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DEVOLUTION OF MANAGEMENT IN PUBLIC IRRIGATION SYSTEMS: COST SHEDDING, EMPOWERMENT AND PERFORMANCE

A Review

Hugh Turral

Working Paper 80

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Preface

This study is undertaken as part of a three-year Rural Resources and Poverty Research Programme funded by the British Overseas Development Administration. The programme focuses on the changing role of the state in natural resources management and the provision of supporting services. One hypothesis driving the research is that as the users of natural resources should gain more control, so management of those resources and the scope for poverty alleviation improve.

The programme covers a number of subject areas: agricultural services (including research and extension), forestry, water resources and pastoralism. Individual literature reviews were prepared for all areas prior to fieldwork being undertaken. This working paper is the product of one such review. Preliminary comparative analysis already conducted has allowed us to draw conclusions which are relevant to natural resources management in general (see, for example, Carney, 1995).

The objective of the overall research programme is to derive policy guidelines about:

- how to identify those areas of management and service provision for which the state should retain responsibility
- which other potential providers are best suited to take over responsibilities ceded by governments
- how to manage the process of change
- how the role of the state must evolve so that those activities which it does still undertake are performed with the greatest effectiveness, in terms of meeting the needs of the rural poor (while not unduly compromising other valid objectives, such as increasing overall agricultural production or maintaining biodiversity)

This is the first ODI Working Paper which draws on work done under the Rural Resources and Poverty Research Programme. There are two papers forthcoming in this series by Diana Carney on 'Changing Public and Private Roles in Agricultural Service Provision' and by Mary Hobley on 'Institutional Change within the Forest Sector in South Asia: Centralised Decentralisation'.

Contents

Glossary

AKRSP	Aga Khan Rural Support Programme
CAD	Command Area Development programme (India)
CNA	Comisión Nacional del Agua (National Water Commission, Mexico)
DTW	Deep tubewell
FAO	Food and Agriculture Organisation of the United Nations
FMIS	Farmer managed irrigation system
GKF	Grameen Krishi Foundation (Bangladesh)
IA	Irrigation Association
IFMIS	Indigenous farmer managed irrigation system
IHE	Institute of Hydraulic Engineering (Delft)
IIMI	International Irrigation Management Institute (Sri Lanka)
ILRI	Institute of Land Reclamation and Irrigation
IMT	Irrigation management transfer
IMTA	Instituto Mexicano de Tecnología del Agua
ISF	Irrigation service fees
ISPAN	Irrigation Support Project for Asia and the Near East (USAID)
MGIP	Madura Groundwater Irrigation Project (Indonesia)
NIA	National Irrigation Administration (Philippines)
NIS	National Irrigation System (Philippines)
NWMP	National Water Management Programme (India)
O&M	Operation and maintenance
ORMVAS	Offices de Mise en Valeur Agricole (Morocco)
RAPA	Regional Office for Asia and the Pacific (FAO, Bangkok)
UNCED	United Nations Conference on Environment and Development
UNDDSMS	United Nations Department of Development Support and Management Services
USAID	United States Administration for International Development
USBR	United States Bureau of Reclamation
WUA	Water user association

1. Introduction

Irrigation management transfer (IMT) is the term used to describe a variety of initiatives in devolving management responsibility and authority from the state to irrigators themselves. Vermillion (personal communication) has defined it as 'a shift of management roles from government to farmers or non-governmental organisations, resulting in a decrease in the role of the state and an increase in the role of non-governmental entities in irrigation management'. Worldwide it is not a recent phenomenon, but it has recently become a prominent part of national policy in more than 20 countries, including those with major irrigated farming systems. The movement has been largely fuelled by financial pressures, both internal and externally imposed by the major international lending agencies, on governments which have been unable either to finance the recurrent costs of irrigation or to recover costs by collecting fees from water users. The initiatives of the Philippines National Irrigation Administration have become an early example of IMT and of the move towards financial autonomy in developing Asian countries, which has influenced the thinking of the major international lending institutions.

