct responsibility for water distribution. Or perhaps it was simply perceived in those days as being a technically very straight-forward activity. There was certainly less scope in those days for close control over water distribution than there is now: large areas were still flood- or basin- irrigated. Nevertheless, it is a notable omission.

Since the completion of the High Dam at Aswan in 1968, flood and basin irrigation have disappeared entirely. Egypt's cultivated (and irrigated) area has risen to about 2.5 million ha. and the average cropping intensity, under perennial irrigation, to about 180%. As has always been the case, the whole of Egypt's cultivated area is ultimately dependent on a single source of water controlled at Aswan. Two important consequences follow from this technical fact: (a) the organisation of water distribution is necessarily highly centralised; and (b) there are substantial constraints on the flexibility with which individual parts of the system can be operated. However, within the limits imposed by these constraints, the need for skilful canal operation has become more and more important as a result of rapid increases of population pressure on the country's land and water resources and of the increasingly complex water demand patterns generated by present farming systems and crop rotations.

Most discussion of irrigation in Egypt today tends to be focussed on macro-issues: inter-country allocation of the Nile Waters, particularly between Egypt and Sudan[1]*; developing a Master Water Plan at the national level; planning and executing large drainage projects in the Delta; and planning new reclamation and settlement projects in the sandy deserts beyond the Delta. Very little attention has been paid to looking in detail at how the existing irrigation system is actually being operated. Recently, however, the Egyptian Water Use and Management Project (EWUP) was set up precisely for that purpose. EWUP is based in the Water Management and Irrigation Technologies Research Institute of the Ministry of Irrigation, Cairo, with financial support from USAID and technical support from Colorado, Oregon and Montana State Universities.*

EWUP is remarkable for being one of the very few water management research projects which is looking not only at farmers' management practices at the field and watercourse levels but also at the operation of the main water distribution system.

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1. See John Waterbury, Hydropolitics of the Nile, Syracuse University Press, 1979.

Readers of past Network papers will know that we regard a 'whole system' approach as absolutely essential for a proper understanding of what is happening to canal irrigation water, and why.[1] *In the absence of any hard evidence to the contrary, it has been customary in Egypt - as elsewhere - to put the blame for poor water management (and its contribution to the Delta's drainage problems) exclusively on the farmers. In particular, they have been accused of water wastage and 'over-irrigation'. The fact that the majority of the farmers - the fellahin so admired by Willcocks - have to lift their water from the watercourses by animal-operated wheels (sakias), and therefore have to bear a substantial variable cost for doing so, would suggest that, on the contrary, they have good reason to use water sparingly. EWUP's studies have begun to challenge the conventional wisdom by producing evidence that the main problems are to be found not on the farms, but in the operation of the main canals and watercourses. The extracts below are from a study of main system operation, on the Mansouria Canal, near Cairo.*[2]

1. The major irrigation system

A typical irrigation system in Egypt consists of major canals, and main and secondary branch canals. Irrigation water is distributed by main canals on a rotational basis.

Under the rotational method, the area served by one main canal is divided either into two equal regions and called a double rotational system, or into three regions and called a triple rotational system. In each of these rotations, water is admitted to only one of the regions (during the so-called on-period) and the intakes of all the other regions are closed (so-called off-period). To insure more control of water distribution, a series of regulators are constructed along the main canals.

Different allocations in space and time are applied on this system according to the location, climate and cropping pattern. :.

The canals are normally designed to maintain a water level that requires the farmer to lift the water up to a maximum of 75 cm. This range allows the farmer to use lifting tools manufactured in the villages. An Archimedes screw is powered by hand, and a water wheel by animal.

Canal cross sections are designed to carry enough water for the crop requirements of the land it serves. The designed canal flow has two limits. The maximum flow occurs in the summer period during maximum evapotranspiration. The minimum flow occurs during the winter when the crops have the lowest water

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1. See, eg, the concluding section of Evaluating the Organisation and Management of Irrigated Agriculture, attached to Network Paper 1/78/3.

2. Preliminary Evaluation of Mansouria Canal System, Giza Governorate, Egypt, EWUP Technical Report No.3, June 1979 (EWUP, 22 El Galaa Street, Bulak, Cairo, ARE).

requirement. The canal is designed to permit the discharge to be controlled by changing the canal water level at its intake.

The job of the irrigation district engineers and their gate operators is to fulfill the water distribution schedules by maintaining the specified water levels in the main irrigation system. With the help of the head regulators in the main canals, each one just below a group of branch intakes, they can close and open sluice gates to control the water levels both in the main canals and just behind the branch intakes. They must adjust these gates according to the rotation schedules.

Figure (1) is a diagrammatic representation of the designed distribution operation in the main canals where:

When the water is appointed to the first reach; i.e. it is the on-period for the first reach:

The intake (a) is adjusted to have the specified water level in the main canal just downstream from its intake.

The regulator (b) is closed to maintain the required water level at its upstream side.

All the intakes (d) between regulators (a) and (b) are adjusted to pass the quantities of water that keep their downstream levels at those specified.

No water is allowed to the second or third reaches.

When water is scheduled for the second reach, the first and third are off and:

The intake (a) is regulated to have the required water level at its downstream side, while the regulator at (b) is fully opened and that at (c) is closed to keep water flowing to the third reach.

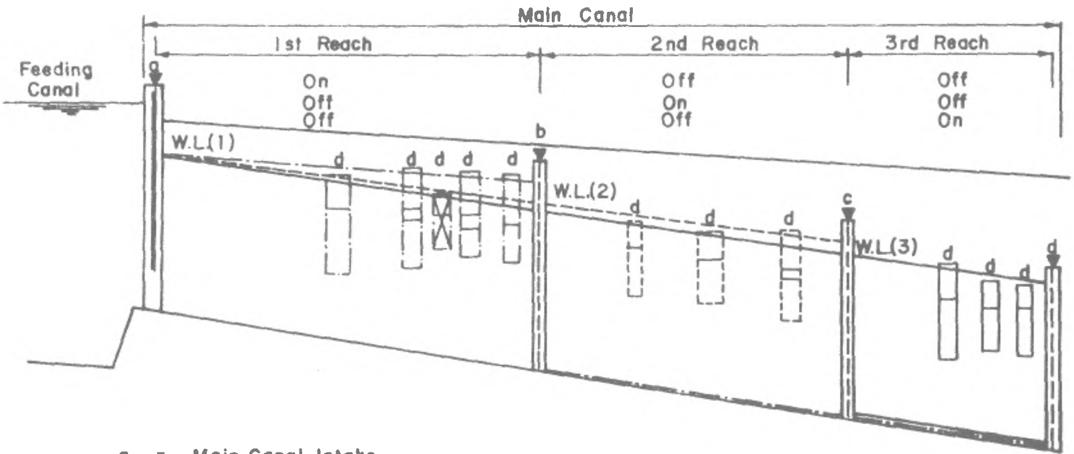
The water at the upstream side of (c) is maintained at a specified level to make adequate head available for the intakes between points (b) and (c).

The intakes between (b) and (c) are regulated to maintain the water levels of the branches downstream from those intakes at the designed levels for the rotation.

During this period, the water still has adequate head available for the intakes on the first reach, but they must be closed to provide enough water for the second reach.

When the water is appointed to the third reach the first and second reaches are off while:

The intake (a) is regulated the same as before, regulators at (b) and (c) are fully opened and the water level on the upstream side of the tail end of the main canal is maintained as specified.



a. = Main Canal Intake

b & c = Water Controll Regulators along the Main Canal for Rotation Operations

d = Branch Canal Intakes

e = Tailend Regulator or Spillway

—·—·— Water Level in the 1st Reach On-period

------ Water Levels in the 2nd Reach On-period

——— Water Levels in the 3rd Reach On-period

W.L.(1) is Water Level when the Water is Appointed to the 1st Reach and 2nd and 3rd Reaches are Off

Fig. 1 Operation of a typical main canal on a triple rotation system.

The intakes (d) of the third reach are regulated to maintain the designed water levels in the branch canals.

During this period, the water is still available at only slightly reduced heads at the intakes in the first and second reaches. They must be officially closed to convey the water to the last reach. Otherwise the last reach will not have its fair share of water.

While the internal distribution within one or more irrigation districts is accomplished only by the maintenance of the adopted water levels in their main and secondary canals, most of the intakes of the major canals and the main distribution sites between Governorates are calibrated, and the water flow through them quantitatively measured.

2. The watercourses

While the major irrigation system is operated and maintained by the government, the minor system, beginning from the canals and extending to individual farms, is in private ownership and is maintained by the farmers themselves.

The canal outlets to the private ditches are normally steel or concrete pipes laid through the canal banks, with their crests 25 cm lower than the designed canal water levels. The hydraulic pressure is thus approximately equal on them. The pipe diameters are chosen to supply adequate water to each private ditch according to its length and the area served by it ...

One private ditch may serve up to 75 farmers, or even more, depending on the size of farms, the size of fields, and the total area served. The area served usually ranges between 20 and 150 feddans (8 to 63 hectares). The farmers are allowed to lift water directly from this ditch to their fields. Fortunately the small fields tend to be long and narrow, with one end touching a ditch. The irrigation scheduling along a ditch is arranged by the farmers. On some ditches, the next turn is given to the one who has been waiting beside his field the longest time. If problems arise between farmers concerning either scheduling irrigation turns or maintenance of ditches, the district irrigation engineer has the legal responsibility to solve them by designing an irrigation scheduling program along the ditch, or by arranging for and supervising a ditch cleaning operation at the farmers' expense.

3. Findings of the Mansouria study

The Mansouria Irrigation District is in the Giza governate extending mostly north from the pyramids. It contains 24,745 feddans (10,400 hectares) ...

The Ministry of Irrigation, through the Giza Irrigation district, releases into the Mansouria canal a quantity of water calculated to meet the irrigation requirement of all the land served by this canal. The water is distributed by the triple rotation method where the canal is divided into 3 reaches. The area of the first reach is 6,288 feddans (2640 ha), the second 12,763 feddans (5360 ha), and the third 5,694 feddans (2390 ha). The schedule is 4 days on and 8 days off.

Because the three reaches are unequal in size, and the second reach has an area of more than double that of the others, a part of the water is diverted to the second reach from the on-periods of the first and third reaches. The second reach receives a full flow for four days. During each of the other four-day periods it receives partial flow, but for two of those days in each period the water level remains high, then drops to a lower stage. This procedure helps to equalize the water shares.

During the on-periods, water is controlled in the main and secondary canals by maintaining the water levels just upstream from the main regulators and just downstream from the branch canal intakes, according to the levels specified in the initial designs.

The Mansouria Canal and its branches are unlined except Beni Magdoul, which received a cast-in-place concrete lining in 1977. Also, this branch canal receives a continuous flow, as part of a comparison study for evaluation of the rotation system.

(Between 1 March and 31 July 1978, detailed measurements of water flows were carried out on three selected branch canals: Kafret Nassar on the first reach of the Mansouria canal; Beni Magdoul on the second; and Hammami on the third). Comparing the three chosen canals it was found that:

> The share of each feddan served by the Mansouria intake was 3281 m^3 in the period with an average of 21.4 m^3/day (5.09 mm/day).
>
> The share of each feddan served from the Kafret Nassar canal that lies on the first reach where water is given under the rotation method was 4700 m^3 in the period with an average of 30.7 m^3/day (7.31 mm/day).
>
> The share of each feddan under Beni Magdoul canal where the water is given continuously without rotation was 3283 m^3 in the period with an average of 21.4 m^3/day (5.09 mm/day).
>
> The share of each feddan served from the Hammami canal on the second reach, under rotation, was 1370 m^3 in the period with an average of only 9.1 m^3/day (2.17 mm/day)...

Among the three branch canals chosen for study, it appears that progressively less water per unit land area is delivered to those branches which are farther from the Mansouria intake ... The same kind of relationship appears to exist within the area served by the El Hammami Branch Canal and its Shimi Branch. The figures are 4.17, 2.09, and 1.79 mm/day, respectively, for the first reach before the final branching, for the shorter Hammami Branch, and the longer Shimi Branch. These compare with 2.17 mm/day per day for the entire Hammami area. In addition, it has been observed that farms near the end of a private ditch receive less water than those near the intake, and that some farmers can only find water in the ditch at night.

All of these water delivery measurements include whatever conveyance loss there is within the area served. Estimates of these losses are not yet available. However, because a high water table exists in the region, it is assumed that at least a part of the seepage from the canals is available for consumptive use. Perhaps some idea of the conveyance losses in the branch canals can be obtained from the measurements that were made in the Mansouria Canal. These ranged from a slightly negative loss for one short section to 1.3% per km through most of the clay soil, and reached the very high value of 3.9% per km through sandy soil. If we assume that these percentage losses can be applied to the smaller canal cross sections in the clay soil of Kafret Nassar and in the sandy soil of El Hammami, respectively, the total loss in Kafret Nassar's 3.73 km would be 5%, and in El Hammami's 3.63 km, 14%. If these losses are not all recoverable as consumptive use, they make the disparity among the water shares even greater. All figures are based on one year measurements.

Since both the Beni Magdoul Canal and its branch are lined, it is assumed that their conveyance losses are less ...

During this test period, engineers for the Egypt Water Use Project were permitted to regulate the inflow to the Beni Magdoul Canal. It was somewhat comforting to learn that the 5.09 mm/day distributed by the Beni Magdoul Canal was identical with the amount delivered by the entire Mansouria system.

It is apparent from the foregoing that the shares of water are not equally distributed, and that some regions receive more than they need and others less than they need for maximum production.

The area served by the Kafret Nassar Canal receives more than three times as much water as that served by El Hammami Canal and more that four times that supplied by the Shimi Branch. Several reasons for these differences have been identified. Some of them relate directly to the practice of using water levels to regulate discharge rather than water measurement, and to the physical characteristics of the system. Among them are:

1. The water level near the intake of any canal is maintained up to the design level most of the time, making water available when it is supposed to be. This becomes less true toward the end of the canal.

2. Intakes to private ditches, especially near the intake of a canal, will discharge more water if the users lift more out onto their lands. This results from the reduced head on the downstream side of the pipe inlet, thus increasing the total head causing flow through the pipe. The same effect is transmitted back to the

sluice gate at the intake of the canal, increasing the flow there also.

3. Since the water level in the Mansouria canal remains fairly high at the initial end during all rotations, there is more opportunity for water to be obtained during the off-period of a particular branch canal through a leaky gate, or by direct diversion to a field.

4. Weeds in unlined canals, including submerged weeds are very prolific in this climate. In spite of frequent cleaning, they can increase the required hydraulic gradient in a canal so much that essentially no water reaches the end until they are removed.

5. Silt deposits give nourishment to weeds even in lined canals, greatly restricting flow. In unlined canals the silt builds up with the weed growth in just a few months, even to the point of causing a reverse gradient in the bottom of the canal, especially near the end. Some of this silt is blown into the canals, especially during the windy period in the spring. The weeds tend to trap both the wind-borne and water-borne silts.

6. When a canal passes by or through a village, it may receive enough trash to restrict flow. Sand and gravel used to scour dishes and pans accumulate in the bottom. Garbage, including broken glass, not only restricts flow but makes the hand-cleaning operation more difficult. During 1978, Beni Magdoul Canal had to be drained and cleaned twice, and El Hammami three times. Some of the material discovered in the cleaning included bricks and concrete blocks that may have been illegally placed to raise the water level behind them, at the expense of users farther down the canal.

7. Illegal pipe intakes to private ditches probably constitute one of the most important factors causing unequal shares. In the first reaches, where a good head of water is available most of the time, an extra pipe through the canal bank will double the flow, thus providing enough water so night irrigation is not required. When there is no night irrigation, the unused portion of the flow may be lost over the canal spillway directly to the drain at night, or perhaps from the end of a private ditch. Farther downstream near the ends of the canal system, illegal intakes can then become almost a necessity to get enough water to supply a sakia (water wheel for lifting water usually driven by animal power) even when irrigating with the water level that reaches a maximum at night. The night water level, even though higher, may still be below the design level for that reach.

4. The search for solutions

The Egypt Water Use Project is now beginning a search for solutions to the problems identified in the Mansouria district. A number of different trials are being considered. Among those which may have a beneficial effect on the problems identified in this paper are:

1. Lining of canals and ditches A full-scale trial is already underway in Beni Magdoul under the auspices of the Water Distribution and Irrigation System Institute. It is hoped that the lining will reduce the weed growth and therefore the maintenance required to get adequate water to the end of the branch canals and private ditches. The lining should also reduce the seepage loss, leaving more water for the last users. If the reduced seepage lowers the water table, the resulting increased gradient may cancel some of the expected reduction in seepage.

2. Water measurement Measuring structures of concrete, masonry, and steel have already been installed at the intake of Beni Magdoul and Kafret Nassar and at the end of spillways. A few have also been installed on selected farm sites. The larger structures contribute to a water budget study that should provide information for better management of the canal system. Various additional techniques for measuring the water delivered to each farm or field may have to be tried before an acceptable one is found.

3. Control of intakes to private ditches *(watercourses)* A suitable method will be sought to control the intake to any private ditch to a reasonable amount. Anticipated problems include the cost of any possible modification of the control structures, the cost of water measurement if that becomes necessary, and the cost of enforcement or the alternative cost of obtaining voluntary cooperation.

4. Scheduling irrigation turns along the private ditches Perhaps trials can be initiated that would encourage the farmers to take turns using the water from their private ditches, thus insuring that those near the end get a fair share. Ideally, each should agree that some of his turns will occur at night.

5. Land levelling and the use of water control devices Land levelling will make night irrigation easier, thus eliminating part of the reluctance to irrigate at night. At the same time it should reduce the quantity of water needed for each irrigation, leaving more water for those farther downstream. The introduction of water control devices such as spiles, siphon tubes, or gated pipes, should further reduce labour and increase efficiency.

6. <u>Irrigation scheduling on fields</u> The training of irrigation advisors who would be able to measure or calculate when it is time to irrigate and how much to apply should reduce the number of excessive irrigations. At the same time these advisors could prevent moisture stress caused by waiting too long before irrigating. If an acceptable program for this kind of service can be found, it should decrease over-irrigation, leaving more water for areas now in short supply. Hopefully it would also increase yield.

7. <u>Auxiliary water supplies</u> Farmers in the water-short areas have already discovered they can augment their water supplies by pumping from the drains or from wells. Some use these sources exclusively because they are more dependable than the canal water. The drain water has medium-high salinity, and has apparently contributed to an increase in soil salinity. With adequate leaching it could be used for tolerant crops. The well water is somewhat better. EWUP will likely not initiate trials with this water unless other efforts fail.

<u>Possible issues for discussion</u>

The Willcocks extracts touch on many issues which networkers may wish to discuss, either particularly in relation to Egypt or in more general terms. Some of those on which we would welcome comments are:

- The thesis which argues that arid environments, and large irrigation systems within them, tend to encourage autocratic administration (section 1 and section 5, para 3 - Mohamed's Ali's saying).

- The tendency, even on small irrigation systems in arid environments, for farmers to choose a "dictator" in times of water scarcity (section 1). For a recent account of irrigation management on small systems in Spain, see A. Maass and R.L. Anderson, ... <u>and the Desert Shall Rejoice</u>, MIT, 1978.

- The importance of paying irrigation staff well as an insurance against corruption (section 3).

- The need for senior irrigation officials to visit the field frequently and talk to farmers' representatives. (sections 5 and 6).

- Willcocks's observations on land reclamation and settlement (section 7).

Comments are also invited on the following points in the EWUP paper:

- The Egyptian practice whereby farmers are usually required to lift water from gravity-fed irrigation channels (Is it a practice found elsewhere? What is the rationale behind it?) (section 1, para 4)

- The canal design and operating system described in section 1 and Figure 1. (see also comments on pp. 15 and 16).

- The nature of the solutions proposed in section 4: do they appear appropriate and complete in their coverage in the light of the weaknesses in operation described earlier in the paper?

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AGRICULTURAL ADMINISTRATION UNIT

ORGANISATION AND MANAGEMENT OF IRRIGATED AGRICULTURE

Network Paper 1/80/4

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WHO GETS A LAST RURAL RESOURCE? THE POTENTIAL AND CHALLENGE OF LIFT IRRIGATION FOR THE RURAL POOR

Preface

In November/December 1979 a four week seminar was held at the Institute of Development Studies, University of Sussex, on the potential and challenge of groundwater development and lift irrigation for alleviating rural poverty in South Asia. The participants, who came mainly from India, Bangladesh and the UK, had extensive first-hand experience of planning, executing or research concerning irrigation development and management.

The participants were present as individuals, not as representatives of their Governments, and there was therefore no attempt to reach formal, officially endorsed conclusions. Nevertheless, the attached propositions were discussed at length and the main argument had general support.

Groundwater resources may be the largest remaining untapped resource available for alleviating the pervasive and intractable problem of rural poverty in South Asia. Groundwater is at present being appropriated largely by those who are richer (or perhaps more accurately less poor) and more powerful. Opportunities for those who are poorer and weaker to benefit are passing. Who is to gain from this last frontier? The haves? Or the have-nots?

In this statement, a group of professionals who can speak with authority on this vital subject analyse the problems and potential and put forward proposals for policy and action.

Correspondence on issues raised in this paper will be welcomed and should be addressed to: Robert Chambers and Mick Howes, Institute of Development Studies, University of Sussex, Brighton BNI 9RE, UK.

Reference will be made to network members' comments in the next issue of the Newsletter.

The statement is also due to be issued as an Institute of Development Studies Discussion Paper.

Introduction

1. Groundwater development and lift irrigation offer a massively underexploited resource and opportunity. In India, less than half the safe yield of aquifers is currently used. In Bangladesh, a country sited on one of the largest and richest aquifers in the world, only one sixth of the potential is being tapped. Groundwater is a last frontier. Intensively used, it has potential in India and Bangladesh for the direct creation of additional livelihoods for at least 60 million families. In addition there are opportunities for lowlift pump developments from surface water sources, particularly in Bangladesh. Few, if any, areas of technology and investment can rival groundwater and unutilised surface water in this potential for productive employment. However, an appropriate share of this last frontier will not be taken by those whose need is greatest without positive policies to secure their interest.

2. Our analysis indicates that public leadership and control can strongly influence who will benefit from this resource, and how much they will benefit. For any far-reaching redistribution of rural incomes, agrarian reform is a precondition, and controlled groundwater development is no substitute. But while effective redistribution of land remains unachieved, control over the manner in which new groundwater is exploited does provide an opportunity for shifting the balance of benefits in the direction of poorer people. We recognise that groundwater development requires investment which the richer (or less-poor) and more powerful rural interests have been best able to muster. We recognise also that those who exploit groundwater contribute annually some 20 million tons of grain to the Indian harvest, keeping down prices and generating employment. We argue, though, that much of the potential for benefitting the poorer people - smaller and marginal farmers, and agricultural labourers - has not been realised. Because poverty is often deepening, because its alleviation has high political and humanitarian priority, and because groundwater development is rapidly preempting options, the opportunities to turn it more to the advantage of the poor deserves urgent and sympathetic consideration.

3. The objective of this statement is, then, practical. It is to outline some experience, problems and opportunities in groundwater exploitation and lift irrigation, and then to identify and endorse policy measures and applied research designed to harness future development more directly to benefit the rural poor.

Experience and Problems

4. The exploitation of groundwater has spread rapidly in India and Bangladesh, and indications are that the momentum will if anything accelerate in the next decade. The Indian National Commission on Agriculture estimated that the gross area irrigated from groundwater would have risen from 1968/9 to 1980 by 8 million ha, from 12 million to 20 million, and would increase by a further 8 million in the decade to 1990. In Bangladesh low-lift pumping from surface sources has doubled over the last decade. Tubewell irrigation has as yet made little impact. There are less than 1.3 million ha irrigated by all methods but the potential is several times this area. These developments tend to be irreversible. Once wells or tubewells are dug and lifting devices installed, strong interests are linked with them and policy options are much narrower.

5. From a social point of view, developments to date have left much to be desired. Aid agencies, governments and local manufacturers are concentrating on larger rather than smaller lifting devices, especially diesel and electric pumps. Bilateral aid agencies have had an interest in supplying them since they can be manufactured in their own countries. Governments have had an interest in accepting them since they can quickly increase production while at the same time serving the interests of some of the more influential people. Manufacturers of lift irrigation machinery in India have supplied a rapidly expanding market created by the spread of electrification. In some areas groundwater has been mined with short-term benefits, while some poorer smaller farmers, unable to deepen their wells or to raise water through greater heights, have been driven out of irrigation. For their part, tubewells have usually operated far below capacity as a result of problems of maintenance, fuel or electricity supply, or control by one or a few of the less-poor farmers. Diesel and electric pumps have accentuated the power crisis and the demand for foreign exchange for oil imports. The main beneficiaries have been larger farmers - through access to credit to buy pumps, through appropriating communal groundwater with those pumps, through heavy state subsidies on electricity and diesel,

and through their ability to use the new seed-water-fertiliser technologies. Benefits to the poorer people have been coincidental rather than a matter of deliberate policy, and much less than they might have been.

<u>The Opportunity</u>

6. New groundwater exploitation presents governments with unusual room for manoeuvre in choosing social and economic policies. However, groundwater is only part of the rural social and production system. Its development can contribute to the alleviation of poverty but it is no panacea. Its potential contribution will only be maximised if supporting policies are implemented. Groundwater development should be viewed as a complement to, not a substitute for, the implementation of land reform.

7. The main immediate opportunity lies in shifting the benefits of groundwater development more towards smaller farmers and landless labourers. In many but not all respects the interests of these two groups coincide. Some mechanical farming innovations require resources which virtually exclude small farmers and agricultural labourers from obtaining or using them; and the record of cooperative ownership and management has been dismal. In lift irrigation, the technical factors which have confined manufacture of diesel and electric pumps to 3 to 5 and higher horsepower sizes have at the same time demanded larger farms for economic use and have excluded the smaller poorer farmers from participation. The opportunity now is two-fold. First, it is to improve traditional lift irrigation devices and distribution systems. These are often based upon open wells using locally made and maintained human or animal-powered lifting devices which are relatively cheap and effective. Given that two-thirds of the 6 million open wells in India and just under half of all irrigation in Bangladesh use such techniques, the potential benefits from even small increases in efficiency are very large, not only in production, but also in reducing drudgery for people and animals alike. Second, there are opportunities for developing and improving new small-scale technology specially designed for small farmers. Such technology includes both hand or bicycle-powered pumps, relying on human energy, and solar-powered micro-pumping units designed specifically for the very small farmer.

8. Such technologies would benefit both the national economy, and the rural poor. The national economy would benefit through substituting human, animal or solar energy for fossil fuels, reducing the demand on foreign exchange and on the national electricity supply. The rural poor would benefit in several ways. Food and income flows would be created for small farmers and landless labourers around more of the year. This might often be critical in creating adequate livelihoods by removing the need for recurring, seasonal indebtedness and other forms of dependence. For small farmers it would raise yield potential and reduce the risks of crop failure, giving greater net return in dry years. For many small farmers, this might also mean much less risk of impoverishment through having to sell land in a bad year. Small farmer irrigation from groundwater may thus provide a safety net, slowing or arresting the slide from small farming into landlessness. Finally, more employment would be created per unit of water than with larger pumps. Human and animal lift techniques are labour-intensive, while solar pumps may require continuous fieldwork to control water flows during insolation. The shift towards smaller lifting technology using renewable energy sources would, thus, also shift the benefits down the scale more to the smaller farmers and agricultural labourers.

9. Against this background, and on the basis of experience gained, it is possible to list desirable characteristics of techniques. In any choice, there will be trade-offs between these characteristics. Some can be applied not only to lifting techniques, which tend to attract the most attention, but also to methods for developing the water source, to water distribution, to cropping systems, and to the linkages between all these.

The list is:

(i) high use of resources in abundant local supply (labour, renewable energy sources, local materials);

(ii) low use of resources in short local supply (fossil fuels, capital, administration, recurrent operating costs);

(iii) physical suitability (able to operate under the worst conditions likely, usable through more rather than less of the year, robust, with low maintenance requirements, effective at design task);

(iv) adapted to the production environment (divisible and thus efficient with small command areas, mobile for use on fragmented holdings, capable of other uses);

(v) generating benefits for the poorest classes (accessible to very small farmers, reducing risks of failure for them, maximising employment for the landless, providing safety nets against impoverishment and indebtedness for both small farmers and the landless, enhancing the quality of life through reducing drudgery);

(vi) having strong linkage effects (increasing employment in manufacture, generating skills).

Implications for Policy and Research

We have examined in detail case studies from Bangladesh, West Bengal, and Tamil Nadu. From these cases and from other experience and evidence, we draw implications for policy and research. In putting these forward as proposals, we do not mean to underrate, or divert attention from, essential complementary programmes. In particular we would emphasise adult education and training concerned to promote and enhance awareness and self-reliance; organisation of the rural poor; credit for consumption loans; and the effective organisation of service centres and input supplies for the smaller farmers. Above all, effective implementation of land reforms, more than any other measure, would provide a new starting point from which the distribution of benefits from lift irrigation could be immeasurably more equitable. It is against this background that we present the following proposals for policy and research requiring government commitment and resources:

(i) Zoning of technology

Groundwater policy has to be specific to environments. Clear differences exist between areas where groundwater is, or may in future be, depleted through extraction or lead to soil waterlogging through excessive infiltration and other areas where recharge is equal to abstraction. Another is between areas where different lift techniques - deep tubewells, shallow tubewells, and animal and human lift - compete for water (for example where aquifers at different levels leak into each other), and other areas where there is no competition between different technologies. The policies and technologies appropriate to such different types of area will differ. In one area a deep tubewell may generate new livelihoods in which the poor share; in another, as in parts of Bangladesh, a deep or shallow tubewell may draw down the water-table near the surface at the cost of the poorer farmers who rely on animal or human lift devices. Again, high discharge-capacity pumps may encourage large farmers to grow thirsty crops such as rice or to use wasteful methods of irrigation when more employment would be created by more water-sparing crops and careful crop husbandry.

If groundwater and lift irrigation are to benefit the small farmers and agricultural labourers to the full, zoning and effective control of technology appear unavoidable. India has already banned the import or manufacture of certain types of machinery in order to safeguard and increase employment. A model bill for controlling groundwater extraction has been available for some time for the States to enact. In Bangladesh there is a case for prohibiting capital-intensive techniques for groundwater extraction wherever small-scale techniques can be used. The next logical step in both India and Bangladesh is the identification of zones and their appropriate technologies, safeguarding the interests of the poor and restraining excessive appropriation by the rich, and then preventing the installation or use of undesirable techniques within those zones.

(ii) Subsidy and credit policies

There are strict limits to the scale and extent of public subsidies. With lift irrigation at present there are often heavy subsidies for the installation of pumpsets, for electricity connections, and for electricity and diesel themselves. These subsidies, in the main, benefit the relatively wealthy and only indirectly and to a much lesser extent the poor. To encourage more productive use of water and energy, and generate more livelihoods, measures to be recommended include:

(a) phasing down subsidies for the capital and recurrent costs of water lift, and as appropriate phasing in subsidies designed to stimulate the sparing and more productive application of water providing the employment effect is positive;

(b) two-stage tariffs for electricity, with a shift to a higher (not lower) tariff for each electric pump beyond a fixed level of consumption;

(c) differential tariffs for electricity, charging larger farmers more than smaller, as already implemented in parts of Tamil Nadu;

(d) subsidies for lift technology which will save non-renewable energy and benefit very small farmers. Examples are hand and pedal pumps, and new solar pumps which are specified for the needs of very small farms. One method of applying such subsidies that deserves consideration is a tax rebate for manufacturers of appropriate small-scale technology. Another approach would be to limit subsidy to only one lifting device per family;

(e) regular revision of revenue-raising taxes and services in line with inflation to ensure disguised subsidies do not grow;

(f) pilot experiments through credit to groups of agricultural labourers to enable them to pump water, and then to sell water together with their labour to neighbouring farmers.

(iii) Research and Development with indigenous technology

Indigenous rural technology has often been looked down on and regarded as of less professional interest than 'modern' technology. Urban and industrial biases, and biases implanted in university teaching and systems of professional rewards and promotions, direct attention away from the technologies of the poor, and have reinforced the belief that the knowledge of educated persons is superior and that of uneducated persons inferior. That view has now been widely challenged and the high costs of neglecting indigenous technology are increasingly recognised. That neglect also means that there may often be substantial early gains from R and D with indigenous technology.

Four activities can be suggested:

(a) learning about and improving the use of human and animal energy for lift. This applies especially where there is water close to the surface, landholdings are small, and there is population pressure. There may be many opportunities for improving efficiency in the use of human and/or animal energy and in lifting devices, and for diffusing technologies;

(b) learning about and improving the methods of water distribution and application used by small farmers;

(c) on-farm research, treating farmers as professionals and colleagues, and covering water distribution and application, input mixes, and farming practices;

(d) research on research. The reversals of attitude needed on the part of professionals are not easily achieved. If they are to be enabled to learn from rural people and to work with them, changes are needed in professional values, and above all in professional training. Research on research, conducted perhaps by independent organisations, may be one way of opening up this basic subject.

(iv) <u>Extension services for water management</u>

Water management at the farm level falls somewhere between the traditional responsibilities of ministries and departments. It is not a concern of irrigation departments staffed by engineers, nor is it usually a concern of agricultural departments staffed by agriculturalists. Farmers are blamed for inefficient and wasteful water management but surprisingly little is known of their techniques, and in the absence of a service with that responsibility, there is little extension work concerned with water management at the farm level.

A new extension service for water management would have responsibilities including:

(a) learning about local methods and problems, and identifying, and evaluating farmers' innovations;

(b) advice concerning the efficient operation and maintenance of pumps and engines and other devices (from deep tubewells through to manual lift techniques);

(c) the dissemination of appropriate new techniques (manual, bicycle-powered, solar-powered pumps, etc.);

(d) advice on methods for the sparing distribution and application of water such as lining canals with local materials, the use of hose pipes, sprinklers and drip irrigation for distribution, and appropriate size and form of well-head storage;

(e) rural drinking water as well as water for irrigation.

(v) The allocation and appropriation of new sources of water

New sources of groundwater have almost always been appropriated by those who are less poor and more powerful. In the coming decades many new sources will be developed. The challenge is to see how the poorer people can be enabled to appropriate these resources. Measures must differ by environments. Where deep tubewells are essential or where groundwater is saline, there may be no other effective course, in the short term, than public management for and with small farmer beneficiaries. Where water is near the surface, the priority may often be the development of very small-scale methods of lift. Practical suggestions include:

(a) research to find and analyse cases of success in enabling poorer people to benefit directly from lift irrigation, and attempts to replicate those successes;

(b) appraisal, environment by environment, to identify the most effective ways, given physical and political realities, of enabling the poor to gain from the exploitation of new water sources without their being dominated and monopolised by the relatively rich;

(c) zoning and control (see (i) above).

(vi) Restraint by international and bilateral agencies

International and bilateral agencies are anxious to disburse funds quickly and to minimise administrative overheads; and have an understandable preference for techniques with which they are familiar. Planners may be inclined to believe that modern capital-intensive techniques are always best, or may simply accept a method which they regard as sub optimal because they are offered no alternative. Soft loans to governments and subsidies to farmers may in turn create an environment in which private and social interests conflict, and small-scale indigenous options are passed over. The incentive to innovate is diminished, the possibility of establishing a base to manufacture irrigation equipment locally is foreclosed, and the rich get richer, whilst the poor are generally left standing on the sidelines.

Non-Governmental organisations, with their smaller scale, more firmly established field contacts, and greater flexibility of response, have shown the way forward, but can achieve relatively little in isolation. A fundamental shift in the orientation of international and bilateral agencies will be required if a process of self-sustained development (in which the poor can participate) is to be set in motion; and this in turn is only likely to come about when they are confronted by more assertive and critical planners and negotiators.

(vii) Research, equity and efficiency

Research has a key part to play in enhancing equity and efficiency in the use of groundwater and lift irrigation. The most useful research is likely to involve the competences of several disciplines, and linkages between the social, engineering and biological sciences. Research may take several forms: operations research projects in defined areas; problem-oriented research; or R and D to improve and develop technology. In all cases, the objective of equity and efficiency should be borne in mind. Out of many possible areas, we select the following as deserving priority:

(a) technology testing. Technology testing, either by a government organisation or by independent institutions on contract, should be established for "poor man's technology". This would test relevant technology, such as handpumps, and disseminate the findings widely. A design and cost-effectiveness mark, with a "guide-price" could help poor farmers make more efficient choices between brands and techniques;

(b) water-sparing combinations. For particular environments, multi-disciplinary research to identify water-sparing combinations of technology should examine questions such as alternatives for water sources, methods of lift well-head storage, the distribution, allocation and application of water, land levelling, farming systems, and crop mixes. Among the latter some priorities are changes to shorter-duration crops, to more water-sparing crops such as wheat in the boro season in West Bengal and Bangladesh, and to crops other than paddy in some parts of Tamil Nadu irrigated from wells. Special attention should be paid to understanding why farmers do or do not adopt practices: the non-adoption of water-sparing water application methods in Coimbatore district is a case in point;

(c) alternative energy sources. Technical, economic and social aspects of alternative energy sources deserve full exploration. Renewable sources such as human, animal and solar power, and wind power if conditions are suitable, deserve priority. In Bangladesh, water lift by natural gas should be examined;

(d) the political economy of groundwater and lift irrigation. Crucial issues in the political economy of groundwater exploitation need to be further analysed, in particular the implications of choices between what may be more rapid and laissez-faire development which favours most those who are already less poor and which preempts options more, and more controlled development which may be slower but more equitable and less preemptive. In addition, technical and economic research should take account of local-level political realities and corruption. These realities must be understood and borne in mind if partial and misleading proposals are not to be generated.

(e) livelihoods. To make equity implications clearer, research is needed into the ability of alternative policies to support families and provide employment. It would be useful to know more about the different livelihood and equity effects of deep tubewells, shallow tubewells, animal-power, human-power, and possible future solar-power technologies, about different methods of water application, and about different cropping patterns, in all cases taking a year-round view of the need for flows and stocks of cash and food for both small farmers and agricultural labourers.

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AGRICULTURAL ADMINISTRATION UNIT

THE ORGANISATION AND MANAGEMENT OF IRRIGATED AGRICULTURE

Irrigation Management Network 2/80
December 1980

4a

NEWSLETTER

1. Network Papers

This Newsletter is accompanied by two substantial papers: 2/80/1 is by Roberto Lenton of the Ford Foundation, New Delhi, and 2/80/2 by a group of people closely associated with an exciting new experiment in small-scale irrigation development in the Philippines. Both papers argue the need for radical changes in conventional approaches to irrigation planning and development and, by reference to recent examples of successful innovation, explain specifically what kinds of changes in attitudes, organizational structures and procedures are required on the part of implementing agencies elsewhere if they are to achieve similar success. Lenton's paper is concerned with field experiments in irrigation management: what sort of decision-making processes have to be developed to ensure (a) that the problems on which the experiments focus are correctly identified; and (b) that the lessons drawn from the experimental "pilot" area can be effectively extended on a large scale. The role of research, in the form of "action research", is also a prominent theme in the Philippines paper which describes and analyses methods of promoting participatory development on small community-operated irrigation systems.

Paper 2/80/3 contains a short collection of comments from networkers on various issues discussed in the 1/80 set of papers, together with a few recent quotations which emphasise the central importance of good main system operation on large irrigation schemes.

Last September a number of networkers were invited to comment on a short note by Ir. Rien Jurriens of ILRI, Wageningen, Holland on the subject of irrigation system design. Over thirty replies were received. A Network Paper based on Jurrient' note and the respondents

comments is being prepared for the next issue (1/81) due in mid-year. In that issue we shall also aim to start up the select annotated bibliography promised in the last Newsletter (p.7).

2. AAU work on irrigation management

As part of her broader programme of work on farmers' organisations, Clare Oxby did some preliminary work on the organisation of farmers in irrigated agriculture, both on smaller systems which are managed by the local community and on larger systems which are jointly managed by specialist irrigation agencies as well as farmers. In September, she wrote a paper with Anthony Bottrall on "The role of Farmers in Decision-making on Irrigation Systems" for the Development Studies Association's annual conference in Swansea. This was circulated as a draft for comment to several network members, and we are most grateful for their constructive replies. More on this study in the next issue.

Between September and December 1980, Anthony Bottrall visited India, the Philippines and Indonesia. Most of the time - two months - was spent on a consultancy under the auspices of the University of Birmingham which was concerned with reviewing the roles of central and local government in financing and administering irrigation development programmes in Indonesia. In the Philippines, he had an opportunity to learn about the National Irrigation Administration's new programme to assist community systems (described in Paper 2/80/2) and to visit two systems on which their participatory approach was being applied. In India and Indonesia, he was asked to comment on some very interesting new proposals to develop action research programmes to improve main system management on large schemes (see Paper 2/80/1, postscript); in India, keen interest is being expressed in these programmes by the Central Water Commission and several research institutions.

While in India, he also met several groups with an interest in doing research on the management of tank (small reservoir) irrigation (see section 5 (xvii) below). Given the marked increase of interest recently shown by development agencies in investing in tank irrigation improvement programmes, and given the particular technical and organisational difficulties associated with small reservoir management, this would seem to be a priority area for new research and one in which good coordination among research institutions and development agencies is likely to be particularly important.

For the future, Anthony Bottrall is planning to develop a programme of comparative research on the organisation and management of support services to small-scale (predominantly community-operated) irrigation schemes. While many case studies have been written on the internal organisation of small irrigation systems, very little analysis appears to have been done of their need for external support services or of the adequacy of those services. Though conducted on a more modest scale, the study would be similar in its form and objectives to the earlier evaluation of organisation and management of large-scale schemes carried out for the World Bank. In addition to desk research, it would ideally embrace up to four field studies in contrasting social and technical environments (eg including groundwater and tank irrigation as well as run-of-the river systems); and its principal objective, besides suggesting appropriate lines of action in the specific field study areas, would be to develop a systematic approach

to assessing organisational capacities and requirements which could be applied in a wide variety of small-scale irrigation contexts. Locations for the research have still to be decided. Close collaboration with local research institutions will clearly be needed: the most productive arrangement might well be a link-up with an institution which is already engaged in studying the internal organisation of water users within small systems. We would like to hear from any networkers who would be interested in the possibilities of such collaboration.

3. Recent/forthcoming meetings

a) Dr J.M. Jewsbury (Senior Lecture, Liverpool School of Tropical Medicine, Pembroke Place Liverpool L3 5QA, UK) has reported on a three-day meeting on schistosomiasis and water resources development held at Southampton University in April 1980. This meeting was attended by about 40 engineers, biologists, and allied health professionals concerned with the development of water resources in the tropics and with the spread of schistosomiasis transmission through these developments. Its objective was to exchange ideas and information between the various disciplines on what can and what cannot be done at present to limit the spread of this disease in the tropics, and to attempt to define areas where insufficient information is currently available. Those present included respresentatives of a number of national and international agencies (such as FAO, World Bank, ODA and WHO), of several of the major civil engineering firms in the UK and Europe active in this field, of the Universities and from the Blue Nile Health Project in the Sudan and the St. Lucia Schistosomiasis Control Project, West Indies.

The meeting was informal and consisted of a number of presentations on such subjects as civil engineering aspects of development projects, snail biology and control, and medical services, followed by discussions in open session and working groups.

It became apparent that the engineers were looking for precise answers to questions (such as the effect of different flow rates and periods of drying on snail populations) which the biologists could only answer in more general terms. Equally, the engineers were unable to provide more than general answers to questions such as the overall costs of alternative methods of irrigation. It was generally concluded however that the exchange of information had been very useful; many of the engineers in particular felt they had a better idea of the complexities of the biological features involved in the spread of the infection. Equally, it became clear to the biologists that the health component of any tender for a project was usually the first target if the client wished to reduce costs. It was felt by many of those present that another meeting in one to two years' time would be useful, even though there were unlikely to be major developments in the prevention and control of the disease in the meantime. Suggestions for future meetings included a) widening the scope to include other diseases associated with development projects in the tropics; b) a repeat of the Southampton meeting which would be attended by alternative representatives of the organisations present, together with representatives of development and control projects in other parts of the world. Several participants felt there was insufficient awareness of the often far-reaching effects on health which could be made by small design changes at the planning stage; they also felt that a short, intensive (perhaps 3 or 4 day) course for engineers on the biology of diseases which are likely to

require consideration in any development project in the tropics would be very valuable.

b) A Workshop on the Rotational System of Canal Supplies and Marabandi: was held at the Administrative Staff College of India, Hyderabad between 23 and 26 April 1980 (for information, write to Dr. K.K. Singh, ASCI, Bella Vista, Hyderabad 4, Andhra Pradesh, India).

c) A seminar on River Basin Planning was held at the University of Swansea, U.K., on 2 - 3 May 1980 (for information, write to Dr. Suranjit Saha, Centre for Development Studies, University of Swansea, Singleton Park, Swansea, U.K., SA2 8PP).

d) A workshop on Farmers' Organizations for Efficient Water Use in Irrigated Agriculture was organised by the Indian Institute of Management, Bangalore, from 8 to 10 August 1980 (for information, write to Professor A. Sundar, IIM, 33 Langford Road, Bangalore 560027, Karnataka, India).

e) A workshop on irrigation management, sponsored by the Agricultural Development Council, New York, was held at the Agrarian Research and Training Institute, Colombo, Sri Lanka in August/ September 1980. More on this in our next issue.

f) The Committee on Natural Resources of the Economic and Social Commission for Asia and the Pacific (ESCAP) held its seventh session in Bangkok between 30 September and 6 October 1980. Among the issues discussed were the activities of ESCAP in the appraisal, development and management of water resources.

g) The Third Afro-Asian Regional Conference of the International Commission on Irrigation and Drainage (ICID) was held in New Delhi from 23 to 28 October 1980, on the theme of Management of Water for Irrigation Systems. It was attended by 280 delegates from 25 countries. A summary of the principal conclusions is given in WAMANA Newsletter, 1, 1, January 1981, pp. 14 - 16 (see Section 5 (v) below).

h) At the time of its Executive Council Meeting in March 1982 ICID will also be organising a Special Technical Session on the theme 'Identification of remedial measures to mitigate the adverse effects of irrigation, drainage and flood control projects'.

i) Members of the British Section of ICID should note that on 13 May 1981 a meeting will be held on 'Irrigation Project Management' (2.30 pm at the Institution of Civil Engineers, Great George Street, Westminster, London SW1P 3AA).

j) The FAO plans to help organise two national water management workshops in Punjab and Sind Provinces of Pakistan in 1981, as well as an international seminar, also in Pakistan. In 1981 - 82 FAO will also be associated with two international seminars organised by the Farm Systems Development Corporation in the Philippines to discuss small-scale irrigation projects (for more information, write to P.J. Dieleman, Land and Water Development Division, FAO, Rome).

4. Recent publications, reports etc.

Publications continue to come in to us thick and fast. They are listed, as in the last Newsletter, under three categories: (a) books and published articles; (b) papers which are not commercially published but are obtainable from universities or research institutes on request; and (c) unpublished papers.

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5. News from networkers

International programmes

(i) The proposal for the creation of an International Institute for Research and Training on Irrigation Water Management (see Newslett 1/80, p. 14) was further discussed at another meeting of the Technical Advisory Committee of the CGIAR in Lima, Peru, during July 1980.

(ii)In October 1980 an International Support Programme for Farm Water Management was established in FAO's Land and Water Development Division. Its object is to assist governments in implementing and accelerating action programmes for improved water management. Support will be given to pilot improvement projects at the watercourse level, in which farmers will be encouraged to participate in all phases of the project (planning and construction as well as operation), and also to training government staff. More information on the programme may be obtained from Mr P.J. Dieleman, Land and Water Development Dvision, FAO, Rome.

Other newsletters

(iii) Issue No. 10 of the Agricultural Development Council's Asian Regional Irrigation Communication Network Newsletter, which was issued in September 1980, contained further valuable information on research publications and, especially, on current and recently completed research projects. Don Taylor, coordinator of the ARICN since its inception 5 years previously, left his ADC assignment in Malaysia in August 1980, and ADC are now apparently looking for someo to take over the running of the Network from him. We hope they succe since many of us have come to rely heavily on it for information and contacts with other researchers.

(iv) Irrinews, newsletter of the Irrigation Information Center (P.O. Box 85000 Ottawa KIG 3H9, Canada; and Volcani Center, P.O. Box Bet Dagan, Israel) celebrated its fifth anniversary in June 1980. In addition to Irrinews, IIIC produces an annotated bibliography of irrigation (Irricab), a book series and directories, catalogues and guides. The last category includes Irrigation: an International Guide to Organizations and Institutions, which contains 864 entries from 109 countries.

(v) A warm welcome to a new quarterly concerned with water manag- ment - WAMANA - which is produced by the Indian Institute of Managem Bangalore. The first issue is dated January 1981. Its object is to copy reviews of research publications, publication lists, descriptio of research projects and information on seminars, symposia and workshops of interest to the water management community. The productio

of WAMANA is one of the activities of the newly-formed Professional Interchange Unit (PIU), whose aim is to "help the formation of a competent and cohesive group of water resources professionals in (India) and to foster and encourage cooperation among them to tackle problems of national relevance". Editors are A. Sundar and P.S. Rao, Indian Institute of Management, 33 Langford Road, Bangalore 560027, Karnataka, India.

Training programmes

(vi) Prospectus for a training course on Irrigation Water Management sponsored by IRRI. Tentative Dates - August 3 - September 11 1981. Sites: Los Baños and Central Luzon Irrigation Systems. Clientele: Irrigation engineers of Asian nations who manage irrigation systems, plan and develop irrigation projects and conduct research on irrigation issues pertinent to effective management and efficient water utilization. Objectives: To develop an awareness and basic understanding of the production requirements of rice, and of the interrelationships of the social, institutional, communication, economic, soils, agronomic and engineering factors contributing to improved water management and gain practice experience in rice production and an innovative approach to irrigation system management. Timetable: Two weeks of rice production training, four weeks of combined formal IWM training and formal irrigation system management practicum. (For more information, write to Irrigation Water Management Department, International Rice Research Institute, P.O. Box 933, Manila, Philippines).

(vii) FAO is supporting training courses on paddy water management for junior and senior engineers in South Korea, as part of a regional programme covering 10 Asian countries (P.J. Dieleman, Land and Water Development Division, FAO, Rome.)

(viii) The Water Resources Development Training Centre in the University of Roorkee, U.P., India, has prepared a syllabus for a Postgraduate course in Water Use and Management. The Centre proposes to link this training with field studies of water distribution and efficiency of water use in the field (Professor O D Thapar, WRDTC, University of Roorkee, Roorkee 247672, U.P., India.)

(ix) The Indian Institute of Management, Bangalore, is developing a course on Irrigation Development and Management, and Water Management, designed for in-service training of administrators. (A. Sundar, IIM, 33 Langford Road, Bangalore 560 027, Karnataka, India).

(x) The Centre National d'Application et de Perfectionnement aux Techniques d'Irrigation (CNAPTI), was set up by the Ministry of Rural Development in Senegal in 1980, to train specialists in irrigation, administration and extension work. For more information see Irrinews No. 21, October 1980, and/or contact M.R. Campani, Director, CNAPTI, Boite Postale no. 74, Saint-Louis, Senegal.

(xi) An international training centre for water resources planning has recently been established in the South of France - the Centre de Formation Internationale à la Gestion des Ressources en Eau (CEFIGRE). It is sponsored jointly by UNEP (U.N. Environmental Programme) and the French Government and its main objective is to train future water resource planners and administrators, especially for the developing countries. See Irrinews No.21, October 1980, and/or contact M.F. Valiron, Director, CEFIGRE, Sophia Antipolis, BP 13 - 06560 Valbonne, France.

(xii) A loan of $1.25 million has been made to Peru by the Inter-American Development Bank to finance a training programme in the operation, maintenance and administration of irrigation districts in the dry coastal areas of the country.

(xiii) A proposal to set up a training centre for irrigation supervisors in Upper Volta is under consideration.

Reports from the field

(xiv) Intermediate Technology Industrial Service is involved in a joint project to field test twenty solar-powered micro-irrigation pumping units in Pakistan. Testing and evaluation will take place at research stations and small farms (1 - 3 ha.) to determine the suitability of the units. If there is sufficient demand, the project's long term goal is to establish a domestic manufacturing capability and promote widespread adoption of this new technology (For further information, contact ITIS, Myson House, Railway Terrace, Rugby, UK).

(xv) Michael Sweet (contact address: 10 Willis Road, Cambridge, UK) is currently working in Upper Burma on a UNDP-funded project which is concerned to investigate the viability of irrigation from tubewells in four parts of Burma - 100 wells are to be developed on a pilot basis. The intention is to establish tubewell irrigation systems (up to about 50 ha.) which will be largely managed by local farmer groups. The farmers will be expected to assume responsibility for O & M of canalisation, minor pump repairs and servicing, water distribution, payment of fuel costs and operators' wages and possibly repayment of capital costs.

(xvi) The Land and Water Conservation Section of the Indonesian Ministry of Agriculture has been helping to support and direct researchers from universities in many parts of the country in evaluations of present performance and future potential of water users' organisations at the tertiary (watercourse) level. The overall programme was discussed at a National Level Workshop held at Tanjung Karang in October 1980 and is now being extended further (Effendi Pasandaran, direktorat Perlindungan, Tanaman Pangan, Jalan Ragunan, Pasarminggu, Jakarta, Indonesia.)

(xvii) There seems to be an upsurge of interest in tank irrigation. Matthias von Oppen and K.V. Subba Rao have written-up a survey of tank irrigation in semi-arid tropical India for ICRISAT (see list of publications above). The University of Minnesota, in collaboration with Tamil Nadu Agricultural University and research institutions in Thailand, is planning a study on tank management in Tamil Nadu, India and in North East Thailand. R. van Aarb (ILRI, Wageningen) reports on a programme of tank improvement in Madhya Pradesh, India (see publications list). And other research proposals on tank development and management have been reported from Gujarat, Karnataka and Tamil Nadu States in India.

9. Composition of network membership

As a result of a request from the evaluators, we have just completed an up-to-date breakdown of the membership of the AAU's Irrigation Management Network. This reveals the following picture:

Networkers' Professional Background	Networkers' Location: Developing countries	Rich countries	Total
Research-social science	80	86	166
Government administration	101	--	101
Research-natural science	42	35	77
Consultants	30	58	88
Aid agencies, UN, etc	22	43	65
Voluntary organisations	2	8	10
Libraries	7	2	9
TOTAL	284	232	516

A more detailed geographical breakdown, by regions and countries, will be given in the next issue. If networkers are interested, we could also consider compiling a register of members, with brief summar of their professional experience and interests. Please let us know if you think this would be useful.

December 1980 Anthony Bottrall.

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AGRICULTURAL ADMINISTRATION UNIT

THE ORGANISATION AND MANAGEMENT OF IRRIGATED AGRICULTURE

Irrigation Management
Network Paper 2/80/1 4b

Field Experimentation and Generalisation in Irrigation Development and Management

Roberto Lenton*

This is a paper by an engineer, originally written for presentation to an audience of other engineers (1). The present version contains only minor editorial changes. It represents a criticism of the narrow, predominantly technical, assumptions on which most field research on irrigation is conventionally based; and by reference to three cases where a broad interdisciplinary research approach has been adopted, it argues that a new kind of decision-making framework is needed if field experiments are to have a substantial beneficial impact on the development and management of irrigation schemes in the wide world beyond the research area itself.

Introduction

Field experiments in irrigation management, often called "action" research or "operational" research projects, and which are carried out in farmers' fields under farmer conditions, are important tools for addressing problems in irrigated agriculture. Typically, the objective of irrigation field research projects is to improve the welfare of farmers in a given region (usually of relatively homogenous

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* Ford Foundation, New Delhi.

(1) Presented at the 17th Annual Convention of the Indian Society of Agricultural Engineers, at the Indian Agricultural Research Institute, New Delhi, 6-8 February 1980.

ecological conditions) by finding ways to improve the quality of irrigated agriculture in that region. Research generally focusses on identifying, testing and evaluating alternative technical and/or organizational methods for providing, or improving, water supply and related agricultural practices in a very limited "pilot" area considered to be *representative* of the overall region under consideration. The results obtained for the small area are then assumed to be generalizable to the larger region of interest.

Unfortunately, many field research projects are considered to have been successfully completed once promising solutions for the pilot area have been identified and evaluated. The larger, and more important, issue of generalization of results is, more often than not, left to others - the implementing agencies, extension agencies, or individual farmers - to address. Nevertheless, it is clear that there are many questions related to the issue of generalization which, in fact, are best addressed by researchers in the field projects themselves. Do the solutions developed for the pilot area in fact provide a good development model able to be extended to the larger region of interest? If they do not, why not? If they do, what are the administrative requirements for larger scale, longer term implementation? What new problems are likely to be encountered in replicating the development model, and how can they be solved. In short, field researchers not only need to identify those strategies most effective for the pilot area, they also need to address the problem of extension of these strategies over a larger area.

The principal objective of this paper is to analyse the process of conducting field research in irrigation management, and to try to draw lessons which might help structure future field research projects so that they effectively address, and contribute to, the extension of limited area results to a larger area of concern. There is a need to discuss and develop improved models for field experimentation in irrigation, and the intent of this paper is to present an initial contribution in this direction.

The remainder of the paper is divided into three parts: The first part contains a description of three outstanding field research projects that have been carried out in the region in recent years. In the second part, these and other projects are analysed in an attempt to understand what can contribute to the successful generalization of results in some projects, and to the lack of it in others. Finally, in the third part, some conclusions are drawn on research methodologies which should be useful to researchers engaged in designing field experiments, and possible directions for field research in irrigation are discussed.

Brief Description of selected Field Research Projects

The three outstanding projects chosen for particular analysis in this paper are the Colorado State University (CSU) Water Management Project in Pakistan, the Central Soil and Water Conservation Research and Training Institute's (CSWCRTI) Sukhomajri Project in India, and the International Rice Research Institute (IRRI)/National Irrigation Administration (NIA) field studies in Water Management and Distribution in the Philippines. These three projects (all of which have been visited by the author) have been chosen because they have either already led to larger-scale replication programmes, or are in the

6. Lunchtime meetings at ODI

The following lunchtime meetings have been held at ODI since the last letter was circulated.

a) 9 May 1980: Richard Palmer-Jones, "Why irrigate in Northern Nigeria?". (Institute of Agricultural Economics, University of Oxford, Dartington House, Little Clarendon Street, OXFORD OX1 2HP).

b) 21 May 1980: Professor Ian Livingstone and Dr Arthur Hazlewood, " Issues concerning irrigation in Usangu Plains, Tanzania". (School of Development Studies, University of East Anglia, NORWICH NR4 7TJ and Queen Elizabeth House, 11 St Giles, OXFORD).

c) 10 June 1980: Mick Moore, "Against the Current: Sources and Methods of Resistance to Better Water Management in Sri Lanka". (Institute of Development Studies, University of Sussex, Falmer, BRIGHTON, BN1 9RE).

d) 18 September 1980: Peter Stern, "Technology and Management of Small Scale Irrigation". (Gifford and Ptrs, Carlton House, Ringwood Road, Woodlands, SOUTHAMPTON, SO4 2HT).

7. Other A.A.U. activities

Towards the end of 1980, ODI published Borrowers and Lenders: Rural Financial Markets and Institutions in Developing Countries (edited by John Howell of the A.A.U. (price £2.95). This is based on papers written for an international workshop held at Wye College, Kent, in May 1979, co-sponsored by the A.A.U. and the Department of Agricultural Economics and Rural Sociology of Ohio State University.

Two recent issues of the Agricultural Administration Newsletter (produced by John Howell and Clare Oxby) came out in July 1980 and November 1980. A discussion paper by John Howell on Ministries of Agriculture and the Administration of Agricultural Development, also came out in November 1980; several further papers are available on request from Fiona Hibbert, AAU, ODI.

Further papers in the Pastoral Network series, organised by Stephen Sandford were issues in July 1980 and January 1981.

8. Evaluation

The AAU, which has been heavily dependent for its financing on a generous support grant from the British Overseas Development Administration, is currently being assessed by two independent evaluators, who will report their findings to ODA. As a result, if they select from our network lists, you may in the near future receive a request from the evaluators to express your opinion about the usefulness of the AAU's work, and of its networking activities in particular. If you have found our work of value, please don't forget to reply as soon as possible. The future of our Unit - and of this network - may depend upon it! Needless to say, unsolicited testimonials would also be welcome.

process of doing so. In each case, however, the type of replication is different: in the first project, which deals with outlet-level water management in a large-scale irrigation system,

replication is achieved through an extensive watercourse improvement programme; in the second, which deals with irrigation development in poor rain-fed areas replication can be achieved through an expanded programme for the construction and management of small tanks; and in the third, which deals with water distribution above the outlet in a large-scale irrigation system, replication can be achieved through a programme of improved management procedures in the government agency which runs the irrigation system.

There are other differences between the research projects, of course. There are differences in staffing pattern, scope of analysis, and research approach. There are also differences in the types of organizations performing the research work: one of the projects is conducted by a University in collaboration with a Government Agency; another, an International Crop Research Centre, also in collaboration with a Government Agency; and the third, a National Crop Research Centre.

The description of the three field research projects follows.

The CSU Water Management Project in Pakistan. The CSU Water Management Project in Pakistan, which has now been discontinued, was an AID-financed project carried out over a ten-year period by a team of around six CSU irrigation specialists based in Lahore, who, together with researchers from the Agricultural University of Faisalabad, collaborated with staff of the government-run Mona Reclamation Experimental Project. Its overall objective was to investigate ways of increasing agricultural productivity in Pakistan through more efficient irrigation.

The CSU team, which contained experts in water law, rural sociology, and communications, in addition to engineers, agronomists, and economists, originally had a broad mandate to study water management problems in Pakistan's publicly-administered irrigation projects. The Mona Project is located within the large Indus Basin irrigation system, and researchers initially concentrated on extensive data collection and analysis, including careful measurement of the extent of water losses in the Mona water courses. Once aware of the magnitude of these losses, the researchers focussed on alternative methods of reducing losses, ranging from improved maintenance to complete channel lining. These alternatives were tested extensively in the field, thus providing data for detailed economic analyses, and an effective low-cost system for reducing watercourse losses based on earthen improvement (with limited lining in critical areas) was developed. Work was also carried out on village-level water associations for construction and maintenance.

The research results were used as the basis for a large AID-financed development programme to improve 1,500 watercourses over a period of five years. The programme is being carried out by a section of the provincial Agriculture Department; and, until its departure in late 1979, the CSU team was given advisory responsibilities. Implementation is largely the responsibility of Agricultural Department Field Teams which help farmers to improve their watercourses, and to use the increased water supply efficiently once the project is completed. A specific in-service training programme for Field

Team staff has now been established at the University of Agriculture at Faisalabad under contract with the Provincial Governments, with direct inputs from the CSU research team. (Westfall and Ali Awan, 1979).

The CSWCRTI - Sukhomajri Project. The Central Soil and Water Conservation Research and Training Institute (CSWCRTI) field research projects in two villages started in 1975 through a grant from the Ford Foundation. The two CSWCRTI field research projects were originally concerned with technologies and management strategies for watershed areas. One project dealt with a thousand-acre watershed close to Dehra Dun; the second project, which is of interest here, was centered in the catchment area of the Sukhna Lake at Chandigarh. The objective of both of these operational research projects was to implement and evaluate alternative soil and water management technologies for improving the soil and water resource base of these areas, and the agricultural income of the poor farmers of the region.

In the second of these two field projects (Seckler, 1979), CSWCRTI scientists were concerned with the problem of sedimentation into the Sukhna lake. The scientists therefore experimented with conservation measures at the head of the watershed leading to the lake, including the construction of a large upstream check dam at Sukhomajri, in the Sivalik hills. Once the dam was in place, it was decided to use the water stored therein to provide irrigation to downstream villages. Therefore, an irrigation distribution system was installed, and the effects of irrigation monitored over a one-year period. The results confirmed that the irrigation system had the potential for substantially improving yields and incomes of the local villagers at a relatively low costs. Thus the final project focus on irrigation emerged as an unintended result of a conservation research programme.

The research project, however, did not end with the publication of scientific papers describing the potential for irrigation development through small tanks. Instead, as in the case of the CSU-Pakistan project, the results of the research were used to lay the groundwork for a potential irrigation development programme based on small tanks - which the international donor community has expressed great interest in. Researchers are now focussing on several important associated problems: how to make sure, through appropriate soil conservation measures, that the effectiveness of these small irrigation tanks does not diminish over the years because of siltation; how to devise an organizational structure to extend the tank irrigation model to the large numbers of villages in the region which could benefit as Sukhomajri has done; and how to devise a management system to ensure that, at Sukhomajri and all other future villages similarly irrigated, benefits can be sustained year after year.

IRRI/NIA Studies in Water Management and Distribution. Beginning in the early seventies, a series of research projects have been carried out jointly between NIA and IRRI or the University of the Philippines at Los Banos. (See, for example, Wickam and Valera, 1978). Field research here is conducted in pilot areas located in large-scale (3,600 to 75,000 ha.) gravity irrigation systems administered by NIA in Central Luzon in the Philippines.

Initially, the IRRI/NIA research projects focussed on problem-identification, based on analysing the impact of farm-level and system-level factors on crop water shortage. This procedure led the researchers to the conclusion that the greatest constraint to increasing agricultural production in the gravity irrigation projects under analysis lay in system-level, rather than farm-level, deficiencies. Thereafter, the researchers concentrated on testing a set of alternative system management techniques implemented by NIA. An improved system management technique based on measurement (flows, rainfall, water requirements, progress of farming activities), control (for delivering specified amounts of water calculated as target discharges for each system component), and monitoring (water adequacy and irrigation behaviour on a daily basis;, crop yields, economic performance, and socio-institutional issues on a seasonal basis), has now been developed, and its implementation in one pilot area by NIA was concluded in 1979. Monitoring of physical performance of the system since 1975 (before improved management was introduced) has shown an impressive increase in tertiary-level efficiency - from about 40% to 70% (Bhuiyan, Early, and Small, 1980).

A programme for replicating the system management technique over a much larger area has not yet taken place. However, an extension of the project on a more operational basis to a nearby 13,000 ha. irrigation system has been proposed to the NIA.

It should be noted that NIA has an important staff training programme focussing on irrigation water management, rice production, and irrigator behaviour, at a large training center located close to the project areas (Bagadion et al, 1978). The system management technique developed by IRRI/NIA has also been used for two consecutive years as the basis for the IRRI regional water management training programme.

Analysis of Field Research Projects

In this section, we will analyse the three field research projects described above, and compare their approach and achievements with other similar projects in the region, in an attempt to identify the factors which can contribute to the successful generalization of results in some projects, and the lack of it in others. All projects referred to either have been personally visited by the author or have been reported in the literature

In comparing and analysing field research projects we must recognize that problems encountered in generalising the results of a field research project can be as much due to the recommendation of a poor solution (because of an inadequate process of problem identification and search for solutions, for example), as they can from inadequate consideration of the problems inherent in extending pilot results to a larger area. Therefore, in what follows we will distinguish two separate stages in the process of conducting field experiments in irrigation, which bear on the ability of the project to extend results to a larger area. The first stage of this process includes the analysis of problems in the pilot area and in the region, and the identification, implementation, and evaluation of alternative, replicable, solutions. The second stage covers the set of activities required to extend the solutions appropriate for the pilot area to other areas in the region.

Methods of problem identification and analysis of replicable solutions

Three factors in the design of the field research projects described in the previous section undoubtedly contributed to the way in which pilot area solutions capable of generalisation were identified successfully. These are the problem identification and analysis process: the monitoring and evaluation procedure; and the institutional arrangements for research.

The extent to which field problems were analysed in their broadest dimensions, and the willingness of the researchers to address fundamental choices available for solving these problems, were undoubtedly key characteristics of the three research projects described earlier. In the IRRI research project, for example, the researchers did not automatically assume, as is often the case, that crop water supply problems were a result of faulty farm-level design or management. The problem-solving approach therefore started, as described earlier, with a systematic problem-identification procedure, which led the researchers to the conclusion that system-level water allocation deficiencies were, in fact, the greatest constraint to increasing agricultural productivity in the pilot area. Research then focussed on testing alternative system management techniques implemented by NIA, which led to the breakthroughs in efficiency mentioned earlier. Had the researchers evaluated more conventional farm-level solutions without first conducting a broad enquiry into the nature of the water management problems of the area, it is probable that the large improvements in efficiency recorded in the pilot area could not have been achieved.

The CSU-Pakistan researchers were similarly able to address very fundamental choices. Granted, their focus on problems "below the outlet" did not lead them to investigate in depth the extent to which water misallocations in the main distribution system were responsible for deficiencies in water supply at the farm-level (as in the IRRI/NIA case). Nevertheless, it was the researchers' careful measurement of the extent of losses of water at the watercourse level, and their realisation that, contrary to popular opinion, watercourse losses were undoubtedly a key water management problem seriously affecting agricultural production in the country, that led ultimately to a viable water management programme capable of generalization to a larger area.

In the Sukhomajri project, the research problem, as initially formulated, was one of soil and water conservation. Seckler (1979) describes well how the field research experience taught the participating scientists that conservation programmes will not work without an associated development programme to provide their economic and social basis. Although this understanding did not come immediately, it is clear that it held the key to the solution: irrigation development through tanks, the only low-cost source of water in the area. If the problem had been seen strictly as one of soil conservation, it is likely that no replicable approach could have been developed (although undoubtedly the limited objective of controlling sedimentation in the pilot area would have been achieved). It was clearly the broader viewpoint which enabled the researchers to develop a solution which could be extended outside the pilot area.

In other field research projects problem identification has often been carried out on a much narrower basis. In many cases the emphasis is on providing solutions to assumed problems of irrigation and drainage, rather than seeking to identify a wider possible range of constraints to increasing productivity. In some cases problem analysis is simply not considered. For example, in one project in Asia visited by the author, researchers assumed *a priori* that lack of farm-level conveyance systems was the problem, and lined field channels the answer; and therefore addressed only the question of selecting an appropriate lining technique - obviously a small subset of the choices available for improving water management in an area.

It should be emphasised that broad problem identification and analysis is needed most when the question of developing workable models for generalization is addressed seriously. In many cases, problems in the pilot area alone can be solved with only a superficial enquiry into their nature. For example, a soil conservation programme could undoubtedly have been achieved at Sukhomajri without an associated irrigation development programme, given the expertise and financial resources of the CSWCRTI - but it could not have been replicated elsewhere in the region, nor even perhaps sustained at Sukhomajri. Researchers must therefore clearly distinguish between strategies which will work only in the pilot area and those that show promise for generalisation over a larger area - and research supervisors must make sure that only *replicable* strategies are subject to detailed research and analysis.

A second key point in assessing field research projects in terms of their potential for replication is their approach towards project monitoring and evaluation. Effective monitoring must include the measurement of all inputs to the project (both those incurred by the farmer and those by the implementing Agency, including the administrative inputs - additional staff, overheads, etc., which tend to be overlooked), and all outputs. The reasons for monitoring and evaluation are apparent: for example, solutions which must be extended to a larger area at the farmers' cost are not likely to meet with much success if they are not profitable, however desirable they may look in terms of increased efficiency and other physical parameters. Similarly, pilot project solutions which must be extended through Government programmes require a realistic assessment of costs *and* administrative requirements before a successful programme of replication can be initiated. Overall, monitoring and evaluation must be geared towards ensuring that programmes developed in the pilot area - often with disproportionate agency resources and staff, or with unrepresentative farmer subsidies - are also viable for implementation on a larger scale.

The three projects described earlier all had thorough programmes for monitoring and evaluation. At Sukhomajri, not only was performance of the tank irrigation project monitored and the benefits and costs evaluated, but an innovative proposal was made to promote the distribution of benefits in an equitable way. In the CSU-Pakistan project, economists systematically worked out the benefits and costs of each alternative, based on rigorous field data, before recommending the programme for earthen watercourse improvement. And in the IRRI/NIA project, as we have seen a detailed monitoring programme was an integral part of the improved system management technique. (It has been pointed out, however, that the administrative inputs - crucial to the replication of the IRRI/NIA project - have not yet been clearly established).

Unfortunately, poor or limited monitoring and evaluation is all too frequently encountered in field research projects. In many pilot projects, effects of on-farm development works are evaluated solely in terms of costs and increases in irrigated areas. Changes in yields and incomes, assessments of which are crucial to the replicability of such works, are very often not monitored. In other cases, pilot projects receive an inordinate share of water and other inputs; in these cases the monitoring programme, even if carefully executed, yields misleading results. It is clear that a development programme based on the replication of a pilot project with unrepresentative inputs would result in lower per-unit benefits, and/or higher per-unit costs, compared to the pilot project itself.

The third factor contributing to the successful identification of replicable solutions in a field research project is the institutional arrangement made for carrying out the research activity. Evidently, the institutional and organisational mechanism which will be employed to extend the pilot area strategies plays a large part in determining the approach to field experimentation.

Where field research is carried out on large-scale gravity irrigation systems, the suggested strategies must be extended by Government agencies. In these cases, University or Research Centre projects unquestionably *must* work in collaboration with an irrigation agency, if they are effectively to explore the widest possible range of solution alternatives. In the case of the IRRI/NIA project, implementation and generalization of system-wide management improvements - the outstanding characteristic of this project - would not have been possible without close Agency collaboration, In the CSU-Pakistan project, limited testing of watercourse improvement strategies could have been undertaken by the researchers alone, but larger-scale evaluation of these strategies under operating conditions would not have been possible without Agency collaboration. Projects carried out by Universities or Research Centres where such agency collaboration is missing often face severe limitations; for example, in one research project on drainage, a very promising alternative which would have required the assistance of a local Government agency for field testing was evaluated on paper, but not in the field, since such assistance was not obtained.

Often, pilot projects on large-scale irrigation systems are carried out by the Irrigation Agencies themselves, without research collaboration with Universities or Research Centres. Although in theory there should be no difficulty here in investigating a wide range of options, in practice agency researchers face another kind of limitation: to need to work within the confines of a pre-determined Agency strategy, rather than making an open-ended enquiry. In these cases, the lack of research autonomy can impede the search for effective solutions.

Where field research is carried out in areas where small-scale irrigation (tubewells, or small tanks or diversions) has the greatest potential for development, it is likely that suggested strategies could be extended by a variety of government and non-governmental (voluntary) agencies. Here the exploration of the widest possible range of solution alternatives will also be aided if research is carried out in collaboration with the potential implementors and beneficiaries. It should be noted that at Sukhomajri the initial absence of a collaborating agency for dam construction created some practical difficulties, but the CSWCRTI has now entered into collaboration with the Haryana Minor Irrigation Organization and another non-governmental organisation for the design and construction of further experimental irrigation tanks, and other engineering tasks.

Methods for extending development strategies from pilot area to region

In analysing this second stage we must note that the institutional and organisational framework employed to extend the pilot area strategy again plays a large part in determining the most appropriate approach to field experimentation. Where field research results must be extended by government agencies, research should be conducted in collaboration with an implementing government agency, if it is to lead to generalisation. It is unlikely that an irrigation agency will embark on a given strategy if it has not been involved in the development and analysis of such a strategy - and even if it does, implementation is unlikely to be effective.

On the other hand, where field research is on irrigation systems of a scale small enough to be implemented and managed by private farmers or non-governmental groups (tubewells, small tanks, or diversions), research is best carried out in collaboration with the farmers, voluntary agencies, credit institutions, and other organisations which would be involved in replication. In this case, however, there is a greater burden on the researchers to work on developing organisation and management structures capable of extending the pilot model to other areas; and then to work with the many different organizations required to make this possible. This approach was adopted at Sukhomajri, with promising results; but it must be noted that in this case the institute researchers received a large amount of outside staff assistance to undertake the non-scientific tasks. In most other cases, work on developing effective organisational procedures for replicating the research results would be beyond the capacity, and outside the scope of activities, of an individual research centre or University.

Three other research factors also contribute to the effective generalisation of research strategies: research staffing, emphasis on training and communication, and research collaboration for monitoring and control during the implementation phase.

How a field research project is staffed plays an important role in determining its approach to generalisation. In the CSU-Pakistan project, the project team included experts in water law, rural sociology, and communications, who addressed the problems of organising and managing watercourse improvement projects in collaboration with farmers. In the Sukhomajri project, specialists in organisation and management from outside the institute have been brought in, and are developing the organisational framework for extending the tank irrigation model to other areas.(1) (In the IRRI/NIA project, the addition of organisation and management specialists would probably have facilitated the development of administrative procedures for extending the management techniques over entire irrigation projects). Bottrall (1979) suggests that organization and management specialists should be an essential part of interdisciplinary irrigation research teams "because the development of appropriate institutions and procedures (and a realistic assessment of the administrative costs) are essential to making pilot projects replicable".

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1. *See also the role of anthropologists and management specialists in helping to extend the Philippines communal irrigation programme (Paper 2/80/2). (Ed.)*

Unfortunately, many irrigation field research projects do not have a very interdisciplinary research staff, and undoubtedly their narrow disciplinary focus contributes to their ineffectiveness in terms of generalisation. In one research project focussing on development works below the irrigation outlet, for example, the engineers and scientists on the staff were able to address questions of soil and water management only. The project did not have staff capable of addressing ways of overcoming constraints on implementation, nor did they have a mandate to do so. Consequently, credit mechanisms and land consolidation procedures, both important questions in extending on-farm development work over large areas, were not analysed.

Training and communication are important factors which characterise field experimentation strategies, but ones whose impact on generalisation is often difficult to assess. To be effective, of course, training must be focussed on the implementors. Although many field research projects include some component of training, few link training directly to implementation. The three projects analysed in this paper, however, were fairly successful in this regard. In the CSU-Pakistan project, we have seen that an in-service training programme for the implementing field team staff has been established. At Sukhomajri, plans for a training programme are currently being developed. And in the Philippines, NIA has a staff training programme which could be used to train agency personnel in the system management techniques required to extend the research results to a much larger area.

Communication of results through publication of scientific papers is, of course, a usual component of all scientific research; but if communication is to assist in extending pilot project results, it must be directed at key control points in a possible implementation scheme. The CSU-Pakistan research project placed great emphasis on this kind of communication. Initially, communication focussed on agency decision makers, in an attempt to demonstrate that the problem of watercourse improvement was important. In later stages of the project, communication focussed on farmers, in an attempt to demonstrate the benefits which would accrue as a result of implementing watercourse improvement programmes.

The third factor, research collaboration for monitoring and control during the implementation phase, is also difficult to assess because of the lack of comparative experience in this area. However, it is clear that if such collaboration does not exist, the replication of a development strategy may not be carried out in the right way, particularly if agency/research group collaboration during the research phase is weak. Bottrall (1979) suggests that one way to ensure effective programme implementation in the absence of research collaboration would be to specify in great detail the procedures according to which a programme should be extended; and to give responsibility for overall monitoring to an independent (preferably non-government) organisation. (It should be noted that in the CSU-Pakistan project, such collaboration was originally provided for, but has now ceased to exist because of the departure of the CSU Team. In the IRRI/NIA and CSWCRTI projects, continued research team collaboration is quite likely to occur).

Lessons and prospects

1. The analysis of two outstanding field research projects - CSU/ Pakistan and IRRI/NIA - has provided evidence that interdisciplinary

action research programmes carried out in pilot areas by research teams in collaboration with Government Agencies, can yield results capable of extension to a larger area by Government Agencies. Important characteristics which contributed to the effectiveness of these projects were a broad problem identification and analysis procedure; an effective monitoring and evaluation programme; interdisciplinary staffing based on problem characteristics; a training and communication programme directly linked to implementation; and (potentially) a procedure for research team/agency collaboration during the implementation phase.

2. One field research project - Sukhomajri - has illustrated the potential for field experimentation in small scale irrigation leading to development models extendable to a larger area by non-governmental organisations.

3. Research autonomy is an important characteristic of successful irrigation field research projects. Administrative approaches to develop research and problem-solving capacities within Government Agencies, while retaining the research autonomy characteristic of University or Research Centres, should be explored.

4. Two of the field research projects analysed in this paper - CSU/Pakistan and IRRI/NIA - involved international efforts. A major characteristic of these two projects was their ability to gather together a truly interdisciplinary research team; quite often research centres are so segregated along disciplinary lines that effective interdisciplinary, problem-focussed, field research is quite difficult. In this context, current proposals for a new international effort in research and training for irrigation system management, along the lines of the International Crop Research Centres, could fill an important need. International interdisciplinary research groups could, for example, work with researchers in National Centres and Government Agencies to undertake field research, provide training, develop new and improved research approaches, and link pilot project research results to larger-scale implementation.

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Postscript: Action research to improve main system management (Anthony Bottrall)

The AAU is particularly interested in helping to develop and promote methods of action research designed to improve main system management on large irrigation schemes, on the lines of the IRRI/NIA project in the Philippines (see Network Paper 1/80/1, pp. 18-19). Irrigation administrations in several countries have expressed interest in setting up action research programmes for this purpose and the AAU has been asked to offer advice on their desifn.

Although the IRRI/NIA case appears to be unique in providing directly relevant lessons in the area of main system management, experience from action research initiatives in somewhat different contexts (eg. the case described in the accompanying Paper 2/80/2) can also be drawn upon to support Dr Lenton's general arguments and suggest in greater detail the kind of basic principles on which all such programmes would need to be developed. The AAU has consequently made some preliminary attempts to formulate such principles, with reference to issues such as: formulation of objectives and scope of management reform; selection of research areas; composition of action and research teams and the relationship between them; elements of the research programme; elements of the action programme; concluding the experiment and extending the results; and time and manpower requirements.

We should be extremely interested to hear from networkers about countries where this kind of action research is being contemplated and provided there is sufficient evidence of interest among network members, we should be glad to open up further discussion on methods of doing such research in a later Network Paper.

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All comments on this paper should be sent to Anthony Bottrall at ODI. They will then be forwarded to Dr Lenton in New Delhi.

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Network Paper 2/80/2

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Dec 80

PROMOTING PARTICIPATORY MANAGEMENT ON SMALL IRRIGATION SCHEMES: AN EXPERIMENT FROM THE PHILIPPINES

Based on articles by

Benjamin Bagadion*, Frances Korten**, David Korten** and others (1)

More and more networkers appear to have become involved in recent years in the planning and design of small irrigation schemes, particularly in Africa. Several have communicated their concern to find ways of promoting participatory forms of management on these schemes - recognising that, after construction has been completed, responsibility for their operation and maintenance will have to be left largely, if not exclusively, in the hands of their intended beneficiaries. This paper describes the development of a remarkable pilot programme in the Philippines whose express purpose has been to identify effective methods of building up strong and enduring irrigators' associations on small irrigation schemes. Although there are obvious physical and social differences between the Philippines and many other countries with small-scale irrigation programmes (especially those with relatively little earlier irrigation experience), many important general lessons in planning and management can be drawn from this particular case study which have wide relevance elsewhere. The relevance of these lessons is not confined to small schemes only. They also apply to programmes of development on larger schemes, particularly at the communally-managed watercourse level.

1. *National Irrigation Administration, Quezon City; ** Ford Foundation, Manila. Full references are given at the end of the paper.

Background

Irrigation is not a new concept in the Philippines. For centuries, groups of farmers have joined together to erect structures of logs and stones to divert water from a river or stream adjacent to their land. The size of the resulting systems varies from a few hectares to as many as 4000 hectares, although most are under 100 hectares. A recent study by de los Reyes (1980a) indicates the widely varying means of managing these associations. Generally, the small systems are more informally managed, while the systems covering more than 50 hectares have often developed some formal management structure, such as a registered association, paid water distributors' irrigation fees, and regularly scheduled maintenance.

These locally managed irrigation associations are referred to in the Philippines as 'communal' systems, as contrasted with 'national' systems. The distinction rests on who owns, operates, and maintains the system. For nationals it is the government, through the National Irrigation Administration (NIA), while for communals it is the farmers. A recent NIA survey indicates that over 5,500 communal systems exist in the Philippines covering over a half-million hectares, thus equalling in importance the national systems which are estimated to cover 481,000 hectares.

Average farm size is small (about 1 ha.). In a recent survey of 51 communals, almost half the sample farmers were found to be owner-operators. Most of the rest were either lessees or share tenants (Illo 1980). Only those who actually cultivate land can be voting members of their associations - absentee landlords may be honorary members, but have no vote.

Average rainfall in the Philippines is high - around 2000 mm. per year in many areas. There is considerable variation within the year, however: 15-20 per cent of the total falls between December and May and the rest between June and November. But even in the wet season, farmers continue to depend on supplementary irrigation for rice cultivation since it often contains several rainless weeks.

The temporary nature of the farmer-constructed diversion structures results in their frequent destruction by the heavy rains of the wet season. Not only is the rebuilding of these structures a significant drain on the farmers' time and energy, but also their destruction may mean crop loss. Furthermore, the farmers' structures can capture onl a fraction of the water in the stream, resulting in less irrigated land than would be possible with a more solid structure. Consequently the farmers on communal systems often seek government assistance. The government has been responding to these requests since the early 1900s, but the scale of the response has increased very substantially in the last decade. Expenditure of $ 100 million is projected for the development of small scale gravity systems over the next five years (1).

Evolution of the comprehensive strategy

Until recently, government assistance to communals was confined to the construction of physical facilities. This work was carried out at no cost to farmers. Minimal attention was given to the irrigation

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1. There are also plans to develop further the many pump systems which exist in the Philippines.

association. While some associations functioned effectively and made good use of the construction assistance, many remained weak. Especially during the 1950s and 60s the assistance programme was dominated by "pork barrel" politics. This had two adverse consequences. The "give away" approach increased farmers' dependence on government and did nothing to encourage greater self-reliance; and available funds were spread over so many different projects that planning and construction were often inadequate. In the early 1970s efforts were made to correct these deficiencies, but even with more rational allocation of funds many completed systems fell rapidly into disuse or served substantially fewer farmers than intended. Many NIA personnel observing these problems became convinced of the need to add another component to the existing assistance strategy - that of investing in the development of viable irrigators' associations.

This conviction was strengthened in 1974 by a presidential decree which required NIA to collect repayment of the cost of irrigation construction. In future all direct construction costs were to be financed on a loan basis to the farmer members of the association. Furthermore, farmers were expected to contribute an immediate minimum of 10% equity in the system through voluntary labour, materials, rights of way, and/or money. It was apparent that work in strengthening the farmers' associations was needed not only for improved operation and maintenance, but also to ensure that farmers understood the new arrangement, agreed to the construction contract, and had a strong enough association to mobilise labour and collect the required fees for repayment of the construction costs.

Because the NIA lacked the personnel to carry out this needed institutional work, it turned to the Farm Systems Development Corporatio (FSDC), an organisation with some experience in organising farmer associations for pump irrigation. In 1975 an agreement was reached under which NIA contracted FSDC to do the organising work in many of the gravity systems that NIA assisted.

The concept at that time was that the institutional and construction work were two quite separate tasks, calling for different skills and appropriately carried out by different organisations. It was assumed that only minimal coordination at the field level would be needed. Subsequent experience showed that this assumption was wrong.

Around the same time another pilot project was initiated on two existing communals at Laur in Central Luzon in which the NIA employed its own Community Organisers (COs). Its object was to experiment with a more integrated approach in which the capacity of the irrigators' association would be developed through active involvement in the planning and construction activities: planning system layout, obtaining water rights and rights of way, organizing volunteer labour inputs to system construction, and exerting control over project expenditures.

Integrating social and technical development proved extremely difficult. One of the Laur associations turned out to be so divided by internal factions that plans to provide construction assistance were temporarily suspended, although by 1979 this association had re-organised itself and construction plans were resumed. The farmers of the other association responded immediately to efforts to develop stronger member participation. However, in this case the lesson was soon learnt that a high level of commitment from a cohesive farmer group does not necessarily make things easier for the engineers: scheduling and system design issues resulted in delays and changes; organisation of volunteer labour presented unfamiliar problems worked out only through lengthy meetings; and farmer insistence on monitoring purchases and limiting personal use of vehicles using gasoline charged to the farmers' loan account was not always welcomed by project engineers. The farmers even questioned the engineers on basic technical judgements, such as the semi-permanent type of dam chosen for construction - insisting that the proposed structure would not withstand the force of local floods. Finally, however, the new dam was completed using the design favoured by NIA's design engineers - only to wash out a few months later.

The experience in Laur brought home to the NIA the difficulties it must try to overcome if it was to work effectively in support of community-managed irrigation: its capabilities on both the technical and the institutional side would need to be upgraded and integrated. Numerous changes in operating procedures were implied. Yet it also established in the minds of NIA's leadership that there were major benefits to be gained in return. Not only could farmer participation in system planning and construction result in a stronger irrigation association better equipped to operate and maintain the finished system; it could also result in a better designed and constructed irrigation system more likely to meet farmer needs. This experience confirmed the need for a further component to the overall strategy: the involvement of the farmer association in all key decisions and activities regarding the construction and improvement of the system.

Previous experience in the Philippines pointed to the need for the final component in the strategy - maintaining the independence of the communals but providing them some post-construction assistance. The desire to maintain the communals' independent nature came from a recognition of the limits of the irrigation bureaucracy. Government policy was to encourage greater land management of irrigation since bureaucratic mechanisms were too cumbersome to react to the varied needs of local groups. However, it was also recognised that some post-construction assistance was needed. Training in water management, record keeping, production activities, and post-harvest technology could enhance the effectiveness of these associations. The responsibilities for managing money, due to the new repayment policies, made follow-up help on this subject of immediate importance.

By the end of 1978 it was clear that the strategy to assist commu[illegible]s needed to contain four basic components. These can be summarised as:

1. Response to requests of indigenous irrigation associations for construction help, with costs financed on a loan basis.
2. Pre-construction development of the skills and viability of the farmers' association.
3. Involvement of the farmer association in all key decisions and activities regarding the construction and improvement of the system.
4. Independent ownership, operation, and maintenance of the system by the farmer association, with some external follow-up assistance after construction.

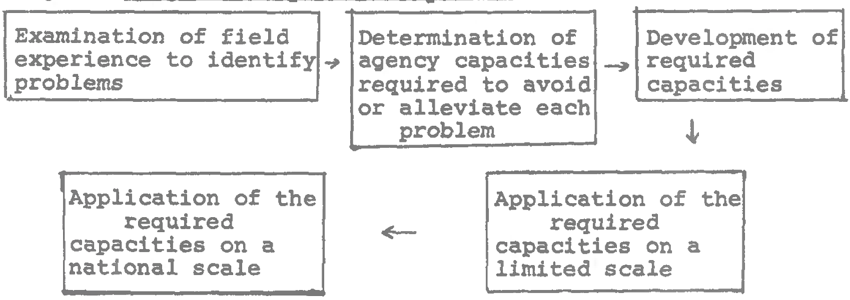
However, it was evident from the problems being encountered that a variety of agency capacities would need to be further developed before the strategy could be implemented on a larger scale.

Programme consolidation and expansion

In 1979 two further "learning laboratories" were established, on the Aslong and Taisan communal irrigation systems in the province of Camarines Sur, Luzon. About the same time a Communal Irrigation Committee was formed in Manila with the object of coordinating the analysis of field experience from these and earlier pilot projects, identifying improved methods of site selection, planning and construction and creating new capacities within the NIA to meet the needs of the participatory approach. The Committee is chaired by a senior NIA official (Ben Bagadion) and contains members from the Asian Institute of Management; Institute of Philippine Culture; International Rice Research Institute; University of the Philippines at Los Baños; and the Ford Foundation. Members include people with skills in engineering, management, anthropology, economics and agriculture.

The Committee's approach is illustrated in Fig. 1. After examination for problems which seem recurrent, efforts are made to develop new agency capacities to overcome them, through research, training, changes in policies and procedures, or combinations of these. Once developed the capacities have been applied on a limited scale, with the plan to apply them later on a national scale if they have proved of value.

Fig. 1 Programme improvement process.



The current programme has the following key elements:

(i) *A series of time-phased learning laboratories* Assessment of the original pilot systems has been used to refine methods subsequently employed on the two later systems. These refinements have made it possible to shorten lead times, reduce the number of organizers required improve project site selection, and avoid many of the conflicts between farmers, engineers and community organizers encountered in the earlier pilots.

(ii) *A national committee to coordinate the learning process* Most committee members have day-to-day responsibility for one or another aspect of the process. Meetings are held monthly to evaluate progress, interpret the experience from the learning laboratory sites and other committee-sponsored research, initiate new studies as needed, commission preparation of training materials, and plan strategies for phased dissemination of new methods.

(iii) *Process-oriented research* Research is an integral part of the learning process. The focal concern is with building into the NIA the new skills, methods, and systems appropriate to its new participative approach. The outside researchers are full participants, their roles distinguished from those of NIA personnel by their special expertise rather than by any presumption of special objectivity. Use has been made of expertise in three main fields: social sciences, management and water management.

(a) *Social sciences* Social scientists have had four main concerns: (1) developing and testing guidelines for NIA field staff to help them in the rapid collection and assessment of social-institutional data critical to project selection and planning *(guidelines for "institutional profiles")*; (2) carrying out *process documentation:* one researcher living full-time on each of the learning laboratory sites has prepared monthly reports on key events which have been fed back to NIA operating personnel, provincial and regional managers, and members of the Communal Irrigation Committee; (3) *studying established irrigation associations* and the forms of organisation and water management methods worked out by their members, to help improve the design of the NIA support programme to other communals; and (4) *training of NIA personnel* in use of the new tools being developed.

(b) *Management* Management experts from the Asian Institute of Management (1) assess the fit (or lack of it) between existing NIA management systems and the methods required for the new participative approach; (2) advise on new management roles and procedures; (3) assist in planning the organizational change process; and (4) coordinate workshops for NIA managers and engineers on the new methods.

(c) *Water management* An agricultural engineering team from the International Rice Research Institute and the University of the Philippines at Los Baños is developing (1) simplified methods for diagnosing and correcting common water management problems which can be used by farmers and NIA engineers; and (2) simplified water management techniques suited to the needs of small irrigation associations. These will be operationally tested and refined in the pilot sites and will then serve as the basis for training programmes directed to farmers, engineers, and community organizers throughout the country.

(iv) *Seeding pilot projects* Once the Communal Irrigation Committee had concluded that a reasonably satisfactory programme model was emerging out of the learning laboratory process, a workshop was held in December 1979 at which directors of each of the NIA's twelve regions were oriented to the new approach. Each was called on to designate one system due for rehabilitation in his region as a pilot on which the participative approach would be used. Thus each region would be "seeded" with its own learning laboratory through which regional personnel could gain experience with the new methods and adapt them to their needs. Additional training has been given to each Provincial Engineer, as well as the community organizers assigned to him. Regular follow-up meetings have been held for further training and to share experience in dealing with uncommon problems, with the object of enabling the personnel involved in these pilots to assist in spreading understanding of the method further within their respective regions.

Field-level decisions: new approaches and methods

Reference has already been made to some of the profound changes which the new participatory strategy has helped bring about in the character of the decision-making process at the field (or project) level. These changes, which have been occurring at all the four main stages of the NIA's assistance programme, will now be discussed in greater detail.

Site selection and preliminary survey. The first component of the programme consists of a response from the NIA to a request for help. (Requests usually come from existing water users' organisations; if none exists in a potentially irrigable area, a new association is formed if the farmers of the area desire irrigation). Deciding on a· appropriate response is often difficult. In some cases the ociation is weak, with poor member participation and passive or occasionally even corrupt leaders. Another problem is that there are often conflicting views among members as to the desirability of NIA assistance, since it may bring them differential benefits; farmers with easy access to water may be relatively satisfied with the present situation (and resent paying for new construction costs) while others downstream may be very keen on improvements to obtain more reliable water delivery.

Further complications enter because of the nation's objective to increase irrigated area for greater food production. This means that NIA must consider not only the needs of existing association members but also evaluate how much additional area can be irrigated and whether such actions as changing the location of the dam and the canals will result in greater irrigated area. Yet such changes may cause disruption of the existing irrigation association if new members must be integrated into the association's traditions and new rights of way must be obtained for changed canal locations. The danger of potential conflict with other upstream or downstream irrigation systems dependent on the same river may also need to be investigated.

These problems point to the need for a means to make a quick social and physical assessment of a communal system before interventions are planned. Such as assessment can serve a variety of functions; it can help with site selection, indicating which communals are most likely to benefit from assistance; determine what assistance is most ded (in some cases construction may not be needed, while organisation work, water management training or even legal help may be more appropriate); it can show how the location of diversion structures and canals may need to be adjusted to both physical considerations (topography and water availability) and to social considerations (desires of the association members, likelihood that new members can be successfully integrated, likelihood that rights of way can be quickly obtained); and it can indicate how long institutional work with the association might take before construction begins.

The Committee is currently experimenting with this type of assessment tool. Data gathering guidelines have been developed (1) and project profiles have been written on over 100 systems throughout

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1. R de los Reyes, "Guidelines for profiles on communal irrigation projects", Institute of Philippine Culture, 1979; and R Coloma, "The development of irrigation projects", National Irrigation Administration, Quezon City, 1979 (both mimeo).

the Philippines. These profiles consist of technical data such as estimated water availability, potentially irrigable area and current crop production, and institutional data such as the ability of the association to maintain its system, distribute water and resolve conflicts. Other considerations include: the association's current leadership; the attitudes of farmers in different parts of the current system and potential new areas toward possible NIA assistance; land ownership information that may be relevant to right of way; and information on other water rights existing on the source from which the communal draws. Current experience indicates that provincially based NIA personnel can develop a profile on a 200 hectare system in about 1½ weeks (excepting water measurement which takes longer), and that the resulting profiles provide a good basis for initial screening of sites, scheduling institutional work, and anticipating problems and adjustments that may be required.

Field experience has shown that there is a need not only to train NIA staff to improve their understanding of local institutions but also to upgrade their technical capabilities. A central problem is that the amount of planning and construction work called for on the country's numerous communal systems exceeds the supply of well qualified engineers. A provincial engineer, who generally has many years of experience, may have as many as 20 small projects to supervise at one time, making it difficult to devote the time required for each. Greater skill is particularly required in two fields; dam design and construction methods; and water flow measurement and estimation of area to be irrigated. For the latter reasonable accuracy is crucial, since the area to be irrigated determines who shall be in the association and this in turn determines who influences decisions, bears repayment responsibility, volunteers their labour, elects officers, etc. Farmers will be angry and embittered if they find they have invested their time, energy and money in the development of a system from which they receive no water.

Several approaches have been identified for developing the capacities needed. A 'retrospective study' is underway in which a sample of the communals assisted by the NIA between 1965 and 1979 will be examined to determine what problems have been encountered since assistance began and to indicate changes needed, particularly in investigation, planning and design procedures. Some preliminary work is also being done to develop data that may later be used to generate formulas for predicting low and peak flows on ungauged small streams. Finally, handbooks are being developed to guide less experienced engineers in investigating, planning, designing and constructing communal systems and also incorporating irrigation association members into this process. This should allow more senior engineers to attend selectively to the problems for which their experience is most needed.

Developing the association. The Philippine strategy is based on the recognition that the effectiveness of an association will depend on the cooperation and active participation of all its members. Hence, simply conferring with a few leaders is an inadequate approach. If water wastage by farmers nearer the source is to be curtailed, water distribution rules developed and enforced, channels and diversion structures maintained, and construction costs repaid, then all members must feel an active allegiance to the association and consider its agreements binding. This means the association must have respected and capable leaders, members must be aware of association decisions and feel they have had an active part in making them. Consequently, both leaders and members must have the skills required for the effective management of the organisation.

While some associations already meet such conditions, many do not. Dealing with these problems takes time. Experience in the NIA pilot projects indicates that for a system covering 200-400 hectares, trained Community Organisers (COs) will often need to work with the association between six and nine months before construction can begin.

The COs' task of developing the associations involves their living within the community to be assisted (approximately one full-time CO for 150 ha.). By various means - eg house-to-house visits, joining planting and harvesting activities, attending church functions and social gatherings - the COs gradually gain acceptance as working partners in the community. They then begin to talk individually with current and potential members to encourage them to think about the strengths and weaknesses of the association and what can be done to improve it. This is followed by a series of group meetings, each involving about 30 members and lasting about three days, in which these issues are discussed and open communication among the members is encouraged. The possible NIA assistance is discussed and the association is encouraged to form *committees* on each aspect of preparing for construction.

The association also organises itself into geographical *sectors* - each sector consisting of those whose land falls under the command of a particular irrigation channel. These sectors, or sub-units, will ultimately have major responsibility for system maintenance and water distribution activities. But before construction they take on responsibility for member recruitment, labour mobilisation and local discussion, since at this level people live close enough to meet together easily.

The committees deal with a range of subjects. Those set up initially are concerned with Survey and Design, Right of Way, Water Permit, and By-Laws. Later on, shortly before construction, additional committees are formed on Materials Handling, Cost and Quality Control, and Voluntary Labour. After their establishment the COs facilitate a continuing dialogue among members and help to advise them on difficult points of procedure and legislation - eg on how to obtain a water permit, how to register with the Securities and Exchange Commission, how to obtain rights of way, how to do association banking. They also help to promote discussions between association members and the NIA's technical staff about the exact assistance to be provided, including the location of the dam and canal structures.

This institutional development work demands a variety of capacities on the part of both the COs and the engineers. COs must be able to influence the association to act effectively as a group in defining issues and solving problems. They must be able to spot problems in leadership, sources of member apathy and resistance to active participation. They must also be able to work with members to plan strategies for either strengthening current leadership or replacing distrusted leaders with ones more responsive to the members. Further they must understand sufficiently the demands of irrigation and agriculture to be able to discuss with both farmers and engineers the design options for the improved structures. Similarly, the engineers must be sufficiently sensitive to the institutional problems to be willing to make adjustments and explore with farmers choices for systems design.

For engineers and COs to learn to work together with farmers in the ways required, conceptual frameworks and guidelines need to be developed which will help them to spot key problems and alternative approaches for each communal. Training must also be developed to prepare people at field level to apply these frameworks in actual field conditions. The process documentation being carried out by anthropologists on four communal projects is providing valuable data on which to develop both the needed frameworks and the appropriate training. An annotated flow chart which details the activities of the farmers, COs and technical staff during the programme's pre-construction phase is included in an Appendix to this paper. This is the product of a very careful examination of process documentation reports.

Planning, design and construction. The organisational work described above lays the groundwork for the third component of the strategy - the involvement of farmers in all key decisions and activities during the planning, design and construction stages. Important activities in which farmers have been encouraged to participate on the pilot projects include the following:

Planning and System Layout

- Initial agreement on likely canal location, following a "walk-through" with technical staff to identify potential problems.

- Working with the survey team and providing information about topography, land ownership and changes in stream flows during the rainy season.

- Reviewing and refining the final layout. (Experience has shown that the design of the system is best drawn up after many meetings and consultations with farmers. Frequent field checks allow association members to maximise their input into the system design. A compromise is usually made between technical staff and association before the final design is drafted).

Attending a pre-construction conference and signing final contracts in preparation for construction. A temporary loan agreement is designed by NIA representatives and the association to signify each group's commitment to the project. A simple ceremony is usually held to manifest this commitment to NIA and, more importantly, to association members).

Construction

- Contributing daily labour, including the haulage of locally-available materials.

- Conducting canvasses (independent of those of the NIA) for the procurement of construction materials. (Whenever the price canvassed by the association appears the more reasonable, awards are granted accordingly.)

- Observing the NIA's award of bids to local contractors for particular services. (In contrast to its usual policy of not allowing outside participation in its committees on bids and awards the NIA now not only allows but requires official representation of the association during actual opening and awarding of bids. This helps dispel possible doubts some farmers might have as to the legality of the procedure).

- Controlling construction costs. (For example, all purchase orders are first noted by the association president before purchases can be made by the NIA. The association also exercises tight control over the use of fuel. Before each day's work, the association president checks the bulldozer's fuel gauge; after work, he checks the guage again to estimate how much fuel - based on per hour consumption - has been used. And to cut cost further, the association sees to it that any equipment not committed for the night shift is impounded after 5 o'clock in the afternoon).

- Verifying both the quality and quantity of materials received and monitoring their use. (If materials are found to be inferior or below proper specifications they are returned to NIA or the supplier for replacement).

- Discussing regular progress reports on construction, including financial reports.

The desire to have farmers participate in these activities is based on a number of assumptions: (1) if farmers are expected to pay for the system improvements, they should have considerable say in what is built; (2) farmers' involvement in the design and construction of the system is a key factor to their sense of ownership and hence is important to motivating their effective operation and maintenance of the system; (3) the experience of involvement in construction provides practice in group decision making, planning and implementation that will be useful later, as the association carries out its system management tasks; and (4) the farmers' knowledge of the land and water characteristics in their area can contribute to constructing better systems than would be possible on the basis of engineers' technical knowledge alone.

Experience so far indicates that these assumptions are appropriate and valid. Not surprisingly, it has also shown that putting the concept of people's participation into practice, particularly in construction activities, is no easy task. Alfonso (forthcoming) has reviewed some of the difficulties and pointed out that many relate to the fact that agency management systems are designed for centralised planning and implementation, rather than for carrying out a partner relationship with numerous dispersed farmer groups. He notes this is a common problem with agencies desiring to develop greater -ticipation by local community groups.

One problem of this type concerns uncertainities of construction funding. Funding is conventionally allocated on a yearly basis, but this makes it difficult to provide six to nine months of institutional work and technical planning before actual construction. A related problem is caused by the pressure to complete construction schedules before the funds allocated for the fiscal year run out. An engineer generally feels that one of the main criteria on which he is evaluated is his ability to complete construction on schedule. Yet in some cases the participatory approach may take longer. Thus unless engineers feel their evaluation will depend on their use of participation they will be inclined to dispense with farmer involvement under the rush to finish the project.

Another problem is that many decisions which should involve farmers are made at levels of the NIA which are not in contact with them. Design of major structures for example is normally done in a distant regional office. Similarly, rules about hiring and procurement tend to exclude farmers. Yet farmers who are paying for a system want hiring done from among their members wherever possible and want some participation in procurement processes.

Other problems evident in on-going projects include:

- The difficulty of co-ordinating the work of COs and technical staff (each tends to assume that their work is separate from the other's);

- A lack of financial reports to the farmers, who want to monitor just how their money is being spent;

- Difficulties for the construction engineer in managing a voluntary labour force in which the farm-labourers rotate from day to day, making continuity a problem.

Various activities are underway to remove some of these barriers to greater participation. Efforts are being made to bring greater predictability to the communals' budget so that field personnel and farmers can be assured that pre-construction work will actually be followed by construction. An initial move regarding evaluation is to shift from an emphasis on simply completing a construction schedule to an emphasis on achieving farmer satisfaction with the completed system. Eventually, evaluation approaches which focus on actually irrigated area may further help to develop a broader view of NIA's task, since actual irrigated area depends on both physical and institutional conditions.

The locations of decisions are being examined to see how a greater degree of farmer-agency interaction can be brought about. To clarify the appropriate roles of farmers, engineers and COs under the participatory approach, guides are being developed which describe the roles of each group at every stage of the planning and construction process. The Committee is counting on the process documentation exercise to continue revealing problems and highlight further the changes needed for smoother programme implementation.

System operation and supporting services Sustaining the independent status of the communals is considered a key part of the Philippine small scale irrigation development strategy. This places accountability at the local level and avoids placing a cumulative burden on the irrigation bureaucracy. A further advantage is that these associatic provide a form of local self-governance, thus contributing to the social development of the people. The strategy's previous three components all aim at bolstering the final component, the existence of a strong, independent irrigation association. However, some assistance still continues to be needed after construction, when members turn their attention to carrying out what will remain the regular day-to-day activities of the organisation - water distribution, system maintenance, conflict resolution, and repayment of construction costs. Experience regarding this phase of association assistance is currently limited, but several problem areas and needed capacities have been identified.

One area that seems to need attention is the upgrading of farmers' skills in record-keeping and financial management now that they are being required to repay construction costs. (1) Often these are new tasks for associations and doubts about how they are handled can generate distrust among members. Simple record-keeping forms and procedures are needed to help farmers deal with this, and regular auditing help may be needed to ensure that members feel their money is being appropriately used by their officers. Other areas for development are raising members' awareness of improved methods of water distribution and management and proposing alternative crops less water-demanding than rice. Water management studies are currently underway to learn more about how communal farmers manage water and what approaches can be taught that might be most suited to locally-managed systems.

It is expected that farmers in well-functioning communals can lay an important role in teaching farmers from other associations. . the longer run some federated structure may evolve (perhaps on a river system basis) which would make it easier for associations to solve common problems and further strengthen farmers' ability to help themselves.

Programme costs

As more is learnt from field experience, the costs of the programme are being gradually reduced. The following figures (in US $) are based on experience in the second set of pilot associations at Taisan and Aslong in the province of Camarines Sur.

Taisan is a 200 hectare system with direct construction costs (labour, materials and equipment) of about $121,500 or $600 per hectare. Aslong is a 400 hectare system with direct construction costs of about $54,000 or $135 per hectare. Taisan is an unusually expensive system and Aslong unusually cheap - a consequence of their respective topographies. A rough average can be obtained by combining the project costs of the two systems: $175,000 for 600 ha or about $300 per ha.

There were also additional costs in the form of extra personnel. Two COs worked on each system for 9 months before construction started and for a further 12 months during the construction period. A community organizer costs about $200 a month including salary, benefits and travel. Thus, for the 21 months of preconstruction and construction work for the two systems the four community organizers cost $16,800 or $28 per hectare - about 9% of the construction costs.

A factor to be offset against this is the COs' ability to elicit substantial farmer contributions to constructing the system. In Taisan and Aslong farmers fully complied with the new NIA policy requiring associations to contribute 10% of project costs during construction as their equity. This was done through contributions of labour and materials. If the value of this equity contribution - about $17,500 - is set against the cost of the COs, their real costs could be regarded as negative.

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1. General NIA policy on amortising its loans is that farmers should pay about 75 kg of paddy rice per year (worth about $13 per ha. irrigated). The loan is then amortised for as many years as the project's cost requires - up to a maximum of 50 years.

Another possible additional cost which is much harder to quantify is the additional expenditure of engineers' time. The engineers definitely have to spend more time in meetings with the farmers working out the many decisions about canal locations and so on. On the other hand there are many customary activities which they do not have to do - the association takes care of getting the workers, building the warehouse, getting rights of way, etc. The engineers who have worked on these projects are not sure themselves whether its takes more or less time. The general view appears to be that it takes more time in the beginning and possibly less time later on.

The cost of training programmes - both for COs and engineers - also needs to be taken into account. Training for the COs is currently being done in three modules. The first is a 3-week course given when they are hired and focuses on general issues of organization and irrigation and specifically on activities of the preconstruction stage; the second is a 2-week course on issues important during the construction stage, with some attention to operation and maintenance; and the third (still to be developed) will be on financial management and water management issues relevant to the operation and maintenance phase. Supervision by more experienced Cos is also needed, as a follow-up to these training sessions.

For the engineers, the Asian Institute of Management has developed two 2-week modules which are designed to train them specifically in using the participatory approach. How large a proportion of total costs is devoted to training in the longer run will, of course, depend a lot on the eventual turnover rate of COs and engineers.

Future Prospects

It is still too early to attempt a detailed evaluation of the programme's costs and economic and social benefits, even on a project-by-project basis. However, the expectation - particularly on the second set of pilot projects - is that whatever extra costs the new approach may involve will be greatly outweighed by the benefits of ending up with an irrigation system that functions, rather than one that does not. One impressive indicator of the strength of the irrigators' associations on the Taisan and Aslong systems has been their ability to contribute the 10% equity contribution in full - a requirement that has seldom been fulfilled on NIA-supported systems where the participatory approach has not been used. Ultimately, however, success will not be judged in terms of the performance of one or two projects (particularly pilot projects) but only by the performance of the programme as a whole.

At present the programme -and the learning process on which it is based - is still developing. Work on the first NIA pilot systems began in 1976. It was another three and a half years before the first steps were being taken to "seed" the larger organization through the creation of learning laboratories in each of the NIA's twelve regions. At least three and a half more years are likely to be required before the new methods will be understood throughout the organization. Seven years will therefore be required before the change process can hope to be completed - a period which extends well beyond the programming cycles of most donor and planning agencies. Throughout that time commitment, patience, and substantial continuity of leadership are needed to confront the difficulties which are encountered on an almost daily basis. Even though these qualities have been present in the NIA, there still is no assurance that the effort will succeed. All the pilot systems in which the new approach is being developed received intensive attention from all levels of management and numerous outside experts. The intensity of input per system is gradually being reduced and the details of a phased dissemination process are being carefully worked out. Yet it remains to be seen whether the new styles of working with farmers can be sustained on a larger scale and whether certain management system problems, some of which fall beyond the control of NIA's management, can be resolved.

Lessons from the Philippine experience

Whatever the final outcome of the Philippine programme, experience far already contains important lessons to be learnt elsewhere and erlines the inadequacy of most conventional approaches to small scale irrigation development which purport to be participative. The lessons concern the general *process* whereby a programme designed to elicit participation should be planned and managed. This process would appear to have wide applicability, although the specific shape and content of particular programmes would obviously be expected to vary in accordance with the needs and resources of different physical and social environments.

Foremost among the factors that have strongly influenced the particular character of the Philippine programme are the long experience of many farmers in irrigated rice cultivation and the existence on most small systems of some form of organisation with previous responsibilities for communal water management. These factors have created certain obvious advantages for the external support agency (in this case the NIA) which is providing technical assistance: a basic framework for institution-building is already in existence and many tasks can be delegated to farmers without the same degree of direction or supervision required in some other contexts (eg on new settlement schemes, to take an extreme example). At the same time they are likely to increase the complexity of the support agency's tasks: there may be old water conflicts between different interest groups to contend with; the association, as a result of its relative strength, may be adept at putting pressure on the support agency and making demands upon it; and the agency, if it is to cope effectively with these demands, may be obliged to make rapid changes its accustomed procedures and methods. But despite these special features certain basic principles can be seen to underlie the Philippine programme which deserve careful consideration by other government and donor agencies. It would clearly be foolish to attempt a wholesale transplant of the programme itself to another place; but the lessons to be drawn from it are surely capable of translation and adaptation to many other contexts, including programmes designed to increase farmer participation on larger irrigation projects (1); community-operated wells and low-lift pumps; and even new settlement schemes. They also have relevance well beyond the boundaries of irrigated agriculture.

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1. The NIA has recently started work on adapting the participatory approach to the development of a system of about 3000 ha., one third of which is an existing system to be improved and the rest a presently unirrigated area. Once the system has been completed, the plan is that it shall be managed jointly, by NIA staff as well as farmers.

There are lessons to be learnt about the processes of decision-making at both the project and programme level. At the level of the individual project, three points stand out:

(1) *Farmers were involved through their association in all key development decisions, from the earliest stages of planning through design and construction to the final stage of operation and maintenance.*

(2) *The tasks of organising farmers and executing the technical programme were closely integrated and coordinated by a single support agency.* Experience showed that the issues farmers were most interested in were technical: types of structures, locations of canals, construction schedules, construction contracts, etc. It followed that organizing work should be done round these issue

(3) *The process of promoting participation and building an effective farmers' association took a long time.* On the Philippine pilot projects, COs worked with farmers for 6 - 9 months before construction work began.

Would-be participative programmes elsewhere have tended to be very different from this. A more common pattern is for an Irrigation or Public Works Department to direct the planning, design and construction work (possibly after some token consultation with farmers' or local government representatives), on a heavily subsidised basis, using contractors and outside labour. Once construction is completed and the engineers have moved on to another site, another agency - usually the agricultural extension service - is asked to come in, "organise the farmers" and persuade them to operate and maintain a system about whose design and layout they have barely been consulted.

Devising a participatory approach is difficult enough even within the specially favoured environment of a pilot project. In the Philippines further lessons of great importance were learnt in the course of efforts to set up an effective national programme to support the pilot projects, build on their experience and develop a strategy capable of being implemented on a large scale.

(4) *Achievement of the programme's objectives called for major changes in attitudes, procedures and organizational structure on the part of the support agency and its field staff.*

In the words of Ben Bagadion of the NIA: "If government agencies hope to elicit people's participation among farmer organizations, it appears that the first thing they should do is to take a hard look at themselves - their organizational structures and procedures ... Actual experience has shown that most often the difficulty encountered in involving farmers in development projects is due not so much to the so called 'backwardness' of these people. Rather it points to the difficulty of government machineries to make a radical shift in their procedures to make peoples's participation feasible". Many existing structures and procedures were found completely inappropriate to a participatory approach. Merely specifying what field staff should do would have achieved very little in the absence of procedural and structural change.

(5) *The programme was built up gradually, step by step, nurtured by a continuous process of learning from experience in the field.*

(6) *The programme had high-level backing and commitment within the NIA to support and sustain it throughout the long learning period.*

The learning process cycle (likely to last at least 7 years in the case of the Philippine programme) can be seen ideally as containing three stages. In the first stage (the establishment of the first pilot projects) the emphasis is on *learning to be effective* - trying to develop a working programme model in a village level learning laboratory which will have a high degree of fit with beneficiary needs. Normally this phase will be fairly resource intensive - particularly rich in its requirements for intellectual input - and will require substantial freedom from normal administrative constraints. As in the beginning of any learning process, it should be considered normal for error rates to be high and efficiency low. Stage 2 (the ablishment of Taisan and Aslong projects) is concerned with *learning to be efficient* - reducing the input requirements per unit of output. Through careful analysis of Stage 1 experience extraneous activities not essential to effectiveness can be gradually eliminated and the important activities routinised. Serious attention should be given to achieving fit between programme requirements and realistically attainable capacities, recognising the organizational constraints that will have to be accepted in the process of programme expansion. In Phase 3 (beginning with the 12 provincial projects) the central concern is with *learning to expand* the programme in an orderly phased manner. The emphasis will be on expanding organizational capacity, though continued refinements may also be required in the programme to respond to the demands of larger scale operation (1).

(7) *The programme was built up through a process of decision-making which differed fundamentally from conventional methods of project planning and programming.*

Many readers will already have noted major differences between the learning process and more conventional approaches. Some of the most significant may be summarised as follows:

(a) Much more time and effort is devoted to learning from and planning with local people, with frequent feedback and adjustment (planning from below). Instead of placing excessive reliance on the intellectual skills of outside 'experts' (planning from above), ways are sought of effectively combining planning from above *and* below.

(b) Instead of seeking to establish a 'blueprint' model of project design and organisation for subsequent widespread replication, largely irrespective of differences in local circumstances, the object is to evolve a new process of decision-making which will make it possible to achieve a high degree of fit between programme design, beneficiary needs, and the capacity of the support agency, to meet the particular requirements of different localities.

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1. For a further discussion of the learning process, see D. Korten 1980, especially pp. 495-501.

(c) Whereas the common pattern is for a sharp differentiation to be made between the roles of researchers, planners and administrators - separating knowledge from decision from action - the learning process approach calls for their close integration. Researchers work hand in hand with operating personnel, planning is done by those responsible for implementation, and top management spends substantial time in the field keeping in contact with operating reality.

(d) Social scientists, commonly relegated to the sidelines of decision-making (often as detached critics, wise after the event), are prominently involved as "action researchers" in various aspects of project planning, implementation and monitoring as well as in overall programme development.

Many governments and donor agencies have recently been showing increasing interest in the potential of small-scale irrigation development. They have also expressed their concern to find ways of enabling rural people - and especially the rural poor - to participate more actively in the decision-making process. It should be apparent from the Philippine experience that any agencies which seriously intend to embark on participatory irrigation development programmes ought to be prepared for a major challenge. Two particularly formidable obstacles they will almost certainly have to face are the pronounced degree to which decision-making in the irrigation field has customarily been dominated by technocratic (and especially engineering) thinking; and the reluctance of financing agencies to support programmes which require a long period of initial experiment before large blocks of funding can be put to effective use on a sustained basis. This will mean that, like the NIA, their single most challenging task will be to reform their own procedures and capacities - with the aim of creating a new administrative environment in which people's participation will have a real chance to develop and expand.

References

This paper draws heavily on the following articles:

Benjamin V. Bagadion and Frances F. Korten, "Developing viable irrigators' associations: lessons from small scale irrigation development in the Philippines", in *Agricultural Administration*, 7, 4, November 1980, pp. 273-287.

Benjamin V. Bagadion, "People's participation: a learning process", in *NIA Digest*, 9, 2, 1980, pp. 2-14.

David C. Korten, "Community organization and rural development: a learning process approach", *Public Administration Review*, 40, 5, S ember/October 1980, pp. 480-511.

For further background on communal irrigation in the Philippines and the NIA's participatory programme, see:

Four reports from the Institute of Philippine Culture, Ateneo de Manila University, Quezon City, Philippines (1980):

(a) Romana de los Reyes, *Managing communal gravity systems: farmers' approaches and implications for program planning.*

(b) Romana de los Reyes, *47 communal gravity systems: organization profiles.*

(c) Romana de los Reyes, et al., *Communal gravity systems: four case studies.*

(d) Jeanne Illo, *The farmers in communal gravity systems: rice yields, work and earnings.*

Also, F. Alfonso, "Assisting farmer controlled development in communal irrigation systems", in D.C. Korten and F. Alfonso (eds), *Bureaucracy and the poor: closing the gap*, McGraw Hill (in preparation).

Comments on this paper or requests for further information should be addressed to Anthony Bottrall/Clare Oxby at ODI. They will then be forwarded to Manila.

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AGRICULTURAL ADMINISTRATION UNIT

THE ORGANISATION AND MANAGEMENT OF IRRIGATED AGRICULTURE

Irrigation Management
Network Paper 2/80/3
DEC 1980 4d

Networkers' Comments on Papers 1/80/1 - 4 and Other Quotes

A. Networkers' Comments

(i) Paper 1/80/1

Charles Johnson, with long experience of the Middle East, makes two points about organisation and management and their evaluation which seem worth recording. The first concerns the needs to consider project water management in a broader river basin or aquifer context:

"Management must also take account of other demands on the same water source, existing and potential. The evaluation of the Wadi Duleil groundwater scheme in Jordan, where uncontrolled abstraction from the aquifer outside the scheme threatens its future, made the point that schemes should not be appraised in isolation without regard to possible future development from the same source, and this applies equally to evaluation. An example of a different sort is provided by the Gezira scheme in Sudan, where it would have been possible a few years ago to enlarge the main canals so as to take more water from the Nile to permit more intensive cropping. This would have reduced the supply available for new development elsewhere in the valley and enough was known about the water supply and the extent and quality of potentially irrigable land capable of being commanded from the same source to make a choice possible. The investigations involved in this go far beyond the scope of management evaluation. What is relevant to evaluation is the need to be aware of any factors that may affect the way the scheme is operated and the scope for changes".

With reference to Para. 10 of the Paper, and the question of the desirability of a single Command Area agency, Johnson comments:

"Your analysis in paras 22 and 23 of the paper points very strongly to the merit of a single coordinating agency at command or scheme level, and this accords with my experience. Its effectiveness would depend very largely on the calibre of its management and technical staff, the resources they are given and their ability to understand each others' problems and methods of working. These provisos apply however they are organized, but staff of a given level of competence would I think work better if grouped in this way than if each category were managed independently...."

"It is tempting to extend this idea to provincial or even nation level, but what is feasible within the relatively uniform confines of a command area becomes more difficult to apply as the area widens in complexity. Agricultural departments have to deal with dryland as well as irrigated farming and with a variety of functions which, most inconveniently, cannot all be fitted into the same geographical units. The command area is appropriate for an irrigation scheme, a catchment area for soil conservation and land drainage, an ecological zone for research, an administrative district or province for the various administrative functions and so forth. And irrigation, at the national level at least, has to fit into the framework of national water policy which embraces a whole lot of things that have nothing to do with agriculture. Each department should be, but seldom is, organized in the way it can best carry out its various functions, and in seeking to improve its organization we must look at these functions as a whole.

It is easy to exaggerate the benefits that might result from putting irrigation and agriculture into the same ministry, as can be seen from the difficulty so many ministries of agriculture have in getting satisfactory coordination between research, extension, animal health, animal husbandry, farm credit etc. which are usually administered by separate departments in the same ministry. My own view is that progress in this direction will come more from improvements in basic and in-service training, seminars and other meetings where problems common to the different departments are discussed and the study of reports and other literature which highlight these problems and issues. Evaluations could make a valuable contribution if they are suitably and sensitively written and disseminated not only to the people who make the political and administrative decisions but also to key personnel in the technical departments and the places where management and technical officers are trained".

Mohammed Mirghani Abdel Salam, an agricultural economist from Sudan, comments on two of the three questions asked about water allocation (1/80/1, pp. 14 - 19). On the first question, "How can it be made rational for irrigation staff to deny water to those who want it." he writes:

"No mention is made of an important factor which is the character and integrity of the field staff. The experience of the Gezira Scheme, particularly in its pre-nationalization era, indicates the importance of these special qualities required for the water distribution staff. Character and integrity in the highly regimented and controlled system of the Gezira were rated higher than technical agricultural knowledge".

On the question of water charges, Abdel Salam writes:

"The Gezira Scheme adopted a profit-sharing system whereby cotton sale proceeds net of some joint account costs were distributed in predetermined proportion between the management, the State and the tenants. Many problems cropped up later when other cash crops were introduced into the Scheme without any change in the institutional set-up. Many economists wrote in favour of a less discriminatory system whereby either sharing is extended to other crops or a land and water charge on all crops introduced. In the mean time tenants continued to service non-cotton crops at the expense of cotton while the Board concentrated its efforts on cotton. In consequence all crops were poorly serviced. Yields deteriorated. Tenants' income failed to rise in a manner commensurate with rising living costs and rising expectations. Thus a bold decision to vitalize the Scheme became inevitable. The Government decided to abolish the partnership and the joint account system as from 1981/82. The Board would be reduced to a government department. The impact of the decision is yet to be seen. Judging by the Gezira experience the most important question appears to be whether the system adopted provides the necessary incentives for cultivators to increase their yield per unit of the scarce resources (land, water, capital). The level of charges is, as you stressed important; the method of charging becomes equally important if one uses the method as indicative of profit-sharing of land and water charges".

(ii) Papers 1/80/2 and 1/80/3

Passages in these papers reminded N.S. Carey-Jones of worries he used to have when he was responsible for planning water development and irrigation in the Ministry of Agriculture in pre-independence Kenya:

"I formed the opinion (which I expressed in The Anatomy of Uhuru, p. 54) that new irrigation schemes (I was thinking of fairly large-scale ones) could only be started on unoccupied, or nearly unoccupied, land. This was because they were too complex, politically and socially, and had too many possible but unknown risks, to be really susceptible to planning and organisation.

Besides this, there is the matter of cost. Willcocks makes the point that it seems unfair to non-benefitting taxpayers to use their money to bring benefits to a comparative few and Palmer-Jones implies the same criticism. If they were to pay their way, this partial manner of distributing funds might be justifiable, as a government investment, but my impression is that they do not do so and that they go on being a subsidy to their beneficiaries".

Of the three irrigation schemes started in Kenya in colonial times, "only Mwea covered even the recurrent costs of running the scheme, with a very little over for capital redemption. Perkerra was a badly designed scheme which could never cover its recurrent costs, nor could Garsen, because it was dependent on pumping. No doubt a good cost-benefit analyst could show, by putting a price on other "values" that all these schemes were economically sound (or the reverse). The trouble is that there are so many unforeseen consequences of a serious nature, as the comments in 1/80/2 show, that can nullify the best cost-benefit analysis".

"... I make these points because I have a feeling that all irrigation schemes (except, possibly, joint hydroelectric/agriculture ones) run at a loss and represent a continuing subsidy. Have you any figures that show that this is not so?

On the points you raise in 1/80/3, all of us concerned with irrigation in Kenya thought that the manager of the scheme was the key figure and that he would have to "direct" farming to some extent if the scheme were to work. (Of course, a good manager would also give leadership, undertake participation, and so on.) There are many decisions for the common good that have to be centrally taken and obeyed. (Hence a major difference between an "irrigated scheme" and a "water supply scheme". In the latter, there is, by definition, no direction).

On the matter of pay, the argument is valid for all civil servants.

On field visits, this is vital to good management. It was, of course, the basis of the old colonial system of government. A district officer was required to be travelling round his district, on foot or bicycle, for three weeks out of every month. Latterly, of course, with improved roads and cheaper motor transport, this tended to fall away. One could expatiate at length on the virtues of visits. Suffice it to say: "management cannot be done from offices".

On Willcocks (para. 7): I could not see any company today wanting to mount an irrigation scheme <u>at its own risk</u>. (Cost and the number of important factors under government control). Nor could I see many governments allowing it".

(iii) <u>Paper 1/80/4</u>

This paper attracted the following comments from <u>T. Hanumantha Rao</u>, a senior engineer in Andhra Pradesh, India:

"Para 3: The rural poor in India do have wells though not in such abundance as the less poor farmers. But most of these wells are yielding less water due to silting up, or water table going down, or wells not dug to the required depths. There are 830,000 irrigation wells in Andhra Pradesh State, out of which 650,000 wells have pumpsets (diesel or electric driven) and 180,000 wells have animal/human power to lift water. Such wells, comprising nearly 25% of the total, are mostly owned by the rural poor. 80% of these dug wells are located in hard rock areas. The following measures need to be taken up immediately to improve their yields. The selection of the methods will vary depending upon particular requirements:

(a) desilting the well
(b) deepening the well
(c) "In-well" drilling comprising horizontal/angular/verticle holes in the rocky bed and sides of the well.
(d) drilling 4" dia or 6" dia bore at the bottom of the well.

Since 66% of groundwater is yet to be tapped in this State, new bores can be drilled and pumpsets installed in several places. Such activity can be oriented to help the rural poor. The State Government is now contemplating setting up a new organisation exclusively to undertake the above developmental programmes, requiring an expenditure of about £10 million per annum. In view of the large volume of work involved, emphasis has to be laid on proper planning and identification processes. Research designed to achieve the above objectives in a short time has to be carried out.

Para. 7: I have conducted a research study on the efficiency of agricultural pumping systems in India (sponsored by Agricultural Refinance and Development Corporation). It was found that the average efficiency of centrifugal pumps was 49%. This can be improved to 65 to 70% by following a simple package of practices and a matrix system (devised by me). Also the power/diesel consumption can be reduced by 25% by appropriate selection of proper sizes of suction, delivery pipes and foot valve. And an additional saving of about 10% can be delivered by proper arrangement of the delivery pipe at the distribution outlet. It was seen that the power/diesel saved would amount to £30 per annum for electric driven pump and £120 per annum for diesel driven pump. The national savings would amount to £[illegible]0 million per annum. The need to save this is acute because of the large foreign exchange component. The ARDC (guided by the World Bank) is taking appropriate follow-up action based on this Research Report. Further research studies are needed to improve the package of practices and to analyse practical field problems including interaction of farmers while implementing the new procedures. Solar pumps are now prohibitive in cost and out of reach of small farmers. Utilisation of such pumps can be advocated when their cost is drastically reduced by fresh innovations and research.

Para. 9 (iii) b and c: I fully agree that Research and Development with indigenous technology, pertaining to small farmers, methods of water distribution and application, needs immediate attention. Priority also needs to be given to on-farm research concerning water distribution and application, input mixes and farming practices.

Respondents' addresses

N.S. Carey-Jones, Mawingo, Welsh St Donats, Nr Cowbridge, South Glamorgan.

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B. Quotes on main system management

Some development agencies are at last beginning to acknowledge the need to examine problems of water management on large irrigation schemes on a whole system basis, rather than confining their attention exclusively to the watercourse and farm levels. However, there is still a strong reluctance in many quarters to face up fully to the implications of major weaknesses in main system management. To help keep this issue in the public eye, we quote below from some recent publications which have come our way the conclusions which others have reached as to the central importance of reforms in main system management. See also the article "Managing the main system: canal irrigation's blind spot", in Economic and Political Weekly (Bombay), 27 September 1980, 15 (39), A-107-A-112.

(a) Asian Development Bank, Irrigation Development and Management (Proceedings of the ADB Regional Seminar on Irrigation Development and Management, Manila, Jan - Feb, 1979), pp. 20 - 21:

"An on-farm focus of water management assumes that farmers are chiefly responsible for water management; a system focus assumes that the responsibility belongs to the agency personnel who manage the system. To those concentrating on farm level improvements farm ditches are the major structural focus. To those concerned with management of the primary system, the main and secondary canal system are most important. Experience indicates that emphasis on one aspect without proper attention to the other will not result in satisfactory water management.

Field research in traditional systems in the Philippines indicates that the main system is at present the more important area. One such study concerned sample farms irrigated by 11 different canal systems in Nueva Ecija, Bulacan and Laguna provinces. The study showed no significant differences between those located near the lateral canals (within 300 m) and those located further away, with respect to the adequacy of irrigation water, the need for pumps to supplement the canal flow, incidence of conflicts and willingness to schedule water (see Table 1). But grouping the same farmers' responses according to their location along the canal, that is, farms irrigated from the head and from the tail end showed highly significant differences, with greatly reduced water availability at the downstream sections. Listening to comments from experienced persons in other Asian countries, one is impressed about the prevalence of problems relating to water inadequacy among tail end farmers.

This problem is largely a system problem, since it reflects an abundance of water in the upstream portion of the main canals and water insufficiency in at the downstream portion. It also reflects excessive diversions of water in upstream reaches which are considerably greater than crop requirements. This, in turn, is reflected by low water use efficiencies in the upstream reaches. Relatively little water remains to irrigate downstream farms which experience moisture stress and reduced yields. The major problem is equitable distribution of water along the canals of systems, and not the on-farm distribution of water after it has been diverted from the canals.

(b) DSE/GTZ/BMZ/Rockefeller Foundation, Water (Report prepared for the Conference "Agricultural Production: Research and Development Strategies for the 1980s", Bonn, October 8 - 12, 1979), p. 34:

"Evidence suggests that improvement in the operation of existing government-controlled irrigation systems is a feasible priority, even with our limited understanding of tropical irrigation systems.[1] Improvement would entail major improvement in control infrastructure, both physical and managerial. In a number of countries in the region, there are significant problems of "head-tail" water distribution, resulting in inefficient use of water, farmer conflicts, and a generally reduced effectiveness of the systems. Improvement efforts logically should proceed from the main canal toward the final turnouts.

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1. A. Valera and T. Wickham, 1976, "Management of traditional and improved irrigation systems; some findings from the Philippines", paper presented at the Workshop on Choice in Irrigation Management at the University of Kent, Canterbury, England.

(c) FAO, Report on the Expert Consultation on Farm Water Management, Beltsville, U.S.A., May 1980, p. 29:

"The lack of effective communication between scheme operators and the farmers-water users has had major adverse effects on water management conditions. On-farm improvements will remain partially ineffective as long as there is no dependable supply according to the needs of the crops.

Administrative failures occur in the supply and distribution of water within the scheme. Often this is a fault of the organizational structure and its composition and representation from among the water users. This is allied to managerial and technical defects of scheme maintenance and operation".

(d) Sam H. Johnson III, "Major policy issues in the development of irrigation in Thailand", December 1979, pp. 8 - 9:

"Once the government decides to charge for a service that service has to be delivered. Users are not going to pay for water that does not reach their fields. Clearly in the case of the NEA pumping schemes the beneficiaries have been willing to pay because the water is delivered on time - before the irrigation bureaucracy can expect the same type of response in terms of payment they have to be able to provide the same quality of service.

An associated issue is that of water user associations. As envisioned these associations would both ensure the equitable distribution of water and efficient maintenance of the system. In fact these associations are operationally weak and in many instances are simply paper entities. While the Government professes a strong desire to have such groups the lack of real effort expended toward the creation of an association and the limited staff capability that exists with an agency such as RID practically guarantees that there will not be a viable organization (Paranakian, 1978).

The basic issue here is a misconception about farmers' groups as a whole and especially about water user associations. In the eyes of many government officials water user associations are seen as a free good - as a means of mobilizing labour to provide a free method of digging field channels and operating and maintening an irrigation system. This perception is incorrect - farmer groups are not a free good and rural labour has an opportunity cost that is often not compensated for by the output of a farmer association. Officials that glibly assume it is socially and administratively simple to form a viable farmer association and that the benefits from the activities of this association will cover the opportunity cost associated with other alternative activities must be able to demonstrate this to the association members before there emerges a viable association. In most instances this has not been done (either the demonstration and/or the accrual of actual economic benefits) and the association has simply remained a paper statistic. This is not to argue that water user associations are not needed, only that much more effort and resources are required to demonstrate the benefits of such an association before they will be an effective device for operation and maintenance of terminal level irrigation systems.

(e) T.K. Jayaraman, "Multiple cropping and crop diversification", in Commerce, Annual Number 1979, p. 93:

"Above all, irrigation system requires better management practices in terms of operation and maintenance, which is much more than mere opening and closing of gates. The status of personnel involved in O & M should be raised. There should be a water management cadre consisting of engineers and agricultural scientists exclusively assigned to irrigation projects with emphasis on technical competence through training and life long specialisation discontinuing the current practice of frequent changes and transfers to other spheres.

(f) Y.K. Murthy, "The irrigation engineer and the farmer", 5th Bhaikaka Memorial Lecture, Institution of Engineers (India), Calcutta, pp. 9 - 10.

"The ultimate object of an irrigation project is to distribute the water conserved for irrigating the agricultural lands. Unfortunately, under the present system, the irrigation engineers confine themselves to various aspects of construction of the main canals, branch canals and distributaries. But no attention is given to the vital problems of water management, which is the basic need for optimum utilization of the potential. Irrigation engineers along with agriculture experts and extension workers should plan out a strategy well in advance of the completion of the creation of the potential so that farmers keep themselves prepared to plan out their cropping pattern and crop calendar. Senior agriculture and extension officers should be appointed in the project to work closely with the irrigation engineers of the project for the purpose."

"To establish effective liaison between farmers and the Government organization concerning the adequacy and timely supply of water and other related matters, it is necessary for the representatives of outlet Committee to form further Committees at higher levels, for example, at minor, distributary and project levels."

"The education system should be re-orientated so that the young engineers should not only acquire sufficient knowledge about irrigation and drainage but also rudiments of agriculture, crop water requirements and water management. Similarly, agriculture engineers should learn at least the elements of irrigation and drainage engineering. In course of time, a separate cadre of officers for water management should be established as has been done in some countries like Israel and Taiwan."

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AGRICULTURAL ADMINISTRATION UNIT

THE ORGANISATION AND MANAGEMENT OF IRRIGATED AGRICULTURE

Irrigation Management Network 1/81 5c

October 1981

NEWSLETTER

1. Network papers

This set of papers has been unfortunately delayed, but another set (2/81) will follow fairly soon, in about two months. The plan was to accompany this Newsletter with three discussion papers: one on Irrigation Design and Operation, based on networkers' responses to Ir. Jurriens' note on the subject of September 1980 (1/81/1); another on Action Research by myself (1/81/2); and a third on methods developed in the Philippines for developing 'profiles' of communal irrigation schemes, prepared by Romara de los Reyes and Salve Borlagdan (1/81/3). Despite the long lapse of time, the first of these has still to be got into a finally satisfactory shape, so rather than delay things further, Papers 2 and 3 are being issued now and Paper 1 will follow later. The only possible advantage of this state of affairs is that some networkers have complained in the past of too many substantial papers arriving simultaneously on their desks; this time they should have less cause for complaint.

2. AAU work on irrigation management

Since the last Newsletter was issued, Clare Oxby has largely been occupied with other aspects of her programme of work on farmers' organisations, but it is hoped that she may be able to return to the theme in the irrigation context at a later date. Anthony Bottrall visited Indonesia again in February/March 1981, this time as a member of an FAO/ODA team which was asked to prepare

a proposal for action research and training in irrigation management, at both the main system and tertiary levels. He then went out for a week to the Philippines, where he visited and commented on the National Irrigation Administration's experiment to extend and adapt the participative approach to irrigation development first used on communal systems (see Network Paper 2/80/2) to a larger NIA-operated scheme - the Buhi-Lalo project in Camarines Sur Province, Luzon.

In July he attended a workshop at the Gandhian Institute of Studies, Varanasi, U.P., India, and presented a paper on the methods used in his comparative study for the World Bank on the organisation and management of large irrigation projects. This was followed by two interesting weeks at the Water Resources Development Training Centre in the University of Roorkee, U.P., contributing to the post-graduate course in Water Use and Management. In mid-August he attended a workshop at Kasetsart University, Bangkok, Thailand, and presented a paper on Issues in Main System Management, with special reference to recent experience in Indonesia.

The Comparative Study of the Management and Organisation of Irrigation Projects has finally appeared as World Bank Staff Working Paper No. 458, datelined May 1981. Copies can be obtained free of charge by writing to the Publications Division of the Bank. Stocks of the first print-run of 3,000 are reported to be getting low but there are plans to produce a further 1,000 copies.

3. Recent/forthcoming meetings

a) The Agricultural Development Council Inc. (1290 Avenue of the Americas, New York, NY 10104, USA) organised two meetings in 1980 which were not fully reported in our last Newsletter. One, in June 1980, was on the theme of "Irrigation: making it useful for disadvantaged groups" and was held in Salisbury, Connecticut, USA. This meeting included discussion of the scope for linking irrigation and drinking water supply with a view to improving benefits to the landless and farmers without irrigation. The other, held in Colombo in August 1980 (in collaboration with Cornell University and Sri Lanka's Agrarian Research and Training Institute), was on "Mobilising local resources for irrigation". The four lead papers were by Prof. K. William Easter, University of Minnesota, ("Capturing the economic surplus created by irrigation"); Carlos Isles, NIA, Philippines ("Irrigation organisation and social participation: a Philippine experience"); Prof. Randolph Barker, Cornell University, ("The mobilisation of government resources for irrigation investment" and Dr Robert Wade, IDS, Sussex University ("Mobilisation of local resources for irrigation: supportive changes in canal management").

b) In March 1981, the National Irrigation Administration of the Philippines held a series of staff training seminars in connection with its pilot communal irrigation programme (for information, write to B. Bagadion, NIA Building, E delos Avenue, Quezon City, Philippines

c) The British Section of ICID held a weekend seminar at the University of Southampton in April 1981, at which a paper was presented by R.C. Carter (National College of Agricultural Engineering, Silsoe, Bedford MK45 4DT) on "Learning from irrigation experience in Northern Nigeria".

d) A workshop on irrigation management, with special reference to problems of water distribution and delivery at the outlet level, was held in Varanasi, U.P., India, in July 1981. It was supported by the Ford Foundation. One of the workshop's main concerns was to discuss social scientists' research methods in the field of irrigation management. (For information write to Prof. K.K. Singh, Director, Gandhian Institute of Studies, PO Box 116, Rajghat, Varanasi 221001, India.)

e) An international symposium on water and agriculture in East Asia was held in Okinawa and Tokyo from 27 July to 3 August 1981 (information supplied by Mr L.J. Li-Hen Wen, Council for Agricultural Planning and Development Executive, Yuan, 37 Nanhai Road, Taipei, Taiwan 107, Republic of China).

f) A workshop on investment decisions to further develop and make use of South-east Asia's irrigation resources was held at Kasetsart University, Bangkok, Thailand in August 1981. It was jointly sponsored by the Agricultural Development Council and Kasetsart University (for information, write to Dr Donald Taylor, Department of Economics, South Dakota University, Brookings, SD 57007, USA).

g) An international seminar on field research methodologies for improved irrigation system management was held at Tamil Nadu Agricultural University in September 1981, with support from the Ford Foundation (for information, write to Prof. R.K. Sivanappan, College of Agricultural Engineering, Tamil Nadu Agricultural University, Coimbatore 641003, Tamil Nadu, South India).

h) An international expert consultation on farm water management was held in Islamabad, Pakistan, from 27 September to 5 October 1981. The meeting was jointly organised by the Pakistan Agricultural Research Council and FAO, with further sponsorship from UNDP and USAID (for information, write to Pieter J. Dieleman, Coordinator, International Support Programme for Farm Water Management, Land and Water Development Division, FAO, Via delle Terme di Caracalla, 00100 Rome, Italy).

i) A national seminar on the Creation of a Multidisciplinary Structure for Irrigation Projects is due to be held at the Administrative Staff College of India, Hyderabad, in October 1981. It was sponsored by the Central Water Commission, New Delhi, and the Department of Personnel and Administrative Reforms, Government of India (for information, write to Dr P.K. Rao, ASCI, Bella Vista, Hyderabad 500475, India).

j) The Fourth Afro-Asian Regional Conference of the International Commission on Irrigation and Drainage (ICID) is due to be held in Lagos, Nigeria from 9 to 14 January 1982. The theme will be River Basin Development for Food Production(for information, write to Dr E.U. Nwa, Organising Secretary, Department of Agricultural Engineering, Ahmadu Bello University, PMB 1044, Zaria, Nigeria).

k) An international symposium and exhibition on Polders of the World will be held at Agora, Lelystad, The Netherlands from 4 to 9 October 1982 (applications to Corporate Planning Department TNO, PO Box 297, 2501 BD The Hague, The Netherlands).

1) Papers are being called for the ICID's 12th Congress to be held at Fort Collins, Colorado, USA in 1984. (For more information, write to Mr K.K. Framji, Secretary-General, International Commission on Irrigation and Drainage, 48 Nyaya Marg, Chanakyapuri, New Delhi 110021, India.)

4. Recent publications, reports, etc

Publications are listed, as usual, under three categories: (a) books and published articles; (b) papers which are not commercially published but are obtainable from universities or research institutes on request; and (c) unpublished papers.

(a) Books, articles

R. van Aart and H.L.M. van der Hoff, "Small-scale pump irrigation in Aceh Utara, Indonesia", Annual Report 1980, International Institute for Land Reclamation and Improvement, Wageningen.

Anon., "Irrigating Borno State - South Chad Irrigation Project transforming the region", West African Technical Review, June 1981, pp 93 - 97.

Anon., "Sahelian countries count recurrent costs", World Water, January 1981, pp 27 - 31.

Anon., "Bali builds on thousand year old subak system", World Water, January 1981, pp 15 - 17.

Asit K. Biswas, "Role of agriculture and irrigation in employment generation", ICID Bulletin, Vol 30, No 1, January 1981, pp 46 - 51.

A.F. Bottrall, "Improving canal management: the role of evaluation and action research", Water Supply and Management, 5, 1981, pp 67 - 79.

A.F. Bottrall, "Water, land and conflict management", book review article, ODI Review 1 - 1981, pp 73 - 84.

H. Stuart Burness and James P. Quirk, "Appropriative water rights and the efficient allocation of resources", American Economic Review, 69, 1, March 1979, pp 25 - 37.

Eric Clayton, "Monitoring, management and control of irrigation projects: the example of Mwea, Kenya", Water Supply and Management, 5, 1981, pp 107 - 115.

Adrian D. Cullis, "Brighter prospects for Kenya's Turkana population", Kidma, 6, 1, 1980, pp 16 - 19.

A. Faniran, "The use of drainage basins in development planning in West Africa", Nigerian Geographical Journal, December 1977, pp 189 - 197.

Mohammed Akram Gill, "Development of water resources in the Sokoto State", West African Technical Review, June 1981, pp 99 - 103.

R.A.L.H. Gunawardana, "Hydraulic engineering in ancient Sri Lanka: the cistern sluices", in L. Prematilleke (Ed.), Senavak Paranavitana Commemoration Volume, E.J. Brill, Leiden, 1978, pp 61 - 74.

ILRI Publication 27, Land reclamation and water management; developments, problems and challenges, Wageningen, 1980.

Indian Petrochemicals Corporation Limited, "Plastics in agriculture and water management", Voluntary Action, Delhi, June 1981, pp 449 - 450.

International Rice Research Institute, Irrigation Water Management, Report of a planning workshop, IRRI, Manila, 1980.

T.K. Jayaraman, "A case for professionalization of water management in irrigation projects in India", Public Administration and Development, 1, 1981, pp 235 - 244.

M.M. Karunanayake, "Farmer organisations and irrigation leadership in Sri Lanka: retrospect and prospect", Marga, 6, 1, 1980, pp 1 - 17.

L.F. Kortenhorst, "Factors affecting the viability of smallholders' irrigation", ILRI Reprint No. 20, Wageningen, 1980.

R.R. Kumawat, "New settlements for the Rajasthan Canal Project Area, India", Ekistics 283, July/August 1980, pp 301 - 307.

George Macpherson, "Irrigation scheme turns tide for rural poor" (on new irrigation in Maharashtra), International Agricultural Development, April 1981, pp 22 - 23.

R.J. Oosterbaan, "Rice polders reclamation project, Guinea-Bissau", Annual Report 1980, International Institute for Land Reclamation and Improvement, Wageningen.

Pierre Platon (Ed.), "OMVS - The development of the Senegal River", Marchés Tropicaux et Méditerranéens, Paris, 1849, 17 April 1981.

Ilira Sen, "Transition in Tawa", book review in Voluntary Action, April 1981, pp 387 - 388.

Gunter Schramm, "Input and market constraints in irrigation planning: Mexico", Land Economics, 55, 4, November 1979, pp 431 - 443.

Gunter Schramm, "Integrated river basin planning in a holistic universe", Natural Resources Journal, 20, October 1980, pp 788 - 806.

Tina Wallace, "Agricultural projects and land in northern Nigeria", Review of African Political Economy, 17, January-April 1980, pp 59 - 70.

J. de Wolf, "Rice cultivation and water control", ILRI Reprint No. 19, Wageningen, 1980.

(b) Research publications

R. van Aart, "Report on a mission to Madhya Pradesh, India, for the evaluation of a project on minor irrigation", July 1979 (International Institute for Land Reclamation & Improvement, Wageningen, The Netherlands).

Bangladesh Institute of Development Studies, "An evaluation study of deep tubewells under IDA credit in North West Bangladesh", An Interim Report, April 1980 (Adamjee Court, Motijheel Commercial Area, Dacca-2, Bangladesh).

Anthony F. Bottrall, "Comparative study of the management and organisation of irrigation projects", World Bank Staff Working Paper No. 458, May 1981 (The World Bank, 1818 H Street NW, Washington DC 20433, USA).

Elizabeth J. Brown, "Irrigation in arid zones. Kenya. A socioanthropological survey of the irrigation schemes on the Turkwel River", AG:DP/KEN/78/015 Consultant Report 1980 (FAO, Rome, Italy).

I.D. Carruthers and N. Mountstephens, "Integration of socio-economic and engineering perspectives in irrigation design", International Commission on Irrigation and Drainage, Tenth Congress, R. 29, Q. 33 (ICID, 48 Nyaya Marg, Chanakyapuri, New Delhi 110021, India).

O.P. Chadha and B.K. Uppal, "Planning approach for irrigation systems of the future", February 1981 (Water and Power Consultancy Services (India) Ltd, 'Kailash', 26 Kasturba Gandhi Marg, New Delhi, India).

Colorado State University, "Development process for improving irrigation water management on farms", Water Management Technical Reports Nos. 65A-D, 1980 (Water Management Research Project, Engineering Research Center, Colorado State University, Fort Collins, Colorado, USA).

K. William Easter, "Capturing the economic surplus created by irrigation", Staff Paper P80-14, July 1980 (Department of Agricultural and Applied Economics, University of Minnesota, St. Paul, Minnesota 55108, USA).

Government of Bangladesh, "Report on irrigation management, pilot programme (1979-1980)", September 1980 (Ministry of Local Government, Rural Development and Cooperatives, Government of the People's Republic of Bangladesh, Dacca, Bangladesh).

Government of Nigeria, 6th National Irrigation Seminar Proceedings, September 1979 (Ahmadu Bello University, Zaria, Nigeria).

Jack Keller, "Irrigating for rainbows", 61st Faculty Honor Lecture, 1980 (Utah State University, Logan Utah, USA).

Gilbert Levine and Henry C. Hart, "Mobilizing local resources for irrigation", Report No. 22, June 1980 (Agricultural Development Council, 1290 Avenue of the Americas, New York, NY 10104, USA).

John L. Merriman, "Demand irrigation schedule; concrete pipeline pilot projects, Sri Lanka", August 1980 (Mahaweli Development Board, Area H, Block 404, Irrigation Department, Tank Irrigation Modernisation Programme, Mahakanadarawa Tank, Sri Lanka).

P. Ponsy, "Control and monitoring of large-scale irrigation projects: experiences of a French regional development company", FAO Agricultural Planning Studies No. 20, pp 260 - 267 (FAO, Via delle Terme di Caracalla, Rome, Italy).

David Seckler and Deep Joshi, "Sukhomajri, a rural development program in India", 1980 (Ford Foundation, 55 Lodi Estate, Delhi 110003, India).

A.W. Shepherd, "The Jamu'iya Scheme. Report on a field project", Publication No. 146, November 1980 (Central Board of Irrigation and Power, Malcha Marg, New Delhi 110021, India).

R.K. Sivanappan and O. Padmakumari, "Drip irrigation", July 1980 (College of Agricultural Engineering, Tamil Nadu Agricultural University, Coimbatore 641 003, India).

R.K. Sivanappan and K. Palanisami, "Demand for water in Tamil Nadu in 2000 A.D. - future focus and policy issues", April 1981 (Tamil Nadu Agricultural University, Coimbatore 641 003, India).

Gaylord V. Skogerboe, John O. Reuss and W. Doral Kemper, "Improving irrigation water management on farms", Water Management Technical Report No. 66, May 1980 (Water Management Research Project, Colorado State University, Fort Collins, Colorado, USA).

Terry Spencer, "The effectiveness of small-scale irrigation in developing countries", MSc Dissertation, 1981 (Institute of Irrigation Studies, University of Southampton, UK).

A. Sundar and P.S. Rao (Eds.), "Farmers' organisations for efficient water use in irrigated agriculture", August 1980 (Indian Institute of Management, 33 Langford Road, Bangalore 560 027, Karnataka, India).

(c) Unpublished papers

Syed Hashim Ali, IAS, "Some critical issues on irrigation development", March 1981 National Seminar on Water Management and Salinity Control (40 Srinagar Colony, Hyderabad 500 873, India).

C.J. Barrow, "River impoundments in developing countries: an appraisal of undesirable human consequences", Development Studies Association Annual Conference 1980 (Centre for Development Studies, University College of Swansea, Swansea, UK).

Shah Jalaluddin Bhuiyan, "CARE agricultural production program in deep tubewell areas of Bangladesh", (Deep Tubewell Irrigation & Credit Program, CARE Bangladesh, House No. 58, Road No. 8A, Dhammondi R/A, Dacca, Bangladesh).

Sean Conlin, "Irrigation in Nepal: questioning the benefits", April 1981 (Land Resources Development Centre, Tolworth Tower, Surbiton, Surrey).

Ben Crow, "Politics and the development of water resources in the Ganges Basin", Development Studies Association Annual Conference 1980 (University College of Swansea, Swansea, UK).

Alan C. Early and Benjamin U. Bagadion, "Custom fit design of farm ditches: a participatory approach to making irrigation systems responsive to the needs of the farmers", Training Module prepared for NIA Communal Irrigation Committee Workshops, March 1981 (Department of Irrigation Water Management, IRRI, PO Box 933, Manila, Philippines).

Alan C. Early and Benjamin U. Bagadion, "Paddy mapping as an organisational tool for communal irrigation system rehabilitation/construction/expansion", Training Module prepared for NIA Community Organisers Training at the IRRI, March 1981 (Department of Irrigation Water Management, IRRI, PO Box 933, Manila, Philippines).

Dietrich H.E. Gebauer, "The importance of farmers' participation for the more effective organisation of irrigation systems", August 1980 (Agricultural Extension and Rural Development Centre, Reading University, UK).

R.A.L.H. Gunawardana, "Total power or shared power? A study of the hydraulic state and its transformation in Sri Lanka from the third to the ninth century A.D.", April 1981 (Centre for South-east Asian Studies, University of Kyoto, 46 Shimoadachi-cho, Sakyo-ku, Yoshida, Kyoto, Japan).

Mick Howes, "Alternative approaches to small scale irrigation: the implications for production, distribution and social organisation: Case Study, Bamna, Bangladesh", 1981 (Institute of Development Studies, University of Sussex, Falmer, Brighton, UK).

T.K. Jayaraman, "Water management policy in surface irrigation projects", 1981 (Command Area Development Commissioner, Mahi-Kadana Project, Navrangpura, Ahmedabad 380 009, Gujarat, India).

Frances F. Korten, "Building national capacity to develop water users' associations: experience from the Philippines", Paper for World Bank Workshop, July 1981 (Ford Foundation, PO Box 740, Makati, Philippines).

F.D. O'Reilly, "Towards Nigerian self-sufficiency in rice", September 1981 (Department of Geography, Bayero University, Kano, Nigeria).

David Redfern, "Mexican irrigation policy: its role in Mexican agricultural development", Paper presented at 1980 Annual Conference of the Development Studies Association (University College of Swansea, Swansea, UK).

Mohan Lal Sharma, "Rajasthan Canal Project Research Programme. One-day workshop", November 1980 (South Asia Studies Centre, University of Rajasthan, Jaipur, India).

Joseph W. Ssennyonga, "The Marakwet irrigation system as a model of a systems-approach to water management", March 1981 (Institute of African Studies, University of Nairobi, Kenya).

5. News from networkers

International programmes

(i) FAO's International Support Programme for Farm Water Management (see last Newsletter, p. 13) has produced documentation on films and filmstrips on irrigation and related subjects; on training courses on irrigation and water management; and on a computer programme for crop water requirements. The ISP has also been concerned with the formulation of projects in Indonesia, Ecuador, Bangladesh and Honduras. (For more information, write to Pieter Dieleman, International Support Programme for Farm Water Management, Land and Water Development Division, FAO, Via delle Terme di Caracalla, 00100 Rome, Italy).

Other newsletters

(ii) The tenth issue of Land and Water, technical newsletter of the Land and Water Development Division, FAO, Rome, was produced in October 1981.

(iii) The second and third issues of WAMANA appeared in April and July 1981 (see last Newsletter, pp 13 - 14).

(iv) A new newsletter, Water Management News, is being produced as part of the Water Management Synthesis Project, whose organisers are based at Colorado State University and Utah State University. The Editor is Dan Lattimore, Department of Technical Journalism, Colorado State University, Fort Collins, CO 80523, USA).

Training programmes

(v) The International Irrigation Center at Utah State University offers in-service non-degree training in agricultural water management and utilisation in English and Spanish; courses in French are being developed, and Portuguese will follow. Three basic programmes are offered: (a) general training programmes, including a 9-12 month training cycle and a short or specialised study of 1-5 months; (b) practical programmes for technical personnel who lack formal academic training, but have a strong practical background in agricultural water management; and (c) in-country training upon request. (For more information, write to Prof. Jack Keller, Department Chairman, Department of Agricultural and Irrigation Engineering, Utah State University, Logan, Utah 84322, USA)

(vi) The Institute of Irrigation Studies at Southampton University offers a one-year Diploma or two-year MSc course in irrigation engineering. Candidates require a degree in civil engineering or other equivalent qualification approved by the University. (For information, write to Dr J.R. Rydzewski, Institute of Irrigation Studies, Department of Civil Engineering, University of Southampton, Southampton SO9 5SH, UK)

(vii) The Department of Civil Engineering at Loughborough University of Technology organises a wide variety of training courses in water and waste engineering both in the UK and in developing countries. (John Pickford, WEDC Group Leader, Department of Civil Engineering, University of Technology, Loughborough, Leics., LE11 3TU, UK)

(viii) A new Water and Land Management Institute has been established near Awangabad, Maharashtra, India. It will conduct two long-term courses every year. The first, for graduates, lasts for about 12 months; the second, for diploma holders, about 10 months. It will also organise 3 or 4 short-term courses each year for senior in-service officers over periods of 8-10 weeks. (H.V. Dhamdhere, Water and Land Management Institute, 'Aziz Mansion', Bansilal Nagar, PO Box 81, Aurangabad 431 001, India)

Reports from the field

(ix) S.P. Malhotra has written an article in The Sunday Statesman, 12 April 1981, on a new experiment in water management in the small reservoir project of Sukhomajri in Haryana, North India. This has involved the allocation of water rights to local farmers, irrespective of their ownership of land. Copies of the article can be obtained by writing to Mr Malhotra at 194 Sector 11-A, Chandigarh 160 011, India)

(x) Barry Downs has written in about the Sukhothai Groundwater Project in Thailand, which is due to command over 10,000 ha after about another two years. Each well, with an average command of c. 50 ha, serves a discrete irrigation area and is based on a 'farmers' venture group'. A baseline socio-agro-economic survey (5% sample) has been completed over the whole of the slowly developing zone and detailed census type surveys are being carried out on each block of well commands to be successively drilled. Downs points out that the availability of this pre-development information could make the operation of the project particularly rewarding to study after its completion. (J.B. Downs, 2 Wychwood Crescent, Earley, Reading RG6 2RA, UK)

(xi) A British consultancy firm, Minster Agriculture Ltd., have recently completed the initial phase of a project designed to assess the technical feasibility of run-off farming techniques in Oman. (For further details please contact Mrs Erica Stott, Minster Agriculture Ltd., 'Belmont', 13 Upper High St., Thame, Oxon OX9 3HL, UK)

(xii) The National Irrigation Administration in the Philippines has recently embarked on an experiment on the Buhi-Lalo project in Luzon to extend and adapt the participatory approach to irrigation development first used on communal systems to a larger NIA-managed project. For more information, please contact Eng. B. Bagadion, Assistant Administrator for Engineering and Operations, National Irrigation Administration, NIA Building, E delos Avenue, Quezon City, Philippines.

(xiii) The Winchmore Irrigation Research Station in New Zealand has produced numerous information sheets about its own activities and about irrigation in New Zealand. These can be obtained from D.S. Rickard, Officer in Charge, Winchmore Irrigation Research Station, Ministry of Agriculture and Fisheries, Private Bag, Ashburton, New Zealand.

(xiv) Indian Petrochemical Corporation Ltd. (P.O. Petrochemicals, Dist. Vadodara 391346, Gujarat, India) have produced a Manual on canal and reservoir lining with low density polyethylene film.

(xv) The Afrika-Studiecentrum, Leiden, Netherlands, has begun a research project on communal irrigation schemes in the Senegal River Valley. In July 1980 there were 325 of these schemes, with average commands of 21 ha. The study, carried out by a sociologist and a social anthropologist, will look at the management of irrigation tanks on these schemes; the socio-economic implications of the change from rainfed to irrigated production; and the role of the support services provided by the Senegalese Government and Dutch advisers (Ellen van der Laan and Geert Diemer, c/o Afrika-Studiecentrum, Postbus 9507, 2300 RA, Leiden, The Netherlands).

(xvi) M. Rukuni (248 Pienaar Avenue, Prospect Waterfalls, Salisbury, Zimbabwe) plans to do a doctoral thesis on the institutional framework for the management of smallholder irrigation projects in Zimbabwe. About 10,000 ha of the country's irrigated land is currently cultivated by smallholders.

(xvii) Ed Martin (Department of Agricultural Economics, Warren Hall, Cornell University, Ithaca, NY 14853, USA) has plans to do research on hill irrigation in Nepal.

(xviii) Two Indian scientists are planning to do research on the economics of drip and sprinkler irrigation in arid conditions in N.W. India (Dr Mruthyunjaya, Division of Economics and Sociology, Central Arid Zone Research Institute, Jodphur, Rajasthan, India).

(xix) As part of a larger ILO project on the development and application of appropriate technology for irrigation works, Michel Vassart (International Labour Organisation, 7 Sardar Patel Marg, New Delhi 110021, India) is engaged in a study of technologies currently used for lifting ground and surface water for irrigation in selected areas of Northern India. He is interested in information on water lifting devices, not necessarily indigenous, including solar pumps, windmills, etc.

(xx) Dr R.K. Patil writes: "I would like to know if there is any literature on practices adopted for volumetric measurement - use of low-cost material for structures below 5-cusec channel system. I am making this inquiry as one of my engineer friends and myself are presently engaged in such an effort. Question is: Can we help farmers to measure water at the farm gate?" Anyone who can help is invited to get in touch with Dr Patil at National Institute of Bank Management, 85 Nepean Sea Road, Bombay 400 006, India)

6. Lunchtime meetings at ODI

The following lunchtime meetings have been held at ODI since the last Newsletter was circulated:

30 April 1981: Sean Conlin, "Questioning the benefits of hill irrigation schemes: a case study from Nepal". (LRD Sociologist, Land Resources Development Centre, ODA, Tolworth Tower, Surbiton, Surrey KT6 7DY.)

4 June 1981: John Wilkinson, "Irrigation and Social Organisati in an Omani Village". (School of Geography, University of Oxford, Oxford.)

16 July 1981: Mick Howes, "Small scale irrigation in Bangladesh". (Institute of Development Studies, University of Sussex, Brighton BN1 9RE.)

7. Other AAU activities

Two sets of Pastoral Network Papers were issued by Stephen Sandford in January and July 1981. Two issues of the Agricultural Administration Network appeared: in April a Newsletter, Discussion Paper and Network Paper, with an additional Discussion Paper by Guy Hunter, "A hard look at directing benefits to the rural poor and at 'participation'" brought out in June; and in July a further Newsletter and a revised handbook of members' interests.

Stephen Sandford has contributed a chapter to a book, The Future of Pastoral Peoples, published by the International Development Research Centre, Toronto.

John Howell has written an ODI Briefing Paper on World Food Production and Security to coincide with World Food Day in October.

8. Evaluation

Many thanks to those who were contacted by the AAU's evaluators (see last Newsletter, p. 16) and responded to their questions. The evaluators produced a generally favourable report on the Unit's activities and the Overseas Development Administration has agreed to continue funding it at its present level of staffing for another three years from April 1982.

9. Composition of network membership

A geographical breakdown of the Network's membership, based on early 1981 figures, is given in the table on the next page. There are some obvious regional imbalances which we should like to rectify.

10. Register of network members

Several people have written in to express their interest in our compiling a register of Irrigation Management Network members. Accompanying this Newsletter, you will find a form which we would be grateful if you would return to Gill Hopcraft. A list of members, their occupations and interests, will be issued within the next 3 - 4 months.

LDC MEMBERS:

BREAKDOWN BY REGION AND COUNTRY, EARLY 1981

		% of total
S. Asia		
Bangladesh	18	
India	96	
Nepal	4	
Pakistan	13	
Sri Lanka	15	
TOTAL	146	(52%)
S. E. & E. Asia		
Burma	1	
P. R. China	1	
Indonesia	26	
S. Korea	1	
Malaysia	5	
Papua/New Guinea	1	
Philippines	8	
Thailand	18	
Taiwan	3	
TOTAL	64	(23%)
Middle East & Europe		
Cyprus	1	
Egypt	2	
Israel	5	
Jordan	1	
Kuwait	2	
Oman	1	
Turkey	6	
TOTAL	18	(6%)

		% of total
E. & C. Africa		
Ethiopia	2	
Kenya	13	
Sudan	3	
Tanzania	2	
Zimbabwe	2	
TOTAL	22	(8%)
West Africa		
Gambia	1	
Ghana	3	
Mauritania	1	
Nigeria	9	
Senegal	1	
Upper Volta	2	
TOTAL	17	(6%)
Latin America		
Argentina	1	
Chile	1	
Ecuador	6	
Honduras	1	
Mexico	3	
Peru	1	
TOTAL	13	(5%)

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AGRICULTURAL ADMINISTRATION UNIT

ORGANISATION AND MANAGEMENT OF IRRIGATED AGRICULTURE

Network Paper 1/81/2

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Oct 81

ACTION RESEARCH TOWARDS IMPROVED WATER DISTRIBUTION

Anthony Bottrall, ODI

This paper was first written for an International Seminar on Field Methodologies for Improved Irrigation Systems Management, held at Tamil Nadu Agricultural University, Coimbatore, India, in September 1981. Some revisions were subsequently made in response to other people's comments. I am particularly grateful to Frances Korten, Robert Chambers and John Howell for their reactions. Further comments will be most welcome, particularly from those with experience of programmes of an action research nature.

For some time now I have been advocating action research as a means of improving the organisation and management of large irrigation schemes, particularly with respect to their water distribution. The advocacy has been in fairly broad terms. Now that increasing interest in the idea is being shown in several countries, there is a clear need to look in detail at what action research actually means and what it is likely to entail in practice. This led me to consult the writings of social scientists who were familiar with the use of action research as a tool for organisational change in other contexts - in most cases commercial and industrial enterprises. I was relieved to discover that my understanding of the action research process was consistent with theirs, though it was also apparent that additional elements need to be introduced into the process if it is to be fully effective in the context of irrigation schemes in less developed areas.

The paper starts by arguing the need for action research on large irrigation schemes. It follows with an investigation into the nature of the action research process, as understood by social scientists who have observed its use elsewhere. Some of its most common dangers and pitfalls are then reviewed. The final section outlines an approach which might be used in future programmes to improve water distribution, particularly at the main system level.

The need for action research

I recently completed a study of the organisation and management of large irrigation schemes, which draws on four case studies in Pakistan, N.W. India, Indonesia and Taiwan (Bottrall 1981). In all cases except Taiwan major weaknesses were identified in scheme performance. Deficiencies in main system water distribution were found to be a principal cause of poor performance; design deficiencies were also a contributory factor in two of the three cases. Productivity of water was generally low and in all three cases the water distribution pattern was markedly inequitable. On one scheme, the worst management problems were associated with the operation of public tubewells and were reflected in frequent breakdowns, poor planning and implementation of operating schedules, lack of communication between tubewell operators and water users, and preferential access to tubewell water on the part of larger farmers. On the other two schemes, poor water distribution practices were manifested in the classic pattern of locational inequity found on many large canal systems. Watercourses at the head of the canal commands were allowed to draw much more water than they were entitled to, leaving those at the tail with inadequate and unpredictable water supplies, or in the worst cases no supplies at all. Evidence showed that there were two principal reasons for the failure of field staff to operate the main system satisfactorily: inadequate technical skills in water scheduling, and insufficient motivation to resist often powerful pressures to misallocate water, especially in times of greater scarcity.

Others have also been coming to the conclusion that poor main system management is frequently a major cause of poor performance on large irrigation schemes (eg Wade 1978; Pant 1979; Palanisami 1981 in India; Moore 1980 in Sri Lanka; EWUP 1979 in Egypt; Wickham and Valera 1979, Early 1980, 1981 in the Philippines). The same view is being increasingly endorsed by senior irrigation administrators (eg Ali 1980; Jayaraman 1980; Murthy 1980; Sinha 1978). These conclusions are very important because they challenge the assumptions on which most governments and aid agencies have been basing their strategies for improving the perfomrance of large irrigation schemes. Typically, they have ignored the issue of main system management altogether and have chosen to limit their attention to problems of water management at the watercourse and farm levels only. This has led to a pattern of investment which has concentrated on physical infrastructure alone at the main system level and on a combination of physical infrastructure and reorganisation at the watercourse level - the familiar package of 'on-farm development' and 'water users' associations'. It should be obvious that in those cases where main system management is seriously faulty, such an investment strategy must be sub-optimal: if water is not being delivered to the watercourse outlet adequately and predictably, investments below the outlet, whether in hardware or software, are bound to produce disappointing returns.

Good explanations have been offered elsewhere as to why main system management has been a 'blind spot' for so many official agencies (eg Wade and Chambers 1980). It has undoubtedly suited most of the parties concerned to act as if water distribution problems at the main system level were solely the consequence of technical factors and only farmers were incapable of managing their affairs properly. As the evidence of poor main system management accumulates, this position is becoming increasingly difficult to sustain and there have lately been encouraging signs of movement in several governments' policies. In India, for example, much more attention is now being given to the need to improve main system operation procedures (eg Pai and Hukkeri 1979, Central Board of Irrigation and Power 1980) and new in-service training courses in water management are being offered to engineers with operating responsibilities (eg the Water Use Management course at the Water Resources Development Training Centre, University of Roorkee, U.P., and the recently established Water and Land Management Institute at Aurangabad, Maharashtra). One could also point to the water management training programme of the Philippines' National Irrigation Administration (Bagadion et al 1979) and various initiatives to improve and simplify water distribution procedures in Indonesia.

Though such initiatives are very welcome, procedural manuals and training courses are unlikely to be enough by themselves to get to the root of the main system management problem. It is probably fair to say that their principal concern has been to upgrade the technical skills of operating staff. Though very important, this may mean that the crucial issue of staff motivation is still left largely untouched. If both aspects of the problem are to be tackled together, further measures are required and I would argue that in many cases they should take the form of a programme of action research. *By this I mean a pilot action programme involving experiments in alternative management methods which a research team helps to design and monitor, with a view to the subsequent replication of the approach on a larger scale after field tests have shown it to be viable.*

On large irrigation schemes there are many reasons for advocating an experimental approach to management reform rather than prescribing specific reform packages. Three important ones are these:

(1) *Uncertainty about likely benefits.* Although an evaluation of an irrigation scheme's performance may yield incontrovertible evidence of major management weaknesses, that evidence will be largely qualitative. Those who have carried out the evaluation will not be in a position to offer quantifiable 'proof' of the extent to which performance levels have been caused by management factors rather than others (eg design factors). Nor, in view of the complex social issues underlying the main system management problem, ought they to be willing to attach firm figures to the probable benefits of untested reforms. A common scenario is likely to be that some government officials, while intrigued by the possibilities of management reforms, will still be sceptical of the benefits realisable from them; others with vested interests will oppose them; and the evaluators, though relatively optimistic, will also

be genuinely uncertain about the likely benefits (and costs) of reform. The uncertainty can be resolved - one way or the other - by action research.

(2) *Variety of local circumstance.* The mixture of reform measures worth attempting in any given situation will depend on local physical, technical, social and economic factors as well as on what is politically and administratively feasible. Possible elements in a reform programme, in roughly ascending order of political and administrative 'difficulty', include (a) procedural reforms, (b) technical and management training, (c) establishment of representative water users' organisations at watercourse level and above, (d) changes in practices governing staff incentives, (e) major changes in the organisational structure of scheme management, and (f) changes in methods of payment for irrigation services. An experimental approach can be used to determine the most appropriate programme in a particular context by means of a gradual sequential testing of measures, starting from the least radical and moving up the scale of difficulty until (for the time being) no further change is feasible.

(3) *Learning about management.* An experimental programme provides an excellent environment for staff on the scheme concerned to learn new approaches and attitudes to management problems. It can also be used as a practical training ground for staff from other similar schemes.

There has been limited experience so far of experimental, open-ended action research in the fields of agricultural and irrigation development, though no shortage of pilot projects with pre-planned 'blueprint' institutions.[1] One example is the attempted introduction of the Programming and Implementation Management (PIM) System into rural area development programmes in Kenya, where external initiators were used 'to appraise local conditions, to design appropriate procedures, to introduce them, and through continuous monitoring and evaluation in collaboration with those who are operating them, to modify them and introduce simplifications' (Chambers 1974: 53). In the context of irrigation, action research has played an important part in the programme to promote farmers' participation in the planning and construction of small community-managed systems in the Philippines (Bagadion et al 1980). But the only example of sustained action research with a focus on the management of water distribution on large irrigation schemes has been the NIA/IRRI programme, also in the Philippines. Experiments with improved management procedures on one distributory produced an overall increase in dry season production of 39% over one year, including a 137% increase in the tail section; in a later experiment, production was affected by pest damage and typhoons but dry

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1 For a powerful criticism of the latter approach, beloved by governments and aid agencies, see Korten 1980.

season water utilisaton efficiency was increased from about 50% to 70% (Early 1981).[2]

We will return to the Philippines experience later in the paper. But before further discussion of how the action research approach might be developed in the context of large scale irrigation, it may be helpful to consider how some social scientists have understood the process and have tried to apply it in other very different environments.

What exactly is action research?

Action research has had quite a long history within the social sciences. First use of the term is attributed to Kurt Lewin in 1946 (Susman and Evered 1978: 586). One of its essential features is its dependence on close collaboration between researchers and clients in seeking solutions to problems of organisation and management. In this it differs radically from more conventional approaches to organisational analysis, in which researchers, adopting the 'positivist' stance of physical or biological scientists, have sought to learn about organisational structure and behaviour from the position of disinterested, detached and neutral observers. From this stance the people in the organisations concerned are seen as objects of external enquiry or experiment rather than as potential collaborators in decision-making.

Proponents of action research have tended to direct their criticisms of the positivist approach at two main targets: conventional management consultants on the one hand and certain rigorously 'scientific' academic theoreticians on the other. Both are criticised for seeking to analyse organisations from the outside instead of entering into an equal and collaborative relationship with them and for failing to establish strong links between theory and practice. In conventional consultancy work, key decisions tend to be taken by the client,who defines the problems to be investigated and draws up the often very narrow terms of reference under which the consultants are expected to operate. The consultants' overriding objective is to solve particular problems of immediate concern to the client and they attach little importance to the development of general theory (cf Clark: 8 - 24). Meanwhile the academics devote themselves to studies whose results are of minimal relevance to decision-making in the real world. The chief charges made against them are that they have encouraged the divorce of

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2 A less closely monitored pilot experiment in main system operation in part of Cirebon Irrigation Section, West Java, Indonesia, is reported to have led to a reduction in dry season fallow from 40% to 10% over two years. For one-off interventions in main system management which have brought remarkable results, though not under action research conditions, see Wade 1978 (Andhra Pradesh) and Shanmugarajah and Atukorale 1978 (Sri Lanka).

theory from practice and created a communication gap between themselves (the 'experts') and the members of the organisations they study.[3]

By contrast, action research programmes are intended as 'learning laboratories' for both clients and researchers (cf D. Korten 1980: 507, fn 64). They require the direct involvement of both parties in identifying problems, planning new approaches designed to overcome them, and evaluating the results. If properly executed, action research should be of much greater utility to a client organisation than conventional research or consultancy, not only in identifying solutions to immediate problems but also (through the learning it entails) in helping to develop the organisation's capacity to deal with other problems that arise later. Moreover, by giving the researchers privileged access to knowledge about the inner workings of an organisation, it should also provide much better opportunities to generate practically relevant theory (Clark 1972: 125 - 128).

The potential advantages of action research stem from its rejection of the view of the researcher as sole expert, investigating and experimenting on an essentially passive world. Instead, the active involvement of clients in the research process makes it possible to synthesise contributions to knowledge by *both* parties:

> 'The action researcher brings theoretical knowledge as well as breadth of experience to the problem-solving process. The clients bring practical knowledge and experience of the situations in which they are trying to solve problems. Neither client nor researcher has better knowledge; in a sense, they are both experts' (Susman and Evered: 597).

Lewin conceived of the action research process as 'a spiral of steps, each of which is composed of a circle of planning, action and fact-finding about the result of the action'. In a later formulation it has been represented as a cyclical process with five phases:

- Diagnosing (identifying or defining a problem)
- Action planning (considering alternative courses of action for solving a problem)
- Action taking (selecting a course of action)

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3 'Many of the findings in our scholarly management journals are only remotely related to the real world of practicing managers and to the actual issues with which members of organisations are concerned, especially when the research has been carried out by the most rigorous methods of the prevailing conception of science' (Susman and Evered: 582).

- Evaluating (studying the consequences of an action)
- Specifying learning (identifying general findings). (Susman and Evered: 587-8)

The extent of collaboration between researchers and clients during each of the five phases can and does vary in different circumstances (ibid: 588). However, in the context of irrigation management with which we are particularly concerned, I would see the following allocation of responsibilities, involving close collaboration between both parties throughout, as approaching the ideal:

Diagnosis. Research team to conduct independent, objective appraisal of client organisation's existing structure and management performance; subsequent joint discussion of findings between client and research team and agreement on definition of principal problems.

Action planning. Joint consideration of alternative courses of remedial action. Joint agreement on course of action to be followed.

Action taking. Client organisation to take agreed action; research team to stand back from action, monitoring client's decision-making processes and their effects.

Evaluation. Research team to present evaluation of action programme to client for joint discussion.

Specifying learning. Client to extract lessons from evaluation of particular concern to itself (which may be fed back into further cycles of action planning, action taking and evaluation). Research team to extract lessons from general theory and for its application in action research programmes elsewhere.

Conceived in this way, the action research process has evident affinities with the planning process (Susman and Evered: 589). Compare, for example, the following 'ideal' sequence of decisions which an organisation might follow in the course of a full planning/management cycle: *Plan formulation* (identification of alternatives - design - appraisal - selection) → *Plan implementation* (budgeting - programming - monitoring - adjusting) → *Plan evaluation* (data collection - data processing - policy analyses) → *Plan reformulation* (Belshaw 1976: 418). The essential difference between the two processes is that in the action research case the organisation enlists the help of external researchers in performing diagnostic, planning and monitoring activities which in normal (ie less experimental) circumstances would be carried out internally by its own staff alone. The ultimate aim of an action research programme must be to evolve an improved management system over which the staff of the organisation concerned, through their participation in the learning laboratory, will be capable of reassuming total control. On the final withdrawal of the research team, responsibility for planning and management will once again become fully 'internalised'.[4]

Another point worth noting about social scientists' perceptions of, and experiences with, action research is that interventions designed to bring about organisational change may take a wide variety of forms. Organisations can be viewed as complex systems containing four salient interacting variables, each of which may provide appropriate points for intervention: *task* (which refers to the objectives and functions of the organisation), *technology* (its physical equipment), *structure* (systems of authority, information systems, coordination and communication), and *people* (the actors in the enterprise, their attitudes and expectations). Since these four variables are highly interdependent, a change in one will almost certainly elicit change in the others. Depending on local circumstances and opportunities, one or other may be selected as an intervention point - or there may be scope for intervention from several points together (Clark: 27 - 30).

The general principles of action research which have been evolved by social scientists through experience in other contexts seem fully applicable to the context of large-scale irrigation management. However, there seems little doubt that, in translating these principles into specific programmes, additional elements will usually need to be incorporated into the action research process if it is to succeed in bringing about significant organisational change. This is because irrigated smallholder agriculture has at least two distinctive characteristics which will not have been encountered by action researchers elsewhere. One is the presence of a large number of farmers with powers of independent decision-making, who add a complicating third dimension to the usual researcher-client relationship. The other is that, instead of being concerned with achieving relatively subtle shifts of emphasis within a single relatively independent and flexible enterprise, the aim on irrigation schemes is to effect very substantial changes in practice within public sector agencies which are accustomed to applying rigid, uniform patterns of organisation and management over large areas (an agro-climatic region, a State, sometimes even a whole country). This means a much greater concern than in conventional action research with pilot experiments and with the extension of lessons learnt on them to other areas.

Both these factors - the need to involve farmers and their representatives as much as possible in the action research process and the need to extend and replicate lessons from pilot areas - imply a long period of experimentation, with a series of action research cycles extending over several years. They

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4 cf David Korten's three stages in the 'learning process' approach to institution-building - learning to be effective, learning to be efficient, and learning to expand. These involve a similar progression from a high degree of externally-assisted experimentation towards ever-increasing administrative 'normality' (D. Korten: 499 - 501).

also imply the need to reinforce the action research process through regular training sessions and workshops for irrigation officials and farmers, from both inside and outside the command area where the experiments are being made.

Given the very different contexts in which most social scientists have gained their experience of action research, one might not expect their conceptions of the process to correspond particularly closely to those of an irrigation engineer working in Asia. However, Alan Early, an engineer with IRRI, has recently written about the NIA/IRRI experiments in the Philippines from a remarkably similar perspective. Echoing many social scientists' dissatisfaction with the limitations of conventional organisational analysis, he rejects traditional forms of irrigation research as inappropriate to the solution of management problems:

> 'Research on irrigation system management problems cannot be carried to conclusion in laboratories or experiment stations. It requires a definite intervention in the procedures of managing irrigation systems' (Early 1981: 2 - 3).

This intervention implies 'a unique collaborative methodology between the [irrigation] agency and the research institution', involving the following steps: define problem, develop methodology, select site, train personnel, implement improved management, collect data, conduct analyses, evaluate experience and report results (ibid: 3). In the NIA/IRRI case, changes in management procedures have been accompanied by minor changes in technology, in the form of improved control and measurement structures (Early 1980: 87; 1981: 11).

This similarity of perspective across disciplines is encouraging. It suggests that conceptual differences need not be a major obstacle to the fruitful collaboration of irrigation specialists and social scientists in future action research programmes. Action research is never easy, however, and we must now turn to some of the problems most commonly encountered in its execution.

Dangers and pitfalls

All action research, whatever the context, is surrounded by pitfalls and those who engage in it need to be on regular guard against them. Things can go wrong at any stage of the cycle, and when they do there are likely to be two main sources of trouble. Firstly, there may be an imbalance in the relationship between the sponsoring agency and the researchers: instead of being genuinely collaborative, decision-making is excessively dominated by one party. Frequently it is the sponsors who dominate, in which case the researchers risk losing their professional identity and ceasing to be independent agents (Clark: 81); but it can sometimes be the researchers who overreach themselves. Secondly, it may often happen, even where the client-researcher relationship is satisfactory, that the researchers have problems in combining and reconciling their dual roles of co-planners on the one hand and objective analysts on the other. Evidence from the irrigation field suggests that non-social scientists without previous action research experience may be particularly prone to confusing the two roles; but even experienced operators with a clear understanding of action research principles are regularly faced with the question of how best to perform two tasks (the theoretical and the practical) for more than one task master, and the answer is rarely easy (ibid: 22, 126).

Particular vigilance is likely to be needed where the action research concerns irrigation management, for the following principal reasons:

(a) The sponsor - usually a government or parastatal agency - will have had little or no previous experience of action research or of the client-researcher relationship it entails.

(b) The irrigation research establishment - largely technologists - have been used to working in a very different intellectual tradition of experimental work. This may sometimes lead to work being done in the name of action research which offends against some of its most basic principles: for example, instead of a programme being planned and executed by two agencies together, a single agency (either within government or a separate research body) may seek to do all the work on its own.

(c) The need to adopt an experimental pilot approach exposes the exercise to serious danger of falling into the 'unreplicable pilot project' trap.

(d) Where main system water distribution has been identified as a major problem, there may be strong resistance from certain quarters to allowing free and unfettered analysis and experiment.

These points can be illustrated by reference to particular problems which commonly arise at different stages of the action research cycle (see pages 7 - 8). The first stage of *diagnosis* or problem identification is of crucial importance. The greatest danger here is that the reasons for the current performance of an organisation will not be explored in sufficient depth and detail before conclusions are drawn about the nature of its problems and the remedial action required to solve them. The consequence will be that too narrow a range of alternative courses of action is examined during the subsequent action planning stage. This fault may sometimes be the result of client domination, often perhaps because the client is in a hurry, wants quick answers and allows insufficient time for preliminary investigations (eg Clark: 113). In the irrigation context, it may also commonly stem from narrow single-disciplinary vision, on the part of both client and researcher. For example, an engineer may automatically assume that poor system performance is entirely attributable to technical factors and start experimenting with different kinds of canal lining; someone else may assume that all problems can be solved by creating water users' associations; or a third person may assume that the only thing needed is to improve main system management (cf Lenton 1980: 5 - 7). None of them is likely to be right. The only reliable safeguard against premature problem definition is for the client to allow sufficient time for an independent, interdisciplinary 'whole system' analysis of current scheme performance and the reasons for it. (The framework for a detailed dignosis of these issues should already have been established before the beginning of the action research process through an initial externally-commissioned identification study, of the kind discussed in my World Bank report.)

Entry into the *action planning* stage requires the research team to transform themselves from independent analysts into co-planners, but both they and the client agency may find the adjustment difficult. Sometimes instead of a genuine partnership emerging, one or other side will dominate. Care also needs to be taken at this stage against selecting and designing an experiment which is likely to be unreplicable. Early, in drawing lessons from the NIA/IRRI experiments, warns that action research on irrigation management 'must be conducted on a realistic scale to avoid pilot project concentration of resources' (Early 1981: 3). The resources concerned may be financial (eg unreplicable subsidies to farmers) and/or administrative. In the latter case, the principal danger lies in increasing the operating agency's staffing levels within the research area to a point which will be unrepeatable on a larger scale.[5] The presence of extra research and planning expertise is also likely to have a distorting influence on the results of an action research programme, but that is to some extent inevitable, especially in its initial stages. Probably the best that can be done to minimise the effects of the distortion is to discount for it at the evaluation stage and to keep reducing the role of external personnel steadily throughout the course of the programme.

Action taking. Once the content of an action programme has been agreed, it must be executed by the client agency alone, with the research team reverting to a purely analytical role, monitoring programme performance. This principle is central to the whole purpose of action research, which is to develop and test the capabilities of the client agency under new conditions of organisation and management. Unfortunately, it has not been fully understood by some of the technical specialists who have been active in water management research. There have been cases where research teams, in addition to designing an experimental pilot programme, have themselves taken on direct responsibility for executing it, with little or no involvement of the staff of the irrigation project concerned. Their intentions have

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5 This does not mean that existing staffing norms must never be exceeded in action research areas. But it does imply that an increase over present norms should not be agreed to by those concerned unless they have reasonable grounds for expecting that the increased level will be sustainable on a large scale in future.

usually been entirely honourable - to show staff 'how things should be done' - but experience shows that experiments of this kind, though not entirely valueless, tend to have little influence on subsequent staff performance. This is hardly surprising, since the staff have been excluded from all opportunity to learn by doing. Moreover they will have noted that the research team's results have been achieved in the absence of constraints under which they themselves normally have to operate; they will therefore be inclined to regard them as impossible to emulate and of largely academic interest (compare small farmers' attitudes to agricultural extension recommendations based on research station experiments). At worst, the experiment may actually demoralise staff further if it appears to have no obvious purpose beyond publicly exposing their deficiencies.

Even where field staff have been given clear responsibility for executing an action programme, the research team may sometimes be tempted to intervene and lend a helping hand. By his references to 'external interventions' and 'the presence of outsiders ... creating extraordinary opportunity for success', Early appears to suggest that there may have been occasions during the NIA/IRRI experiments when IRRI researchers have strayed across the borderline and involved themselves in decisions which should have been left in the hands of NIA staff (Early 1981: 3, 17, 20). The temptation is easy to understand, but it should be strongly resisted since it can cast doubt on the validity of the whole experiment.

Monitoring, evaluation and drawing conclusions. For good monitoring and evaluation the research team must be in a position to analyse the client agency's performance independently and objectively. Here as elsewhere in the action research cycle there may be particular proneness to analytical error in the irrigation context because of the predominantly technical traditions of irrigation research. One major danger is that the research team will confine itself to the measurement of quantifiable performance indicators without documenting the processes by which performance has been achieved. It is only through systematic recording of the ways in which decisions have actually been taken that significant lessons about management reform can be confidently learnt and extended.[6] Another danger

6 The organisers of the NIA/IRRI experiments can be criticised on this score. As Frances Korten has pointed out, they have never explained how NIA personnel managed to persuade upstream farmers to wait several weeks for their water to enable downstream farmers to receive supplies first. In fact, the experiment involved intensive communication with the farmers. Yet the details of that communication process - issues such as methods of contact and communication, farmer organisation, and staff motivation - 'were not reported on, though they consumed considerable day to day attention of the researchers. I think they were considered to be administrative "nuisance" issues, outside the scope of "scientific" research' (F. Korten 1981).

is that the real financial and administrative costs of the experiment will be overlooked, so that the expected benefits from its extension on a larger scale will be exaggerated (Lenton: 7 - 8). The answer in both cases lies in the use of improved monitoring and evaluation procedures and of an interdisciplinary research team with the appropriate skills in organisational analysis to apply them.

A further very insidious danger, which has nothing to do with weaknesses in analytical technique, is that the client or the researchers, or both, may be tempted to 'bend' the research results. This is likely to be a particular hazard where action research on irrigation is concerned because so much - sometimes the whole shape and scale of an investment programme - can hang on its conclusions. The danger can be illustrated by a particularly deplorable pilot project I once encountered in the field. Without investigating alternatives, aid agency and government officials had in this case started from the assumption that high returns were likely to come from improved watercourse layout. A few pilot watercourse projects were then constructed at unreplicable cost and new water users' associations were created. A monitoring unit was set up, using staff from the irrigation agency concerned rather than independent researchers. Ignoring the cost aspect, the unit estimated the benefits of the pilot watercourses by comparing their crop production levels with those of nearby control watercourses. The pilots' production levels were shown to be much higher and on the strength of this they were proclaimed a great success. What was not mentioned, however, was that the pilot watercourses were being allocated much more water than neighbouring units and were also given preferential access to fertiliser and other inputs. The monitoring team's conclusions were therefore based on a conscious fraud. It is difficult to escape the conclusion that the sponsors were never seriously interested in objective research into alternatives but instead saw it as an opportunity to bolster arguments for an already favoured investment programme. A major capital-intensive programme of watercourse rehabilitation and construction has since been launched on a nationwide scale.

From the foregoing paragraphs it is clear that unless it is very carefully carried out, action research (or work done in its name) can often be a source of intellectual confusion and, in the worst cases, intellectual dishonesty. Fear of association with such work is probably one of the chief reasons why some academics tend to shy away from action research in general (though there may be other reasons too, such as failure to understand the principles of good action research, aversion to working with governments or businesses, or fear that action research work might not prove professionally rewarding).[7] However, it does not follow that because a job is difficult to do well it should not be attempted at all. The NIA/IRRI programme, though open to criticism, has shown that serious action research on irrigation management is possible. Further progress can be

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7 On the last point, see Vyas 1979: 22.

made if we are prepared to learn from past mistakes and failures. Intellectual confusion can be reduced by a better understanding of action research principles, while the most effective weapon against dishonesty is public exposure.

In summary, experience suggests that if an action research programme is to be successful, the following conditions must be met:

(a) Two separate agencies must take part - the client organisation and an independent research-cum-planning support team.

(b) The programme must be concerned to test alternative approaches to organisation and management and analyse them as objectively as possible.

(c) The relationship between the two agencies concerned must be collaborative: 'one of joint effort, where there is mutual determination of goals, and in which each party has ... opportunity to influence the other' (Clark: 79).[8]

(d) The changing roles and responsibilities of the research team at different stages of the action research process must be clearly specified and understood by both parties.

(e) To guard against the selection of too narrow a focus for the action research programme, it must be preceded by a wide-ranging diagnosis of weaknesses in current practice.

(f) In monitoring performance, the research team must record in detail the decision-making processes through which a particular level of performance has been achieved, so that the right lessons can be fed into the next action research cycle and into new programmes elsewhere.

(g) Before attempts are made to adapt the programme for extension to other areas, care must be taken to ensure that it is financially and administratively replicable.

(h) In the irrigation context, the effective extension of lessons to other areas will require the action research programme to be integrated with regular training and workshops.

There is also the further point that, where the programme is designed to influence policy over a large area, a coordinating committee with responsibilities for longer-term planning and supervision will be needed at provincial or national level. Direction of the experimental communal irrigation programme in

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8 Clark's full text reads '<u>equal</u> opportunity to influence the other'. Ideal, no doubt, but an entirely equal relationship is difficult to envisage in most irrigation contexts, except perhaps where the research agency has international support, as in the case of IRRI.

the Philippines is in the hands of a national Committee chaired by a senior NIA official and containing members from five other agencies with various research and training functions (Bagadion et al 1980: 5); and the main system management research programme is being coordinated by a joint NIA/IRRI Committee (Early 1981: 20).

Improving water distribution: a suggested approach

Armed with these basic principles and the experience gained from the NIA/IRRI experiments, we are in a position to propose a general approach to action research as a means of improving water distribution on large irrigation schemes. Let us assume that a particular scheme has already been selected for study and that its performance has been subjected to a comprehensive diagnosis. Important criteria used in scheme selection will have included:

(a) *Representativeness.* In the interests of making the results of the action research widely relevant, conditions on the scheme selected should be as representative as possible, in terms of their physical, technical, economic and social characteristics, of conditions prevailing on other large schemes in the same agro-climatic region.

(b) *Technical viability.* The physical and technical characteristics of the scheme should be such that it is capable of satisfactory operation without major capital investment at the main system level.

(c) *Potential gains for all irrigators.* Priority should be given to those schemes where it seems probable that the redistribution of water - almost always from top-enders to tail-enders - can be achieved without the former group losing. Chances are best where there is conspicuous over-watering in the head-reaches and a reduction in water supplies may even lead to increased production through improved drainage. Elsewhere, greater resistance to reform is likely from top-enders, making redistribution more difficult and probably requiring a greater degree of 'institutional engineering' (Chambers 1980: 28 - 31).

On a well-selected scheme, diagnosis will have revealed significant weaknesses in main system management practices; relatively minor deficiencies in main system design; and significant operation and maintenance problems at the watercourse level, some of them a direct consequence of poor main system distribution.

At the initial action planning stage, the Coordinating Committee will need to reach agreement on a number of important issues, including the selection of action research sites within the scheme; research methods and evaluation criteria; the time scale of the project; and staffing levels and costs.

Site selection. The limited resources of the research team will usually dictate that, initially at least, the experiment be confined within one section of a large irrigation scheme, probably a distributory command. (In the Philippines cases, the command areas covered 5700 ha and 2500 ha respectively.) As far as possible, the selected area should be typical of the scheme as a whole, with regard to soils, topography, channel layout, size of command area, and farmer characteristics. To ensure valid 'before' and 'after' comparisons, current water supplies to the distributory head should either be greater than or very close to the design discharge.[9] Within the area, at least three locations - at the top, middle and tail of the distributory system - should be selected for detailed monitoring (the first Philippines study used four sites, the second, three). Depending on the resources available, these might be single watercourse commands or somewhat larger areas.

Research methods and evaluation criteria. Evaluation should include a quantitative analysis of performance as well as a qualitative assessment of the underlying reasons. In the evaluation of performance, particular attention should be paid to productivity of water use, equity of water distribution, environmental effects and cost. The only satisfactory method of measuring performance, in terms of productivity and equity, is through the measurement of water. This involves the collection of data on flows at different points of the distribution system, together with information on rainfall, evaporation, seepage and percolation, as well as measurement of soil moisture in farmers' fields; sample crop-cutting is also required to estimate yields (cf Early 1980: 87 - 89; 1981: 6,12). In addition to 'before' and 'after' comparisons, consideration should also be given to 'with' and 'without' comparisons (between the research areas and other control areas nearby) - though in this case too there are likely to be practical and methodological difficulties.[10] The qualitative assessment will depend on interviews with farmers and operating staff, detailed observation of their behaviour and scrutiny of scheme records. As has already been emphasised, the research team will need to be well versed in organisational and institutional analysis.

The *time-scale* of the action research programme will depend

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9 The former would allow production from more water before the experiment to be compared with production from less water after its introduction; in the latter case it would be possible to compare the production obtainable from the same or similar water supplies both before and after. But before and after comparisons would have no value if water supplies to the distributory head had to be substantially increased at the start of the experiment.

10 A strict with and without comparison would require water supplies to the control distributory to be kept at the same level as supplies to the experimental distributory. This would involve additional intervention in scheme management practices. For a discussion of methodological problems in evaluating/monitoring irrigation performance, see Small 1981.

on the range and complexity of organisational innovations which are contemplated. The NIA/IRRI experiments, which have largely confined themselves to the introduction of improved water distribution procedures, have run for up to three years, including a preliminary benchmark survey year. But where a more complex programme of organisational change is involved, as in the communal irrigation programme, the learning process cycle may take up to 5 - 7 years to complete (Bagadion et al 1980: 17). *Staffing levels and costs* will also vary according to circumstances. For the second NIA/IRRI experiment, covering a command area of 2500 ha, IRRI's research team consisted of one part-time senior supervisor, one Research Assistant-Project Coordinator, three other Research Assistants, and seven field and student assistants. The only apparent addition to the NIA staff complement was one employee working on a part-time basis. Total costs of the experiment to NIA, including the capital costs of structural improvement, honoraria to field staff and additional transport costs (but excluding research team costs) have been estimated, on a discounted annual basis, at $2.20/ha/year (Small 1981: 18 - 21; Early 1981: 11). Research costs may be substantial, particularly with regard to the collection and analysis of technical data; IRRI made extensive use of computer processing in their studies (Early 1980: 89 - 90).

Before the full programme is launched, a preliminary year will be needed in which the research team can carry out a baseline study, with the object of monitoring existing practices and performance, before any technical and management changes are introduced. In the latter part of the year, necessary improvements to control and measuring structures can be made and initial training courses for field staff instituted.

By the time the action programme is started, agreement will have been reached on the new management practices to be tried out in the coming crop season. It is important that agreement is also reached on the precise division of responsibilities between operating staff and farmers under the new system. During the first year (at least) innovation is likely to be concentrated on the introduction of new water distribution procedures. An essential first step, as in the NIA/IRRI programme, will be for irrigation staff to communicate the programme to farmers and seek to elicit their cooperation (Early 1981: 6, 12). This is likely to involve substantial time and effort, particularly in the head-reaches, where farmers may often take a lot of persuading that they will not lose through a reduction in their total water supplies. In some cases, additional water management extension staff may be required to help them manage their reduced (but more timely and predictable) water supplies with greater efficiency.

The irrigation staff's other main task is to implement the new procedures to the best of their ability. Those responsible for designing the procedures will have had two main objectives in mind: improving the technical basis of water scheduling and distribution, with the aim of optimising the fit between water supply and demand; and minimising deliberate misallocation by inducing changes in attitude on the part of irrigation staff as well as farmers. The changes in technique will usually imply, as in the NIA/IRRI case, the replacement of a simple, crude, largely supply-orientated distribution method by one which is much more complex and involves more data collection and analysis, particularly on the agricultural (demand) side (ibid: 12). One hoped-for consequence of the need for staff to acquire new technical skills would be increased job satisfaction; and this, combined with procedural changes designed to strengthen supervision by senior staff, could have a significant effect on morale and hence on the pattern of allocation. But other more direct forms of staff incentive are also likely to be needed. One of the easiest to introduce early in an action research programme would be the holding of competitions, with small prizes going to the best performers. This simple device is used to good effect in Taiwan, where competitions are held between irrigators' groups as well as field staff.

In subsequent years of the action research experiment, increasingly complex innovations could be considered. These might include, on the technical side, changes in cropping calendars and crop planning procedures and, on the institutional side (depending on what is judged politically and administratively feasible), water users' organisations at the watercourse level; further incentives to irrigation staff (eg increased opportunities for water management training and associated promotion); and changes in organisational structure (eg closer coordination between irrigation staff and agricultural extension and research staff; creation of representative water users' associations at the distributory and/or scheme level, with planning and monitoring responsibilities).

Precisely what innovations will be considered and adopted at the later stages of an action research programme cannot be predicted or planned long in advance. It is an essential characteristic of the action research approach that new ideas should be generated through an internal learning process. The process is fuelled by the research team's monitoring and evaluation activities, the conclusions of which are fed back into action planning for the following season or year. Alternative strategies will then be reviewed jointly by the research team, operating staff and hopefully (as they become increasingly involved in management decisions) farmers' representatives.

Feedback information from monitoring and evaluation will not be confined to the planning of new initiatives within the original action research area. With the passage of time, lessons learnt within the research area will also be extended to all other parts of the same irrigation scheme and to other irrigation schemes in the same region. This extension can be assisted through the organisation of training sessions and workshops for both irrigation officials and farmers. Although an action research programme in one particular small area may take many years before being brought to completion, it should be designed to have a continuous impact on thinking elsewhere right from its inception. As a result, when the programme does reach completion and the research team finally withdraws altogether (handing over to an internal Planning and Evaluation Unit within the scheme), the end result should be a whole irrigation scheme with reformed procedures and institutions, with others in the same region moving along similar though not identical paths.

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AGRICULTURAL ADMINISTRATION UNIT

ORGANISATION AND MANAGEMENT OF IRRIGATED AGRICULTURE

Network Paper 1/81/3

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GUIDELINES FOR IDENTIFYING AND APPRAISING COMMUNAL IRRIGATION SCHEMES

Prepared by Romana de los Reyes* and Salve Borlagdan** (1)

For the background to this paper, see Network Paper 2/80/2, "Promoting participatory management on small irrigation schemes: an experiment from the Philippines", especially pp. 7 - 8. The present paper consists of three sections: an Interview Guide (3a); a Write-up Guide (3b); and an Analysis Guide (3c). The Interview Guide is for the use of field investigators who are called in to prepare a 'profile' of an area where farmers have made a request to the National Irrigation Administration (NIA) for the development of a communal irrigation system. Before the investigator goes into the area, preliminary site surveys will have been carried out by field staff of the Provincial Irrigation Office (PIO), the results being recorded on a form known as CPID Form No. 2. After collecting the data called for by the Interview Guide, interviewers are required to write profile reports, using the Write-up Guide. The reports are then reviewed by

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the Provincial Irrigation Engineer (PIE) with the use of the Analysis Guide and his proposals are forwarded through the Regional Irrigation Office for consideration by the Central Projects Implementation Division (CPID) of the NIA.

An assessment was recently made of a sample of 39 field interviewers/ profile writers. Most of them were found to be less than 35 years old; men slightly outnumbered women; about three-quarters were college graduates, with both arts and science degrees; they had worked for an average of 3 years with the NIA, 33% as clerks, 28% as agricultural staff, 18% as engineers, and 21% as public affairs personnel (information officer, writers, etc.). All attend a training course before starting their work. Given ideal conditions (i.e. if preliminary investigation data has been gathered, the CPID Form completed, weather conditions are good), data gathering takes 1 - 1' weeks on average and writing up another week. But the process can take much longer in cases where preliminary investigations have not yet been made.

The Guides should be of particular interest to networkers concerned with small-scale irrigation development, especially in areas with existing irrigation or settled agriculture. In their complete form the Guides contain numerous spaces and tables for the presentation of answers, but they are not included here. Copies of the full Guides can be obtained from the Office Manager of the Institute of Philippine Culture, Ateneo de Manila University, P.O. Box 154, Manila 2801, Philippines. And Salve Borlagdan, at the same address, can provide more information on experience with using them.

INTERVIEW GUIDE FOR COMMUNAL IRRIGATION PROJECT PROFILES (1/81/3a)

(Glossary: NIA = National Irrigation Administration; CPID = Communal Projects Implementation Division; PIO = Provincial Irrigation Office; PIE = Provincial Irrigation Engineer).

An inventory of data sources for each section and sub-section of the Guide is given at the end of the paper.

I Project Description

1. Name of project/system.
2. Project/system category: New/Ext'n/Rehab/Ext'n-Improvement.
3. Type of existing system(s) in potential irrigable area defined by Provincial Irrigation Office (PIO); Gravity/Pump/Gravity and Pump/None.
4. (a) Location (villages and towns) of presently irrigated area.

   (b) Location of new/expansion area.
5. Water source(s) of existing system(s).
6. PIO's proposed water source(s) of project.

7. PIO's estimate of potential irrigable area and number of farmers:

	Wet season		Dry season	
	Area	Farmers	Area	Farmers
a. Presently irrigated area	______	______	______	______
b. Area to be restored/improved	______	______	______	______
c. New are to be generated	______	______	______	______
TOTAL	______	______	______	______

8. Project proponents: Farmers in the project/area/Local officials/Local politicians/National Irrigation Administration (NIA)/Foreign lending institutions.

9. Is project site a critical area (i.e. are there any and order problems)? Yes/No.

II <u>Water Availability and Water Rights</u>

A. EXISTING SYSTEMS WITHIN THE <u>PIO</u>-DEFINED POTENTIAL IRRIGABLE AREA (REFER TO CPID FORM 2 FOR LIMITS OF THIS AREA)

1. Are there existing systems within the potential irrigable area? IF YES, CONTINUE BELOW; IF NO, SKIP TO <u>B</u>.

2. How many existing systems are there?

3. FOR EACH SYSTEM: Identify communities where fields served by system are located. What is/are this system's water source(s)? FOR EACH SOURCE: How is the water diverted (intake, dam, pump)? What is/are the diversion structure(s) made of? What is/are its state of repair?

4. FOR EACH SYSTEM AND SOURCE: Do farmers have water rights for this source? IF YES, for what amount (lit./sec.)? Who holds water rights?

5. FOR EACH SYSTEM: How many hectares are presently irrigated in the wet season? dry season? How many farmers are served in the wet season? dry season?

6. FOR EACH SYSTEM WITH A DAM: How often (once a year, once every two years, twice a year, etc.) is the dam damaged or destroyed? Why? How many hectares do not receive water when the dam is damaged/destroyed? What problems are often encountered in reconstructing the dam?

B. PIO's PROPOSED SOURCE(S) AND DIVERSION SITE(S)

1. What water source(s) and diversion point(s) does the PIO propose for the project? (REFER TO CPID 2).

2. FOR EACH PROPOSED SOURCE AND SITE: How much water is available from this site during the wet season? dry season? (REFER TO CPID 2, show discharge measurements and dates taken, and calculate average Q).

C. FARMERS' PROPOSED SOURCES AND DIVERSION SITES, AND POTENTIAL IRRIGABLE AREA

1. If an irrigation system were to be constructed in your area, what would be the best water sources? Where is the best site to divert water (SPECIFY LOCATION)? (IDENTIFY TWO SOURCES AND SITES RECOMMENDED BY MOST FARMERS).

a. Source and site suggested by PIO.

b. Source suggested by PIO but <u>not</u> diversion site.

c. Source and diversion site <u>not</u> suggested by PIO.

2. FOR <u>b</u> AND/OR <u>c</u> ANSWER: Identify individuals/groups who suggest source and site. How much land can be irrigated by available water from this source and site during the wet season (SPECIFY BY COMMUNITY)? How many farmers will benefit during the wet season? Does the available water supply decrease in the dry season? By how much (PERCENT)? How much land will be irrigated in the dry season? How many farmers will benefit?

D. WATER RIGHTS STATUS FOR PIO- AND FARMER-PROPOSED SOURCE(S)

1. FOR EACH PROPOSED SOURCE (refer to B1 and C1): Do the potential project beneficiaries already have rights to draw water from this source? YES/NO (CHECK WITH A4).

2. FOR PROPOSED SOURCES WITH WATER RIGHTS: For what amount is this right? Who holds this right? (CHECK WITH A4).

3. FOR PROPOSED SOURCES WITH <u>NO</u> WATER RIGHTS: Have any of the farmers / the farmers as a group applied for water rights? If YES, when? for what amount? who applied (individual/group/association)?

E. OTHER USES OF PIO- AND FARMER-PROPOSED SOURCES

1. FOR EACH PROPOSED SOURCE IDENTIFIED IN <u>B</u> AND <u>C</u> ABOVE: Is this source presently used by existing system(s) within the project's potential irrigable area? (ALSO CHECK WITH A3)

2. IF ANY OF PROPOSED SOURCES IS <u>USED</u> BY EXISTING SYSTEM(S) WITHIN THE PROJECT'S POTENTIAL IRRIGABLE AREA:

Are there other users of this source? YES/NO.

3. IF ANY OF PROPOSED SOURCES IS NOT USED BY EXISTING SYSTEM WITHIN THE PROJECT'S POTENTIAL IRRIGABLE AREA:

   Are there users of this source? YES/NO

4. IF THERE ARE NO EXISTING SYSTEMS IN PROJECT'S POTENTIAL IRRIGABLE AREA:

   Are there users of this source? If No, SKIP TO F.

5. IF ANSWER(S) TO Q. 2, 3 and/or 4 ABOVE IS YES: Who are the (other) users of (NAME SOURCE)? Where are they located vis-a-vis the proposed diversion site(s) on this source? UPSTREAM/DOWNSTREAM? For what purposes do they use the water? How long have they used it? Do they possess water rights? IF USER IS AN IRRIGATION SYSTEM: What area does it irrigate during the wet season? dry season? How many farmers are served during the wet season? dry season?

6. FOR EACH PROPOSED SOURCE WITH DOWNSTREAM USERS: If this source were tapped for the proposed project, how would it affect the present downstream users? Would they be deprived of water? Is there any evidence that they will oppose the project? Why?

F. PLANNED FUTURE PROJECTS

1. Do you know of/Are there any other planned future projects (e.g., irrigation, domestic water supply, electricity, recreation, etc.) which will draw water from the proposed source(s)? IF YES, CONTINUE BELOW; IF NO, SKIP TO III

2. FOR EACH PROJECT: Who (individuals, groups, organizations, public/private agencies) are implementing these projects? Where will these projects be located vis-a-vis the proposed diversion site(s)? What do the farmers/PIO expect these projects' effects to be on the project's water supply.

G. ALTERNATIVE WATER SOURCES:

1. If (PIO- AND FARMER-PROPOSED SOURCES) could not be tapped, what would be the best alternative source? Where is the best site for the diversion structure? How much land can the available water at this site irrigate in the wet season? Does the water supply decrease in the dry season? By how much (PERCENT)? How much land can the available water irrigate? (FOR FARMER-PROPOSED ALTERNATIVE SOURCE(S), record source and diversion site and assessment of water supply. FOR PIO-SUGGESTED ALTERNATIVE SOURCE(S), REFER TO CPID 2, record source and diversion site, show discharge measurements and dates taken, and calculate average Q.)

III <u>Characteristics of the Potential Irrigable Area</u>

A. SUBMIT SKETCH MAP PREPARED BY PIO (CPID 2). CHECK THAT MAP CONTAINS THE FOLLOWING:

a. limits of the potential irrigable area using PIO-suggested source(s) and diversion point(s).

b. limits of existing system within the potential irrigable area.

c. existing and proposed water source(s), diversion and canal structure, and canal network.

d. areas within potential irrigable area which are mountainous, hilly or rolling, relatively flat, or swampy and water-logged.

e. types of crops planted in d.

f. soil types: in the area the canal traverses from the diversion site to the service area; in the presently irrigated area; and in the potential expansion area.

g. village/municipal road, town/village site.

B. FOR EACH PIO-PROPOSED SOURCE AND DIVERSION SITE, ASK THE FOLLOWING (ALSO REFER TO CPID 2).

1. If a permanent diversion structure were constructed on (SOURCE AND DIVERSION SITE) how many hectares will be irrigated in the wet season? dry season?

2. How much of the potential irrigable area is presently irrigated in the wet season? dry season? How many farmers cultivate the irrigated lands in the wet season? dry season? How much of the wet season-irrigated land is planted to rice? of the dry season-irrigated area?

   How many farmers till the wet season-irrigated riceland? the dry season-irrigated riceland?

3. How much of the unirrigated portion of the potential irrigable area is planted to rice? Other crops? uncultivated? FOR EACH CROP AREA: How many farmers presently cultivate this land? How much of this land will be irrigated in the dry season? How many farmers will be served in the dry season? FOR UNCULTIVATED AREA: How much of this land will be irrigated in the dry season? How many farmers will be served in the dry season?

4. Which area and how much are mountainous? Hilly or rolling? Relatively flat? Swampy and water-logged?

5. What soil type(s) exist(s) in these areas? in the area the existing and proposed main canal traverses before reaching the existing/potential irrigable area?

C. FOR EACH FARMER-PROPOSED SOURCE AND/OR DIVERSION SITE WHICH DIFFERS WITH PIO-PROPOSAL: Earlier you said that if the diversion structure were built on (MENTION FARMER-PROPOSAL), the fields in (MENTION COMMUNITIES) will be irrigated. Suppose the diversion structure is built on (MENTION PIO-PROPOSAL), will the irrigation water reach all these communities? IF NOT, How much land in (SPECIFY EACH COMMUNITY) will not be irrigated? Why?

IV. <u>Project structures and costs</u>

A. FOR PROJECTS WITH EXISTING SYSTEM(S), OBTAIN FOLLOWING FOR EACH PROPOSED DIVERSION SITE:

1. Is there an existing dam/intake on the proposed diversion site? Is the proposed site upstream of an existing dam/ intake? Is it downstream?

2. IF PROPOSED DIVERSION SITE IS UPSTREAM OR DOWNSTREAM OF DAM/INTAKE OF EXISTING SYSTEMS: To draw water from this site, where will the main canal pass through? Is this route the same as that of the main canal of existing system? Is it different?

3. IF PROPOSED MAIN CANAL ROUTE IS DIFFERENT FROM THAT OF MAIN CANAL OF EXISTING SYSTEM: Who are the likely new beneficiaries (that is, those who are not served by the existing system) who will draw water from the upper sections of the main canal? Are they likely to control the water distribution? Why?

4. IF PROPOSED MAIN CANAL ROUTE IS DIFFERENT FROM THAT OF MAIN CANAL OF EXISTING SYSTEM. Are there people who presently control water distribution in existing system? If the main canal route is changed will these people still control water distribution? Why? IF NOT, will they oppose the project? Will they oppose the relocation of the main canal? Why?

B. FOR EACH FARMER- AND PIO-PROPOSED SOURCE AND DIVERSION POINT:

1. What is the maximum height of floodwaters in the (SOURCE AND DIVERSION SITE)? Usually, how strong is the current of these floodwaters? Does the (source) overflow during the typhoon months? IF YES, does it flood the ricefields? Which areas are affected? On <u>average</u>, how deep is the river during the rainy season? during the dry season? How shallow does it get in the dry season?

2. In your opinion, what kind (type and materials) of diversion structure is appropriate in the (SOURCE)? Why?

3. Has (MENTION SOURCE) changed its course in the past? Is it likely to change its course in the future?

4. How far is (MENTION SOURCE AND SITE) from the nearest all-weather road? Are there access roads to the proposed diversion site? Describe conditions of access road.

5. <u>FOR PIO-PROPOSED POTENTIAL IRRIGABLE AREA:</u> Considering the terrain of the potential irrigable area, what special structures (tunnels, flumes, siphons, drainage canals, etc.) are required?

V. <u>Rights of way</u>

FOR POTENTIAL IRRIGABLE AREA OF EACH <u>PIO</u>- AND <u>FARMER</u>-PROPOSED DIVERSION SOURCE AND SITE:

1. What is the average size of landholdings within the potential irrigable area? How large is the biggest landholding? the smallest landholding? What percentage of landholdings are less than 2.0 hectares?

2. Who are the big landowners whose lands will be traversed by the proposed main canal before it reaches the service area? FOR EACH NAME MENTIONED: Is he an absentee landowner? Does he own lands which will benefit from the proposed system? Will he be willing to give rights of way?

3. Who are the big landowners whose lands will be traversed by canals within the potential irrigable area? FOR EACH NAME MENTIONED: Is he an absentee landowner? Will he be willing to give rights of way?

4. Who are the landowners whose holdings are less than 2.0 hectares and whose lands are likely to be traversed/used by the proposed system's canals and structures? Will they be willing to give rights of way? Who among them are likely to oppose the construction of canals or structures on their lands?

5. IF THERE ARE EXISTING SYSTEMS WITHIN THE POTENTIAL IRRIGABLE AREA: Who are the big landowners on whose lands the existing canals of the systems are located? FOR EACH NAME MENTIONED: Does he benefit from the existing systems? If the proposed system were to use the existing canals, will he agree?

   Who are the small landowners on whose lands the existing canals of the systems are located? Do they benefit from the existing canals? If the proposed system were to use the existing canals, will they agree?

VI. <u>Integration of Existing System(s)</u>

1. Are there existing systems within the <u>PIO</u>-defined potential irrigable area? Within the <u>farmer</u>-defined potential irrigable area?

2. IF YES, what are the systems and who are the system owner(s in each case?

3. FOR EACH SYSTEM WITHIN POTENTIAL IRRIGABLE AREA: What is/are the water source(s) of this system? Does it have its own diversion structure on this source? Does this system share any of its canals/structures with other systems? IF YES, with what systems?

4. FOR EACH SYSTEM WITHIN POTENTIAL IRRIGABLE AREA: Do you (owners and users) want to become a part of the proposed project? Why? Why not? What problems do you anticipate if you become part of the proposed project?

VII. Farmers' Interest in the Project

1. TO FARMERS: What are the different major groups of farmers in (COMMUNITIES COVERED BY PIO-DEFINED AREA)? Do these groups want NIA assistance? IF NOT ALL GROUPS WANT ASSISTANCE, Which groups want assistance? Which do not want assistance? Why? FOR GROUPS WHO WANT ASSISTANCE: What kind of assistance?

2. Who approached the NIA for assistance? What kind of assistance did they ask? Was it a group decision? IF INDIVIDUALS ARE IDENTIFIED, INDICATE TO WHICH GROUP AND/OR SYSTEM (if any) THEY BELONG. IF GROUPS ARE NAMED, IDENTIFY MEMBERS INVOLVED IN DECISION-MAKING AND THE SYSTEM (if any) TO WHICH GROUP BELONGS.

3. Might any individual/group oppose NIA's intervention? Why?

4. FOR INDIVIDUALS AND GROUPS IN 1 AND 2 ABOVE: Are you aware of the conditions (loan and equity participation) under which the NIA grants irrigation assistance? If NIA built an irrigation system in the area, which of the groups/individuals would contribute labour in construction? Which are not likely to do so? Why? Which individuals/groups will be willing to pay for construction costs? Which are likely to refuse? Why?

5. FOR ENTIRE PROJECT's PROPOSED POTENTIAL IRRIGABLE AREA: Who (individuals/groups/or associations) has received irrigation-related assistance in the past? When? From whom? Under what conditions? What were the outcomes? How do these outcomes affect the farmers' perception of the proposed NIA project?

VIII. Viability of the Association

A. IF THERE IS/ARE EXISTING SYSTEM(S) WITHIN PIO- and FARMER-DEFINED POTENTIAL IRRIGABLE AREA:

1. FOR EACH SYSTEM: Are the farmers in the system currently organized into an association?

2. FOR EACH NON-ASSOCIATION MANAGED SYSTEM:

a. Who are currently involved in the management of the system/Whom do farmers recognize as leaders or managers?

b. FOR EACH NAME MENTIONED: What do farmers call him? What are his responsibilities? How was he chosen (by election, appointment, succession, etc.)? How long has he occupied his position? Under what circumstances will he be replaced? Does he receive monetary compensation? IF YES, how much (specify terms)? IF NOT, what benefits/privileges does he receive?

c. FOR EACH NAME MENTIONED: What other positions in the community does he currently occupy?

d. Who among the village/municipal officials are involved in the management of the system? In what ways?

3. FOR EACH ASSOCIATION-MANAGED SYSTEM

a. What is the association called? When and why was it organized? Who initiated it? Is it registered? When?

b. Who are the incumbent officials and employees of the association? FOR EACH NAME MENTIONED: What is his position? How was he chosen? How long has he been an official/ employee? How do the farmers assess him?

c. How many association members are there? Does membership include all users of the existing system? IF NOT, why?

d. Who among the village/municipal officials are involved in the management of the system? In what ways?

e. Are there non-members who greatly influence the association' management? Who? FOR EACH NAME MENTIONED: What makes him influential? How has he influenced the association?

4. WATER DISTRIBUTION (FOR EACH SYSTEM OBTAIN THE FOLLOWING):

a. Who attends to water distribution in the system?

b. FOR EACH NAME MENTIONED: Does this person cover a particular area (e.g. sector) in the system? IF YES, what is this area called? How large (in hectares) is this area?

c. FOR EACH NAME MENTIONED: Does he receive any remunerations? IF YES, how much (specify terms of payment)? IF NO, how he is compensated?

d. How is the water distributed? PROBE whether distribution is governed by rules such as water measurement, scheduling by area/days, etc.

e. Is the system of water distribution in the wet season different from that observed in the dry season? How? Why?

f. What major conflicts have occurred over water distribution? Briefly describe each conflict (names of persons involved, cause, how resolved, who participated in its resolution).

5. SYSTEM MAINTENANCE (FOR EACH SYSTEM OBTAIN THE FOLLOWING)

a. Who are responsible for system maintenance?

b. FOR EACH NAME MENTIONED: Does he receive any remuneration? IF YES, how much (specify terms of payment)? IF NO, how is he compensated?

c. Do farmers have a schedule for maintaining the dam/intake? canals? What is this schedule? How are farmers informed/ notified about a maintenance activity?

6. CONFLICT (FOR EACH SYSTEM OBTAIN THE FOLLOWING)

a. Besides those mentioned in 4f above, what other major water-related conflicts have occurred? Describe each briefly ?

b. Who among recognized political leaders here are involved in system management? Does he own any land served by the system? Where: upstream, midstream or downstream? How is he regarded?

c. Have local political leaders had conflicts over system management in the past? Give instances.

d. Are there factions among system users? What are the bases of factionalism? Have leaders of these factions had conflicts over water management? Give instances.

7. FEES (FOR EACH SYSTEM OBTAIN THE FOLLOWING):

a. Do farmers pay any irrigation fees? Do they pay right of way fees? What other fees do they pay?

b. FOR EACH KIND OF FEE: How much do farmers pay (per hectare, per season, per crop)? Who collects the fees? What percent of the expected fee collection was collected in the last two years?

c. Have there been cases here (in the irrigation association or in any other community organization) involving misuse of funds? IF YES, briefly describe these cases. What actions were taken against the persons involved?

8. IF POTENTIAL IRRIGABLE AREA HAS MORE THAN ONE EXISTING SYSTEM: Have there been instances of cooperation among farmers in these systems? Describe the instances. Have there been instances of conflict? What was the conflict about? Who figured in the conflict? Has the conflict been resolved? How has the conflict affected the present relationship among farmers of these systems?

B. IF NO IRRIGATION SYSTEM EXISTS IN POTENTIAL IRRIGABLE AREA:

1. Did an irrigation system once exist within the area? IF YES, What was its water source? How many hectares were irrigated in the wet season? dry season? How many farmers were served in the wet season? dry season? Why did the system die or become inoperative?

2. IF NO, was there an attempt in the past to develop an irrigation system here? IF THERE WAS NO ATTEMPT: Why not? IF THERE WAS: Who (individuals or groups) tried to develop a system? Why did it not succeed?

3. Who are the recognized leaders in the project's potential irrigable area? FOR EACH NAME MENTIONED: What positions does he occupy in the community? Will he become one of the irrigation association leaders? Why? Why not?

4. Have there been instances of cooperation among farmers in the project's potential irrigable area? Describe them. Have there been major conflicts? IF YES, What were they about? Who were involved? Was the conflict resolved?

INVENTORY OF DATA SOURCES FOR THE
PROFILE INTERVIEW GUIDE

Section and items in the Interview Guide		DATA SOURCES			
		Ordinary farmers	Farmer-leaders/ I.A. officials	Bgy./Town Officials	CPID #2 PIO records/ PIO personnel
<u>Sec. I</u>					
	1-9				√
<u>Sec. II</u>					
<u>A</u>:	1-3	x	√	√	x
	4-5		√	√	
	6	√u	x		
<u>B</u>:	1-2				√
<u>C</u>:	1-2	√	√		
<u>D</u>:	1-3		√	√	x
<u>E</u>:	1-5	xu	√	x	√
	6	√u	x		
<u>F</u>:	1-2	x	√	√	√
<u>G</u>:	1	√u	√		√
<u>Sec. III</u>					
<u>A</u>:	(MAP)	√u/d	x		√
<u>B</u>:	1-5	x	x		√
<u>C</u>:		√	√		
<u>Sec. IV</u>					
<u>A</u>:	1-4	√u/d	√		√
<u>B</u>:	1-4	√u	x		x
	5	x	x		√
<u>Sec. V</u>					
	1-5	√u/d	√		x
<u>Sec. VI</u>					
	1-3	x	√		√
	4	√(owners/users)	√		
<u>Sec. VII</u>					
	1-4	√u/d	√		
	5	√u/d	√		x
<u>Sec. VIII</u>					
<u>A</u>:	1	x	√		
	2 a-d	√	x		
	3 a-e	x	√		
	4-8	√	√		
<u>B</u>:	1-4	√	√		

NOTE:
- √ - means "primary source"
- x - means "reference"
- u - refers to "upstream farmers"
- d - refers to "downstream farmers"

I.A.- Irrigators' Association
Bgy.- Barangay (village)

CPID #2 - the Investigation and Planning Data Form for communal projects.
PIO - Provincial Irrigation Office

GUIDE FOR WRITING COMMUNITY PROFILES

I. PROJECT DESCRIPTION

Follow format in the Interview Guide (IG).

II. WATER AVAILABILITY AND WATER RIGHTS

A. PIO-proposed water sources and diversion sites (IG IIA,B,D,E)

Identify the water sources and diversion sites proposed by the PIO. For each PIO-proposed source and site, present data on:

a. discharge measurements taken at the site;
b. dates when measurements were taken; and,
c. average Q.

Then present the following data:

a. whether proposed source is presently used by an existing system within the potential irrigable area;
b. whether or not farmers possess water rights to draw from the source;
c. if they do possess water rights, who is/are the water rights rights holder/s and the amount of water stipulated in the water rights;

d. if they do not, whether they have applied for water rights, the identities of water rights applicants, and the amount applied for.

B. Farmer-proposed sources and diversion sites (IG IIA,C,D,E)

Identify the farmer-proposed sources and sites (not more than two). Specify whether or not these sources and sites differ from those suggested by PIO. For each farmer-proposed source and site which differs from those suggested by PIO, present the following data:

a. farmers/groups who suggested the source and site;
b. reasons for their choice;
c. communities which will be served by the source and site, and for each community, the hectarage and number of farmers to be served per crop season;
d. farmers' estimate of the available water supply in the dry season;
e. whether or not the proposed source is presently used by an existing system or systems within the potential irrigable area;
f. whether or not farmers possess water rights to the source; and,
g. if they do possess water rights, who is/are the water rights holder, and the amount of water stipulated in the water right.

C. Other users of PIO-proposed sources (IG IIE)

For each PIO-proposed source, identify the upstream users. For each upstream user, present the following data:

a. purposes for use of water;
b. length of use;

b. water rights holder; and,
e. amount of water stipulated in water rights.

If user is an irrigation system, also present the following data:

a. area irrigated by season; and,
b. number of farmers served by season.

Do the same for downstream users. Then include:

a. effect of the proposed system on the downstream users; and
b. the downstream users' reactions to the project.

D. Other users of farmer-proposed sources (IG IIE)

Follow format for the PIO-proposed sources. Be sure to differentiate the upstream and downstream users of each farmer-proposed source.

E. Future users of PIO-proposed sources (IG IIF)

Identify other planned future projects which will draw water from each PIO-proposed source. For each planned project, present the following data:

a. implementors of the project;
b. purposes for use of water;
c. location of project's diversion site vis-a-vis the PIO-proposed diversion site; and,
d. farmers' and PIO's perceived effects of the future project on the proposed system.

F. Future users of the farmer-proposed sources (IG IIF)

Same as IIE above. Be sure to differentiate the future users for each farmer-proposed source.

G. PIO-proposed alternative sources (IG IIG)

Identify the PIO-proposed alternative sources. For each source, present data on discharge measurements taken, dates when measurements were taken, and average Q.

H. Farmer-proposed alternative sources (IG IIG)

Identify the farmer-proposed alternative sources. For each source, present data on farmers' assessment of the available water supply.

III. CHARACTERISTICS OF THE POTENTIAL IRRIGABLE AREA

A. PIO-defined potential irrigable area

Present data on all items specified in IG IIIB in table format.

IV. PROJECT STRUCTURES AND COSTS

A. Location of PIO-proposed diversion sites and possible main canal route (IG IVA)

For each PIO-proposed diversion site, specify whether this is the site of an existing diversion structure (i.e., the diversion site of an existing system to be included in the proposed system), or whether it is upstream or downstream of an existing diversion structure. Then specify:

a. possible main canal route;
b. individuals/families likely to be the new beneficiaries and who will draw water from the upper sections of the main canal; and,
c. whether these new beneficiaries are likely to control water distribution and why.

Also specify:

a. the individuals/families who presently control the water distribution in the existing system;
b. whether they are likely to lose control of water distribution once the canal route is changed; and,
c. their reactions to the possible loss of control.

B. Location of farmer-proposed diversion sites and possible main canal routes (IG IVA)

Same as above.

C. Characteristics of PIO-proposed sources and sites

For each PIO-proposed source and site, present data on all items specified in IG IVB in table format. Then for each proposed source on which the dam of an existing system is located, present the following data:

a. frequency with which dam is damaged/destroyed;
b. reasons for damage/destruction;
c. area which becomes unirrigated when the dam is inoperable; and
d. farmers' problems in reconstructing the dam.

D. Characteristics of farmer-proposed sources and sites

Same as above. See IG IVC and IIA-5.

V. RIGHTS OF WAY

A. PIO-defined irrigable area

For potential irrigable area of each PIO-proposed diversion source and site, present data on all items specified in IG VA in table format.

B. Farmer-proposed irrigable area

Same as above.

VI. INTEGRATION OF EXISTING SYSTEMS

A. Existing systems within PIO-defined potential irrigable area (IG IIA, VI)

Identify the existing systems within each PIO-defined potential irrigable area. For each system, present the following:

a. system owners - individuals/groups/associations;
b. water sources;
c. whether or not the system has a diversion structure on each of its water sources;
d. type of diversion structure on each of the system's sources;
e. materials of the diversion structure;
f. state of repair of the diversion structure;
g. facilities which system shares with other existing systems (specify the systems who use the same facilities)
h. whether or not farmers using the system desire to become part of the project;
i. if they desire to become part, whether they anticipate any problems and what kinds of problems; and,
j. if they do not, reasons why they do not wish to be part of the project.

VII. FARMERS' INTEREST IN THE PROJECT

Using IG II, VII and VIII, identify the major groups within the PIO-defined irrigable area. For each group, specify:

a. the kind of NIA assistance it desires;
b. whether or not it has approached NIA for assistance; and,
c. if it has, who among the leaders approached NIA.

Also, with reference to IG VII, identify:

a. the groups who are likely to contribute labour and/or are willing to pay the construction costs and why;
b. the groups not likely to contribute labour and/or repay construction costs and why; and,
c. groups likely to oppose the project and why.

VIII. VIABILITY OF THE ASSOCIATION

A. If there are existing systems, for each system draw on IG VIII A1-7 to write a narrative report on:

a. organizational set-up;
b. water distribution;
c. system maintenance;
d. conflict; and,
e. fees

B. If there is no existing system, write a narrative report based on IG VIII B1-3.

ANALYSIS GUIDE FOR PROFILES OF COMMUNAL IRRIGATION PROJECTS

(For use by Provincial Irrigation Engineers)

1. Project description

See Interview Guide.

II. Water Availability and Water Rights

1. How much water is estimated as available at the proposed diversion point(s)? For the wet season? For the dry season? How reliable do these estimates appear to be?

2. Do the potential project beneficiaries already have rights to draw water from the proposed source(s)?

   If they have, for what amount? Who holds (individual, group or communal organization) the water rights? Are these rights sufficient for this project's potential irrigable area?

   If not, can they get one?

3. What other groups draw water from the proposed source(s)? For what purpose(s)? How long have they used the water? Would these groups be deprived of water if this project were carried out? Do these groups possess water rights? For what amount? Who holds (individual, group or organization) the water right?

4. Are there other planned future projects (e.g. irrigation, domestic water supply, electricity, recreation) which will draw water from this project's proposed water source(s)? What effect will they have on this project's water supply?

5. If the proposed water source(s) could not be tapped, what other possible sources could be used? How much water is estimated as available from these sources? In the wet season? In the dry season? How reliable do these estimates appear to be? Which of the alternative sources is the most desirable?

III. Characteristics of the Potential Irrigable Area

1. What percent of this project's irrigable ares is mountainous? hilly or with rolling terrain? relatively flat? swampy and water-logged? (Refer to sketch map).

2. How much of the potential area is planted to rice in the wet season? In the dry season?

3. How much of the remaining portion of the potential irrigable area is cultivated/crop area? Uncultivated? What crops are grown during the wet season? During the dry season?

4. In the crop area not planted to rice, how much of this area is likely to be converted to ricelands? How much of the uncultivated area is likely to be converted?

5. What soil types under what forms of land use, exist in the presently irrigated area? In the potential expansion area? What soil type(s) are found in the area to be traversed by the main canal before it reaches the potential

irrigable lands? Considering these soil types, what amount of water is likely to be needed to irrigate the entire potential irrigable area? Considering the available water supply and the existing soil types, how much land (in has.) is likely to be irrigated? What the key problems on the possible extent of the service area?

IV. Project Structures and Costs

1. How much now irrigable lands will this project generate in the wet season? In the dry season?

   If no new area is generated, would this project yield other benefits to the farmers? What? Do these benefits warrant the costs of this project?

2. Does this project require the construction of a permanent dam? Yes/No.

   Would construction of this dam allow more water to be diverted than is currently diverted?

   If this dam is to be constructed, is it likely to cause wet season flooding of nearby fields or erosion of the stream banks? Is the stream known to change its course?

   Could a reasonably priced permanent dam withstand the floodwaters during the rainy/typhoon months?

3. Is the terrain between the proposed diversion site and the potential service area hilly? rocky? Is it feasible to build a canal through it?

4. Does this project area's terrain require the construction of special irrigation structures like tunnels/piped canals, flumes, siphons, drainage canals, and others?

5. How far is the proposed diversion site from the nearest all-weather road? Is there a need to construct access roads?

6. Will the proposed diversion structure (dam or intake) be placed on the existing diversion site? Upstream? Downstream?

   If the diversion structure were relocated, would it require a change in canal location? Would this change create new beneficiaries who would be able to control the water distribution in the future system?

   Would this change in canal location remove the control of water distribution from those who presently control it? What is their likely response to this loss ot control?

7. What is the estimated per hectare cost of this project?

8. What are the key problems on project structures and cost?

V. Rights of Way

1. What percent of the landholdings in the proposed project's potential irrigable area are less than two hectares? Are the owners of these holdings likely to give rights of way?

2. Are rights of way needed from absentee landowners?

3. Are rights of way needed from landowners whose holdings need no irrigation? Are they likely to give rights of way?

4. Are rights of way needed from landowners who are likely to oppose the project?

5. What are the key problems on right of way?

VI. Integration of Existing System(s)

1. How many existing irrigation systems are there within the project's potential irrigable area? Who owns them (individuals, groups, or communal irrigations)?

   What is/are the water source(s) or each system? Does each system have its own diversion structure(s) on the source?

.. Do these systems presently share any of its canals structures with other systems? Yes/no.

   If YES, what structures/facilities? With what systems are these shared?

3. Will all owners and users be integrated with the proposed project? Yes/No.

   If YES, will this integration require them to share the same irrigation structures and facilities? What problems are anticipated as a result of this integration?

4. What are the key problems on the integration of existing systems?

VII. Farmers' Interest in the Project

1. What major farmer-groups exist within the proposed project area (e.g., upstream and downstream groupings, communal organizations, residential groups, political factions)?

2. What types of NIA assistance does each group want?

3. Which of the farmer-groups have expressed interest in the proposed project? Which seem to oppose it?

4. Which of the farmer-groups are willing to contribute labour and pay back construction costs? Which seem unwilling?

5. What kinds of irrigation-related assistance have the farmers received in the past? Did they benefit from these? If not, why?

6. What are the key problems on farmers' interest?

'III. Potential or Actual Viability of the Association

1. If there is/are existing irrigation system(s):

   a. Who manages the system? Are farmers organized into an association? If so, is it registered?

b. Do farmers pay fees? What kinds of fees? For each kind of fee, what is the current rate?

c. Do they have water distributors? How is water distribution done?

d. Do they have regularly scheduled maintenance activities? How is system maintenance accomplished?

e. Are there any major conflicts dividing the farmers? What are these conflicts and who (individuals or groups) are involved?

f. How do the farmers view their current leaders? Are these leaders respected and trusted?

g. Are the current leaders interested in the proposed projec

h. Will new members be added to the existing organization? If so, are there likely to be major differences in integrating them in this organization?

2. If there is/are no existing irrigation system(s):

   a. Why was a system not developed? Were there previous attempts to develop a system?

   b. Is there evidence of previous cooperation among the people to be served by the proposed project?

   c. Who requested NIA assistance? Identify individuals and groups among farmers who approached NIA.

   d. Is there evidence of who will be the prospective leaders of the proposed association? Are these leaders trusted and respected in the community?

3. What are the key problems on the viability of the association?

IX. Overall Assessment of the Project/System

1. Of all the key problems, which ones are the most critical?

2. What measures are needed to solve them?

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AGRICULTURAL ADMINISTRATION UNIT

ORGANISATION AND MANAGEMENT OF IRRIGATED AGRICULTURE

Irrigation Management Network 2/81 6a

December 1981

NEWSLETTER

1. Network papers

This is another familiar delayed issue. With this Newsletter come a paper on farmers' participation in the development of improved tertiary channel layouts, which draws on the work of of Yem Othman (Malaysia) and Toti Moya (Philippines) (2/81/1); and - in response to 1/81/2 - a note from Roberto Lenton on the relationship between action research and other forms of engineering research (2/81/2). Also included is a full list of current Network members' names and addresses, with biographical notes added in the case of those who returned the Register Forms sent out with the last Newsletter.

2. Recent news

Details of recent/forthcoming meetings, news from networkers, etc, are held over till the next issue which will follow shortly.

3. Recent publications, reports, etc

(a) Books, articles

M. Bashir Choudhri, M. A. Mian, M. Rafiq, "Nature and magnitude of salinity and drainage problems in relation to agricultural development in Pakistan", Pakistan Journal of Forestry, April 1978, pp 70-91.

Ramesh Bhatia, "Energy alternatives for irrigation pumping: some results for small farms in North Bihar", in R. K. Pauchuri (ed.), International Energy Studies, Wiley Eastern Ltd, New Delhi, 1980.

S. D. Biggs, "Monitoring for re-planning purposes: the role of research and development in river basin development", in S. K. Saha and C. Barrow (eds.), River Basin Planning: Theory and Practice, John Wiley, 1981, pp 325-342.

Asit K. Biswas, "Water for the Third World", Foreign Affairs, 60, 1, Fall 1981, pp 148-166.

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I. Carruthers and C. Clark, The economics of irrigation, Liverpool University Press, 1981.

O. P. Chadha, "Consultancy services in water resources development", Irrigation and Power Journal (India), 37, 4, October 1980, pp 387-389.

Françoise Conac, Irrigation et développement agricole: l'exemple des pays méditerranéens et danubiens, SEDES/CDU, 88 Boulevard Saint-Germain, Paris V, 1978.

P. J. Dieleman and A. Arar, "Irrigation in the Near East Region", Entwicklung und Ländlicher Raum, May/June 1981, pp 10-14.

J. Farrington and R. S. Fieldson, "The assessment of farmers' behaviour in the design of irrigated settlement: an analysis of settlement projects in Sri Lanka", Quarterly Journal of International Agriculture, 20, 3, July-September 1981, pp 293-303.

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David C. Korten, "Community organization and rural development: a learning process", Public Administration Review, September/October 1980, pp 480-511.

C. S. Murty and N. B. Reddy, "Minor irrigation schemes and small farmers" (in Andhra Pradesh, India), Kurukshetra, 1 August 1981, pp 12-14.

James E. Nickum (ed.), Water management organization in the People's Republic of China, M. E. Sharpe Inc, New York, 1981.

Gunter Schramm, "Human-institutional factors", Natural Resources Journal, October 1976, pp 923-937.

Gunter Schramm and Fernando Gonzales V., "Pricing irrigation water in Mexico: efficiency, equity and revenue considerations", Annals of Regional Science, 11, 1, March 1977, pp 15-35.

N. G. R. de Silva, "Farmer participation in water management: the Minipe Project in Sri Lanka", Rural Development Participation Review (Cornell), 3, 1, Fall 1981, pp 16-19.

Donald C. Taylor, The economics of Malaysian paddy production and irrigation, Agricultural Development Council, Bangkok, 1981.

D. L. Vyas, "Economics of farm investment structure on irrigated farms of Borunda tubewell command area in Rajasthan", Annals of Arid Zone (Jodhpur), 20, 2, 1981, pp 123-128.

Robert Wade, "The State and irrigation reform in South Korea", Journal of Rural Development, 13, December 1980, pp 253-267.

(b) Research publications

M. M. Bashir Kausar and M. Afzaal Khan, "Organizing and testing water users' associations and their federation", in Annual Research Report, 1979-80, pp 67-85 (Water Management Research and Training Programme for Rural Development, University of Agriculture, Faisalabad, Pakistan).

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Ph. Bonnefond et al, "Etudes d'unités de production de paysans pratiquant la culture irriguée dans le cadre de la SAED", 3 vols., December 1980 (ORSTOM-ISRA, Richard-Toll, Dakar, Senegal).

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Ho Nai Kin, "An overview of water management, irrigation requirements and agricultural practices for rice cultivation in the Muda area - with special reference to Muda II Irrigation Project", June 1981 (Section of Agricultural Extension and Training, Muda Agricultural Development Authority, Alor Setar, Kedah, Malaysia).

Indian Agricultural Research Institute, "Studies in economics of irrigation", Research Bulletin No. 32, 1980 (Division of Agricultural Economics, IARI, New Delhi-110 012, India).

Ueli Meier, "Local experience with micro-hydro technology", 1981 (Swiss Centre for Appropriate Technology, Institute for Latin American Research and Development Co-operation, University of St. Gallen, Varnbüelstrasse 14, CH-9000 St. Gallen, Switzerland).

J. L. J. de Sonneville, Final report of the consultant in systems analysis, UNDP project INS-70/527, May 1979 (PROSIDA, Directorate General of Water Resources Development, Jalan Pattimura 20, Kebayoran Baru, Jakarta, Indonesia).

Vanpen Surarerks et al, "Water management conflicts in Northern Thai irrigation systems", February 1980 (Faculty of Social Sciences, Chiang Mai University, Thailand).

Donald C. Taylor, Kusairi Mohd. Noh, Mohd. Ariff Hussein, "An economic analysis of irrigation development in Malaysia", ?1981 (International Food Policy Research Institute, 1776 Massachusetts Avenue NW, Washington DC 20036, USA).

Michel Vassart, "Technologies for lifting irrigation water", draft paper for comments only, August 1981 (International Labour Organisation, 7 Sardar Patel Marg, New Delhi-110 021, India).

Hassan Wahby, Gene Quenemoen, Mohamed Helal, "A procedure for evaluating the cost of lifting water for irrigation in Egypt", EWUP Technical Report No. 7, October 1980 (EWUP, 22 El Galaa Street, Cairo, ARE).

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Anthony Bottrall, "Issues in main system management", paper to workshop on investment decisions to develop SE Asia's irrigation resources, Kasetsart University, Bangkok, Thailand (AAU, ODI, 10-11 Percy St, London W1P OJB), August 1981.

Anthony Bottrall, "An approach to evaluating the organisation and management of large irrigation schems", paper to workshop on irrigation management with special reference to problems of water distribution and delivery at the chak (outlet) level, Gandhian Institute of Studies, Varanasi, India, July 1981 (AAU, ODI, 10-11 Percy St, London W1P OJB).

I. D. Carruthers (with R. Stoner), "Social and economic aspects of groundwater development", World Bank Staff Working Paper, 1981.

A. Das Gupta, "Irrigation water management in Gandak Command", paper to workshop, Rajendra Agricultural University, Bihar, January 1981 (Area Development Commissioner, Gandak Area Development Agency, Muzaffarpur, Bihar-842 001, India).

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Roberto Lenton, "A note on alternative forms of performance evaluation in irrigation systems", May 1981 (The Ford Foundation, 55 Lodi Estate, New Delhi-110 003, India).

John A. Replogle and John L. Merriam, "Scheduling and management of irrigation water delivery systems", paper to ASAE National Irrigation Symposium, Lincoln, Nebraska, 1980 (John L. Merriam, Agricultural Engineering Department, California Polytechnic State University, 235 Chaplin Lane, San Luis Obispo, CA 93401, USA).

Peter Rogers and Christopher Hurst, "Engines for development I: the potential demand for small heat engines", October 1980 (Center for Population Studies, Harvard University, Cambridge, Mass. 02138, USA).

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Robert Wade, "Rainfall, PET, and irrigation institutions", April 1981 (IDS, University of Sussex, Falmer, Brighton BN1 9RE).

Robert Wade, "Employment, water control, and water supply institutions: South India and South Korea", ?1981 (IDS, University of Sussex, Falmer, Brighton BN1 9RE).

4. Lunchtime meetings at ODI

10 November 1981: Joe Morris, "Irrigation rehabilitation and settlement in Egypt's New Lands" (lecturer in agricultural economics, National College of Agricultural Engineering, Silsoe, Beds.).

26 November 1981: Anthony Bottrall, "Action research and irrigation management" (AAU, ODI, 10-11 Percy St, London W1P OJB).

5. Other AAU activities

A set of Agricultural Administration Network papers was issued in November 1981. This included a Newsletter, a Discussion Paper by Clare Oxby on farmer groups in Cameroon, and three Network Papers on the use of micro computers in agricultural development.

6. Register of network members

If your entry in the Register consists of name and address only and you would like some biographical notes added, please complete the enclosed form and return it to the Irrigation Management Network at ODI. If you have already sent details, please ignore the form,

Please also try to keep us regularly informed of any change of address.

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AGRICULTURAL ADMINISTRATION UNIT

ORGANISATION AND MANAGEMENT OF IRRIGATED AGRICULTURE

Network Paper 2/81/1
6b

DEC 1981

TWO APPROACHES TO TERTIARY COMMAND DEVELOPMENT: DESIGN OFFICE V. PARTICIPATORY FIELD SURVEY

After a period in which many large irrigation systems were constructed with little or no regard to their physical or institutional requirements below the secondary canal level, planners have now become generally aware of the need to improve the design of tertiary command layouts and to stimulate the formation of water users' groups to operate and maintain them. This has led to the introduction of numerous initiatives misleadingly described as 'on-farm development programmes'.

Though this shift in focus has been a welcome one - especially where it has been associated with improvements in main system management - the value of the programmes has often been greatly reduced by the tendency of planners (and particularly engineers) to regard the physical design of the tertiary layout as a task which is separate from, and prior to, that of promoting effective water users' organisations. Moreover, much of the design work has continued to be done by consultants in remote Design Offices, using conventional survey techniques which are unable to capture the important variations in micro-topography typical of most tertiary commands. Most of the resulting layouts are therefore both technically defective and socially unacceptable - since the farmers have not had a chance to suggest adjustments in channel alignment which would suit their organisational requirements. Yet planners continue to be surprised when subsequent efforts to form 'water users' associations' are unsuccessful and farmers destroy many of the channels and structures provided for them.

The two contributions which follow - one by a sociologist, the other by an agricultural engineer - make it clear that the processes of tertiary channel design and group formation are likely to be successful only if they are undertaken in close interaction with each other (cf. the conclusions of Paper 2/80/2 on the development of small communal systems). Yem Othman discusses the participatory field survey approach adopted by an interdisciplinary team on the Muda Project in Malaysia, where tertiary development has only recently begun. Toti Moya describes the consequences of using a 'Design Office' approach on a system in the Philippines and indicates the benefits likely to follow from adopting a much more detailed survey technique into which farmers' modifications can be incorporated. The approaches advocated by both authors call for substantial changes in attitude and style on the part of irrigation system designers. To that extent they are more 'difficult' than the conventional approach. But the additional financial costs are unlikely to be great and they can confidently be expected to be easily outweighed by the additional benefits.

Both contributions are based on substantially longer and more detailed papers presented at a Workshop on Investment in S.E. Asian Irrigation held at Kasetsart University, Thailand, in August 1981, under the auspices of the Agricultural Development Council, New York.

THE MUDA II EXPERIENCE

Yem Othman*

Planners' conceptions and farmers' expectations

Too often, planners of technological change have paid insufficient attention to the context of land, people and culture into which that change is to be introduced. When their programmes have been 'rejected' by the target beneficiaries, they have tended to attribute it to the latter's 'impermeability to change', 'unmodernising mentality', 'primitive orientation', etc. They have seldom considered the question - or rather the grudge - sometimes expressed by the intended beneficiaries: 'who planned the programme in the first place?'.

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* Sociologist, Planning and Evaluation Division, Muda Agricultural Development Authority, Alor Setar, Malaysia.
His paper to the ADC Workshop was entitled 'Farmer participation in terminal irrigation development - the case of Muda II Project, West Malaysia'.

The emergence of the terms 'software' and 'hardware' in development parlance reflects an increasing awareness among planners of the importance of the cultural context of technological change and of the need to look for the reasons for 'rejection' within that broader context, instead of attributing them to absolute weaknesses on the part of the intended beneficiaries. This has led to numerous statements about 'the need to promote farmer participation in development programmes'. It is noticeable that the greatest pressures for farmer participation often arise after the key planning decisions have been made - when proof of sluggish project performance is reported, or when symptoms of impending failure emerge.

At the root of the problem is a conflict between the planners' conceptions of participation and the clients' expectations. Quite often, a planner may simply be appalled by the tedious and time-consuming job of asking 'each and every farmer' to comment on the design layout of a tertiary system; he may also doubt the farmers' ability to comment sensibly on design matters. Meanwhile, on the clients' part, 'participation' (contrary to what they might expect it to mean) has meant no more than giving answers to interview schedules, attending extension meetings, and finally thumb-printing official forms in land acquisition exercises for what they perceive as a 'government project'.

In such a situation, a communication gap emerges between the planners and the clients, which reinforces their traditionally negative impressions of each other. Matters have been made worse by the tendency of government elites to regard peasants as mere recipients of dole-outs from above, especially in irrigation development programmes. Even though central governments have spoken of mass participation in development, peasants have not been given a proper role in decision-making (Takahashi 1977: 131).

In this heavily one-sided communication process, the client often has more to lose than anyone else; in the final analysis it is his piece of land which is at stake when technological change is introduced. Yet planners tend to emphasise technical-economic cost considerations without giving sufficient throught to socio-cultural costs. In irrigation development there is a particularly urgent need for a compromise between planners' and clients' conceptions and for a fair balance between technical, economic and socio-cultural cost, because of the frequent danger of 'water anarchy'. This not only affects the performance of the irrigation system, but also gradually erodes relations between the change agency and its clients, which can in turn have important political repercussions.

The key to the needed compromise lies in better communication. Where communication is lacking, withdrawal behaviour will be common on the farmers' part, typified by statements such as: 'the project belongs to those who plan it, so let them maintain it' - a remark actually made to the author in the course of a discussion with farmers.

"The chance to say something"

Technical change in agriculture is directed at the resources available for cultivation, at methods of production, and at the organisation of production. These three factors are interrelated, and whether we are dealing with water control, the improvement of land or seed or livestock, basic to all is the work of man, his division of labour, his groupings, his traditional procedures, his relationship to the land. His survival and also often the reason why he wants to survive, depend on these. All change, even in techniques and tools used, will affect his way of life and his relations with others (Mead 1954: 177).

In introducing innovation into the land-man-culture context, the role of a change agent - be he administrator, engineer, agriculturalist or extensionist - is analogous to that of a skilled carpenter whose task is to improve the farmer's housing conditions. In the latter case the farmer - who is the rightful owner of the house - would be greatly disappointed if the carpenter simply entered the house and undertook the repair jobs right away without giving him a fair 'chance to say something' about his house, his expectations or his needs. Without such a chance, the carpenter might repair parts of the house the owner does not want repaired; or he might leave undone parts which need repair. The owner knows his own house best.

In this analogy, it is lack of communication (or more precisely the unwillingness of the carpenter to communicate) which prevents a compromise from being reached between the owner's practical knowledge and the carpenter's technical skills. It would be easily understandable if the owner found it hard to express any gratitude to the carpenter, let alone his appreciation of his 'services'.

In the real world of irrigation development it is difficult to imagine that there are still cases where needy farmers are opposed in principle to such changes as the introduction of tertiary channel networks, in-field access, or new inputs. Nevertheless, there may be several reasons why they still resist them in practice. They may perceive the change as threatening their interests, they may not understand the change, or they may resist being forced to change (Spicer 1952: 18). Another reason, suggested by the analogy, is that the manner in which the change is introduced is unacceptable because it offends against prevailing norms of social behaviour.

The promotion of people's participation in development projects is not an easy task. But it would certainly be made easier if planners could always bear in mind the importance of giving their clients a sense of being 'honoured' by them in the course of project planning and execution. The main reason why communication is needed to enhance popular participation is that people can be motivated toward decision-making only if (a) they feel that they have been properly consulted during the design phase of a project, and (b) they have adequate information on which to base their decisions. They also need a continuing opportunity to make their aspirations known as the project proceeds (Fraser 1981: 37). Hence the attitude of the farmer on the Muda scheme who said: 'what we want is a discussion with the planners and a chance to say something!'.

The Muda II project

The Muda scheme, managed by the Muda Agricultural Development Authority (MADA), has been operating since 1970 and supplies a command area of about 250,000 acres. Its infrastructure includes two reservoir dams, a diversion barrage, 11 regulators, 603 miles of distribution canals, 541 miles of drainage channels, 24 pumping stations, 482 miles of laterite farm roads, and an already existing 60-mile coastal embankment with 25 tidal gates to prevent tidal ingress and assist drainage.

With the introduction of the scheme two rice crops have been grown instead of one and between 1970 and 1979 average yields increased from 1.45-1.5 to 1.65-1.75 tons per acre. Total production has increased by about 70%. However, due to gross inadequacies in the irrigation and drainage infrastructure, some fringe areas could not be irrigated at all and others could not be properly double-cropped. There were numerous appeals from farmers for better water distribution facilities. The principal inadequacies have been:

(a) secondary canals, without tertiary networks, spaced ¾-1¼ miles apart and serving areas from 500 to 2000 acres. With field-to-field flooding, it can take as long as 40 days for the first water of the season to reach the tail of the block and there are major conflicts between head and tail farmers over cropping calendars and water requirements. And with 4-5 villages and 400-500 farmers, each block becomes very difficult to manage in social terms;

(b) the coastal plain, though generally flat on a macro level, contains many local differences in elevation. This means that some areas have been short of water while closely adjacent ones have been flooded;

(c) the drainage system has also been very widely spaced, adding to the problems of waterlogging, hampering planting and harvesting activities, and reducing the quality and value of grain output;

(d) there are no access roads within the irrigation blocks, making it difficult to bring in inputs to the fields and transport produce out on time.

Consideration of these constraints led to the birth of the Muda II project, which aims to provide tertiary facilities at a canal density of 30-35 metres per ha (against a present density of 10 m/ha). The facilities include tertiary canals, drains and farm roads, to which 80% of the farm lots will have direct access.

In planning and implementing Muda II, a positive attempt is being made to reach a compromise between technical design criteria and the farmers' felt needs. This new approach involves a 'marriage' between planners' technical expertise and farmers' practical field experience. In the words of the Muda II Project Engineer:

> "The individual farmer within his own 4 acre plot of land is the most knowledgeable person in as far as the terrain of his land is concerned and also best qualified to determine what is acceptable to him within reasonable limits. Not to tap this available knowledge and not to solicit comments or opinions from the farmers on the proposed tertiary development works would indeed be a lapse in the integration process of project implementation... /Their/ acceptance of the proposed tertiary development works at the very onset is imperative if the objectives of the project are to be realised" (Quah Teik Hoe 1981: 3).

The planning and design process

The planning, design and construction of tertiary facilities are done by the Drainage and Irrigation Department (DID) Project Office of Muda II, in consultation and coordination with other MADA staff, whose disciplinary backgrounds include engineering, agriculture, economics and sociology. The planning and design process involves the following steps:

1. Initial tertiary layout plan of a designated irrigation block is prepared on the basis of criteria set out in a Feasibility Report, using existing survey data as well as field verification by the design engineer.

2. The tentative layout plan is sent for comments to the Operation and Maintenance Section of the Division of Engineering, MADA, and also to the Division of Agriculture.

3. The Head of the Agriculture Division discusses the plan with his senior extensionists, who then make a trip to the designated area to identify local leaders and other influential people.

4. The extensionists fix a date for a meeting at MADA headquarters to which the identified leaders and influentials are invited. MADA provides the transport.

5. At the meeting the Head of the Agriculture Division gives a briefing on the proposed project, which is followed by informal discussion between the farmers and MADA staff. A copy of the proposed tertiary layout plan is normally presented for initial comment.

6. The farmers are asked to familiarise their fellow villagers with the proposed project and to fix a date for a more 'down-to-earth' meeting with MADA extensionists and DID staff.

7. At this second meeting - normally held in a farmer's house, school, mosque or village community centre - more detailed information on channel alignment, location of structures, etc, is presented. Three senior extension staff are assisted by an irrigation inspector from MADA's O & M Division and the design engineer of that particular irrigation block as well as the sociologist. Farmers' frank comments and opinions are solicited. They are encouraged to base their comments on communal rather than personal interests.

8. The farmers' comments are relayed to the Design Section of the Project Office for review and further action, including another visit to the location and a detailed grid survey to confirm farmers' comments and enable alternative layouts to be prepared.

9. The finalised layout plan is submitted to the land office for the purpose of land acquisition.

   (At the same time other actions are taken, including the formation of local irrigation committees, farmer training, preparation of extension manual, etc.)

10. On approval of the final design and completion of the land acquisition process, construction proceeds.

The outcome

The comments of the farmers at the village meetings have usually revolved round the alignment of tertiary canals, drains and farm roads; the type of canals (concrete, earth, pipelines, etc); the type of farm roads; the location of structures (eg tractor crossing, irrigation control-cum-crossing, farm irrigation turnout); scheduling of irrigation supply; and the existence of ancient burial grounds, of which the implementing agency was unaware. Usually the majority of the proposed layouts have been acceptable, but where there have been requests for changes they have almost always turned out to be correct and logical.

To date the Head of Agriculture Division has given a total of 24 briefings on Muda II to a total of 220 farm leaders and influentials (who have included figures such as the village imam); while the travelling discussion group has conducted 120 sessions with 4,648 farmers. Out of the 120 meetings, there was only one case where the farmers' group rejected the proposal altogether, and it was later discovered that the opposition came from only a few farmers with vested interests.

The real test of Muda II has still to come. It remains to be seen how efficiently water will be distributed to the farmers' fields, how well they understand the mechanics of the new system, how far they will observe the rules, how genuinely they regard it as 'their' project rather than the government's, and how committed they are to maintaining and caring for it. However, they have been given 'the chance to say something' at the planning and design stage and they have accepted it. It is to be hoped that this will provide the basis for an enhanced sense of collective responsibility when the new tertiary system becomes fully operational.

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EXPERIENCE ON THE LOWER TALAVERA RIVER IRRIGATION SYSTEM

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This paper summarises the results of a detailed study which examined the pattern of water distribution within selected tertiary commands along a lateral of the Lower Talavera River System (LTRIS) and investigated reasons for variations in that pattern. It goes on to advocate changes in the procedures currently used by the National Irrigation Administration (NIA) in planning and designing tertiary layouts, after comparing (a) the layouts actually installed by the NIA on the selected tertiaries, (b) the modifications subsequently introduced by

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the farmers, and (c) the layouts which would have followed if an improved design method - the 'Custom Fit Technique' - had been used.

Patterns of tertiary-level water distribution

LTRIS, in Nueva Ecija Province of the Philippines, is a diversion type gravity system supported by a reservoir. With a command area of 2500 ha, it is probably the best equipped irrigation system in the country. It has also been the site of a joint experiment between the NIA and the Irrigation and Water Management Department of IRRI involving the introduction of improved methods of main system water distribution. As a result of the five-season experiment (between 1977 and 1979) water use efficiency for the system as a whole rose from a pre-project level of 47% to 73% in the 1979 dry season; equity of water distribution between head and tail reaches was greatly improved; time gaps between farming activities were substantially reduced; and there were far fewer water-related conflicts (Tapay et al, 1980). Given the importance of main system management in determining the range of options open to farmers below the tertiary turnout, a well-managed system like LTRIS provides an excellent setting for a study of tertiary-level water distribution practices.

The study was conducted on three tertiary command areas in the upstream section of LTRIS during the 1979 dry season. After ocular inspection and farmer interviews on their source of irrigation supplies, each command area was divided into 'irrigation sectors'. Sample paddy fields representative of a sector were chosen at an intensity of one field per 4 ha. These fields formed the units of observation and analysis.

The following information was gathered:

a) Water: daily irrigation flows into each sector; seepage and percolation in each observation field; rate of evapotranspiration of the crop; and rainfall depth.

b) Crops: variety of rice planted; dates of sowing and transplanting, age of seedlings (through farmer interview); and grain yields in each observation field (through crop-cutting).

c) Topography and channel layout: profile level surveys for each command area, based on an average of one elevation shot from the centre of each bunded unit; effective gradient of the distribution channels, based on elevation shots at 10 m intervals; density of channels in relation to area served; an estimate of potential hydraulic working head (paddy field elevation relative to turnout); distance of observation fields from water source; their soil characteristics; and their accessibility to the distribution channels.

d) Farmers' behaviour: daily observations of activities such as checking canal flows, closing and opening turnout gates at will, breaking embankments, and disturbing measurement devices.

Analysis began with the evaluation of the relative water supply (RWS) across the irrigation sectors within the tertiary commands. This involved computing the ratio of the weekly mean supplies to the weekly mean demands and was used as a measure of water adequacy on the farms.[1] It was found that at the level of the lateral canal water supply was adequate throughout the irrigation season: measured available flow was most of the time greater than the weekly mean target discharge. However, the distribution of water among farms within the sample tertiaries was very variable, with RWS in the three cases ranging from 1.55 to 0.52, from 2.14 to 0.49, and from 1.64 to 0.30. It was also found that 66% of the variation in crop yields could be accounted for by variation in water supply.

Physical explanations for the variability in RWS levels were then investigated. Through regression analysis it was found that water availability on the farms was significantly affected by the following factors, in descending order of importance: (a) field elevation relative to the turnout (accounting for 31.4% of the variation), (b) accessibility to distribution channels (23.1%), (c) sandiness of soil (13%), and (d) channel density (12.4%). The independent effects of channel gradient and field distance from turnout were insignificant. However, the interaction between field elevation and distance from turnout was highly significant and accounted for an additional 19.2% of the explained variation.

Two of the findings - the importance of field elevation in relation to turnout; and the fact that distance from turnout became important only when the potential hydraulic head was insufficient - have serious technical implications. They strongly suggest that the procedures employed by the NIA in designing and constructing channels did not properly account for high paddy fields.

That the other most important explanatory variable was accessibility underlines the difficulties of those farmers who were obliged to depend for their water supplies on patterns of field-to-field distribution controlled by those with direct access to the channels. In general, farmers with direct access did not allow the next farmers to get water unless their own

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1 RWS is the inverse of water utilisation efficiency (WUE) expressed as a decimal:

$$RWS = \frac{IR + RN}{ET + S\&P}$$

where IR = weekly mean irrigation inflows, RN = weekly mean rainfall depth, ET = weekly mean evapotranspiration rate, S&P = weekly mean seepage and percolation (mm/day). RWS of 1.0 means total crop needs are fully served at 100% WUE; less than 1.0 implies water requirement not fulfilled and WUE above 100%; more than 1.0 implies overapplication and WUE below 100%.

crop needs were fully satisfied. Moreover, the timing of the farmers' cropping activities was often different. Interviews revealed that conflicts among irrigators usually arose when the direct access farmers had just applied agricultural chemicals or were terminally draining their paddy fields and the next farmers wanted to irrigate by bringing water through the same fields.

The final stage of the analysis involved correlating the frequency of different types of farmers' negative behaviour with each of the physical parameters of water distribution. Where negative behaviour took the form of obstructing irrigation flows by canal checking, it was found to be significantly associated with channel gradient and density and to a lesser extent with field elevation in relation to turnout. In practice all the sample tertiaries were provided with a density of channels which compared favourably with the 50 m/ha requirement for improved systems (ADB 1980). The fact that some farmers still engaged in checking therefore suggested either that there was insufficient hydraulic head at source, or that the farmers had modified the channels in such a way that they became incorrectly positioned. The latter proved the more common reason: farmers explained in interviews that, because of the many right-of-way problems encountered when constructing channels, they had located them wherever they could regardless of topography.

Another reason for the prevalence of checking, which would be independent of any deficiencies in irrigation design, may be found in the wish among farmers in the LTRIS area to build up large flow rates simply in order to complete their irrigation in the shortest time possible (Early et al, 1978). The same result could in theory be achieved either by building a higher water elevation at the source or by constructing distribution channels with a wider cross-section. But the former would be unlikely to appeal to irrigation designers since it would entail a greater risk of washouts; and the latter would probably be rejected by farmers since it would involve more loss of land. It follows that, to minimise the frequency of checking, well-designed physical facilities need to be accompanied by efforts to influence farmers' attitudes to irrigation activities.

All the other forms of negative behaviour - breaking embankments, closing and opening turnout gates at will, and disturbing measuring devices - were found to be positively related to farmers' distance from the turnout. These actions can largely be explained as attempts to accelerate and increase the delayed low flows with which those furthest from the water source are often confronted.

It is evident from these findings that a substantial part of the farmers' interference behaviour stems from the nature of the tertiary distribution system itself. It is their logical response to a physical system which does not fully serve their needs and desires.

Alternative approaches to tertiary design

At several points in the sample tertiary areas farmers had broken or completely erased the channels NIA had designed and constructed for them, either because they were incorrectly positioned or poorly constructed, or both. This was a reflection of one of the basic weaknesses in the design process, which was its failure to take sufficient account of lócal variations in the micro-topography.

NIA's design of tertiary facilities in LTRIS, which specified the division of each turnout command into 4 to 6 smaller 8-12 ha units for rotational irrigation, had been based on topographical maps of 0.5 m contour intervals (CI). As an experiment, topographical maps of 1.0 m CI and scale of 1:3000 of the three tertiaries were submitted to the Design Section of the Communal Project Implementation Department at NIA's headquarters for redesign. At the same time, maps of the same scale but bearing an average of one elevation shot per paddy field were submitted to another engineer at IRRI. Exactly the same sets of specifications were provided to both designers. In both cases, extra care was exercised to keep the location of the tertiaries anonymous and the objectives of the design unspecified.

The IRRI engineer used a procedure called the 'Custom Fit Technique' in his design. This method involves the backward plotting of the design water surface elevation, starting from the highest field in the tailend section of a tertiary command and working up to the turnout, with careful consideration being given to the available working head. The NIA engineer on the other hand used standard NIA design procedures (Iglesia 1979). After the plan and layout of the channels had been done, the researcher asked both designers to plot the channel design profiles including the full supply elevation (FSE). At the same time a map was made of the actual channel layout as it had been modified and reconstructed by the farmers (though in this case FSE could not be plotted because of the large variability in cross-section).

The first comparison to be made was between the density of distribution channels under the original NIA design, as proposed under the NIA re-design and the 'Custom Fit Technique', and as modified by the farmers. In two out of the three cases the NIA re-design called for longer channel lengths than the 'Custom Fit Technique' - by 25% and 88% (in the third case they were shorter by 9%). Except in one case, the farmer-modified designs had the lowest channel density requirements.

An interesting point to emerge from the experiment was that the distribution system as designed by the NIA engineer was virtually the same as the original design based on 0.5 m CI maps, both in terms of channel placement and of numbers of control structures; but this was not altogether surprising since he had been given less information on the topography than the original designer. Probably more remarkable was the recommendaiton made by both the NIA and the IRRI engineers that in one of the tertiary areas an additional turnout should be built exactly at the point where farmers were drawing water illegally. This is a clear example of a case where 'negative behaviour' on the farmers' part turns out to have been perfectly rational.

A comparison was also made between the hydraulic characteristics of the NIA and IRRI engineers' designs. To assess the soundness of each design, nearby field elevations were superimposed on the channel design profiles. The NIA design required the distribution system, particularly in its more distant reaches, to carry water to farms located at elevations equal to or higher than the FSE. To reach these farms water would have to flow at very low gradients or (as has happened in practice) be checked up; this has led to frequent overtopping of banks and the flooding of upstream farms. The design also included certain drainage ditches in places where no water could be expected to drain, while others were so positioned as to contribute to upstream flooding. By contrast, under the design achieved through the 'Custom Fit Technique', at least 0.10 m hydraulic working head was available to all fields taking water from the system; and no drainage channels were needed since the topography allowed excess water to flow off into a natural creek.

Even though the 'Custom Fit Technique' requires the use of a map with one elevation shot per bunded unit it is not likely to be more expensive than the NIA's techniques. Especially on flat lands where fields tend to be larger the preparation of paddy elevation maps may even be less costly than the preparation of 0.5 m CI topographic maps, mainly because of the relatively small number of paddies involved. In the case of undulating topography, where fields tend to be smaller and more numerous, preparation of the paddy maps may be costlier. But further savings in costs can be expected from the technique during construction. It must be remembered that the layout recommended under NIA design procedure is 57% longer and therefore entails higher construction costs. And the cost disparity would be still greater if all costs were amortized over the total life of the project, since, as we have seen, the NIA-designed channels have proved to be short-lived.

The principal lesson to be learnt from these investigations is that, even where the important condition of satisfactory main system management has been met, conventional civil engineering approaches to design and construction are inappropriate when it comes down to the development of channel layouts at the tertiary level. The approach required calls for two major changes in current practice. The first is to obtain more detailed information on the topography of the area: however careful the consideration given to other factors influencing design accuracy (eg soil, method of water application), design work will remain costly guesswork as long as detailed topographical information is lacking. The second is to consult farmers and to modify the physical layout in accordance with their legitimate wishes and desires. Farmers' participation must be drawn upon in the planning and design of tertiaries since these are the portions of the irrigation system which they are expected to manage.

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A NOTE ON THE RELATIONSHIP BETWEEN ACTION RESEARCH AND OTHER FORMS OF ENGINEERING RESEARCH

Roberto Lenton*

Rather than comment directly on Anthony Bottrall's paper on Action Research (1/81/2), I thought it might be useful to complement his observations on the relationship of action research to other forms of social science with some thoughts on its relationship to other traditional forms of engineering research (in particular the use of models). One of my tentative conclusions is that the best way in to improvements in main system management is through a combination of action research and models, rather than directly through action research on water distribution.

One other general point I have is that a distinction might be made between action research as a research tool, as a training tool, and as a management tool. As a research tool, action research can help to improve our understanding of the general outcomes of different interventions under varying

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environmental conditions, and of the way in which these interventions might best be implemented. As a training tool, it can help irrigation staff learn about the nature of the proposed intervention and how to implement it. And as a management tool, as Bottrall points out, action research can assist management to evaluate the proposed outcome of a specific intervention to improve performance of a given irrigation system, and demonstrate and offer quantifiable evidence of the benefit of these interventions. Bottrall's paper focuses on all three uses of action research. But action research might well be structured differently according to its objectives, and this perhaps deserves further attention.

The note below summarises some points made in a recent lecture at the Central Water Commission, New Delhi, entitled "Management Tools for Improving Irrigation Performance". The principal objective of the lecture was to help engineers understand - and get excited about - the management of entire irrigation systems. For this reason, the lecture had a distinct engineering bias. Nevertheless, I would welcome comments and criticisms, from networkers of any background.

Let me start by recognizing that the concept of action research is not new to engineering at all; it is at the heart of the problem-solving approach of engineers. Much engineering research (and practice) has long been directed at understanding the results of given interventions - the effect that a proposed aero-dynamic design of a vehicle will have on resistance and therefore on fuel efficiencies, for example, or the effect of a proposed spillway design on the discharge capacity of a reservoir. What is new about action research for engineers, however, is that the interventions are directly tested in the real world, rather than in the simulated world of models - be they physical, numerical or analog. The traditional engineering approach, based on the application of scientific knowledge to the solution of practical problems, has generally used scientific observations and controlled field experiments to determine causal relationships between variables, which are then used (with or without formal mathematical models) in the design of interventions (generally structures, machines, products). Only when the relationships between variables are not well understood or too complex to model are proposal interventions directly tested in the real world (eg in road tests to determine vehicle fuel efficiency). Major interventions (such as those involved in the design of civil engineering structures), for obvious reasons of cost and practicality, are tested through physical or mathematical models before they are implemented in the real world.

The action research approach is therefore similar to that employed in engineering when the variables involved are too numerous or complex to allow meaningful relationships to be derived. The fact that the generally accepted approach in irrigation management has been to work in the "real world" through action research or "pilot projects", rather than with models, therefore, no doubt reflects the difficulties of establishing relationships which satisfactorily represent the social as well as the physical relationships in irrigation, since the former play such a dominant role, particularly at the farm level. The question in my mind, however, is whether this is necessarily true at higher levels of analysis. At the main system, reservoir, or river basin level, for example, the operation of the system can largely be understood in terms of flow movement in open channels, lakes, and catchments. Of course, at these levels human interventions - both of agency staff and of farmers - are fundamentally important in that they control, to a large extent, the flow of water in the system, and I am not implying that main system management can be understood purely in terms of physical relationships. But I do believe that, with some further research, the principal relationships involved in the operation of an irrigation system could be derived and represented in models. At the river basin level, catchment models (where the dominant relationships are between rainfall and runoff, which are now fairly well understood) have been successfully developed and used over the last several years.

If we accept that the development of good irrigation system simulation models is possible, and if we further recognise that structuring interventions in the main system is costly, and a full programme of action research might take several years to complete, we might conclude that the entry point to improvements in main system management may well be through the development of good system simulation models to explore available options to improve performance, rather than directly through action research. Certainly, field research aimed at a better understanding of flow-relationships at the main system level, coupled with greater efforts at development and validation of system models of irrigation projects, would seem to be called for. I wonder, therefore, whether the appropriate research approach might be sequential. One pattern might be:

1. Conduct field research at the main systems level to further our understanding of the relationships between operating variables, and to provide the data base for proper model development;

2. develop and use models to analyse large numbers of possible system interventions;

3. evaluate the most promising interventions in the field through action research;

4. use action research data to refine relationships in model; and

5. use model to extend action research results, evaluating the behaviour of the proposed intervention over a longer time period and under conditions other than those prevalent in the action research area.