IMT is considered by many to be a policy in its own right, whereas it is in fact a policy instrument supporting broader objectives in:

- financial responsibility and cost reduction by the state
- improved transparency and participation in government
- efficiency in resource use in the agricultural sector

Perhaps there has been too much emphasis on the process and progress of transfer and too little on actual management and performance after 'turnover'.[1] At the same time, its place in the overall policy framework concerning agriculture, governance and water resources management is often ambiguous. Although there has been localised pilot experience and older national programme experience in the USA, Japan, Taiwan and Korea, IMT is considered to be a young 'process'. This prompted the International Irrigation Management Institute to initiate an international conference on irrigation management transfer at Wuhan, China, in September 1994. This conference provides the starting point for the present review, which is in part a synthesis of the experience presented in 100 papers given by participants from 28 countries.

[1] Turnover is the jargon term for handover.

The experience is varied, the contexts are often specific, and many countries are still in the process of transition from localised (often 'pilot' project) initiatives to a national programme. Water user associations exist with varying degrees of functionality in more than 35 countries, predominantly in Asia, and operate within:

- farmer-managed irrigation systems
- agency-managed systems
- jointly managed systems
- 'turned-over' irrigation systems
- privately operated systems

Over 20 years of effort has been undertaken on the establishment of WUAs as local managers within irrigation systems, as a contingent part of the post-World War II boom in irrigation construction and rehabilitation sponsored by international lending agencies (primarily the IMF and the World Bank). This, in turn, has provided the background and basis for subsequent initiatives in IMT. Graaf and van den Toorn's paper neatly summarises the social and managerial genesis of irrigation development as follows:

1970s–1980s	on-farm development, farmer participation and agency strengthening – management reform within public enterprises
1980s–1990s	IMT as an instrument of general economic reform and financial responsibility
mid-1990s	institutional reform in water resources management, subsuming irrigation
late-1990s	policy reform in water resources management to account for competing demands from urban, industrial and environmental uses

In many cases WUAs were effectively extensions of the irrigation technocracy, in fact if not in conception, except in the case of FMIS. Much of the accumulated experience used to inform IMT programmes comes from extensive research on FMIS and traditional methods and institutions of management, which has been focused almost exclusively on 'smaller-scale' projects or at least those with relatively simple infrastructure and operational rules.

The discussion of IMT is underwritten by continuing debates on a number of topics that have been at issue for as long as publicly managed irrigation has existed:

- operation and maintenance – payment, service quality and responsibility
- irrigation service fees – payment, collection, volumetric and area pricing
- incentives to good management – agency and user
- delivery of water – timing, quantity and location; equity; conjunctive use
- performance – assessment, productivity and efficiency

Observers and practitioners have engaged in a quest for the essential ingredients of successful and sustainable transfer, but it is by no means clear that it can be fulfilled. The present review highlights the great variety of forms of management transfer, and of the perceptions of the various actors involved. It discusses the impacts on efficiency in service delivery, on agricultural production and on equity, and the nature and factors of sustainable management. But, although the state can divorce itself from the day-to-day management of parts of public projects, and occasionally of complete systems, there is a continuing role in governance (regulation, monitoring and enforcement of water allocation at the resource level). Clearly, a strong relationship exists between the activities pursued in governance and their application in routine management, which does not allow a responsible state to disengage fully from irrigation management. The core of IMT is the continuing evolution of workable partnerships which encourage balanced and efficient use of national and local resources; this may have many different outcomes and may even be cyclical.

Experience to date indicates that governments could be more forthright in expressing their intentions in IMT, whilst being more realistic about what constitutes a workable and efficient partnership with water users. Does the state see its interest as limited to cost recovery, or does it also embrace improved productivity and efficiency? Does it see a role for a healthy private enterprise in irrigation management and does it have a strategy to deal with poverty and equity issues that accompany privatisation, or is it happy simply to abandon public irrigation enterprises (as in Sudan)? States have to follow a clear strategy that responds to the complex policy mix in food self-sufficiency, macroeconomic policy, resource allocation and management, democratisation and financial management. They must then provide the means and the incentives to implement such strategies, whilst defining clear boundaries to the extent of their financial and institutional commitments both in the immediate and the longer term. Further attention needs to be given to realistic assessment of the improvements in functional management and productive efficiency at local *and* national levels and to determining the overall economic efficiency and equity of IMT programmes. The present enthusiasm for the process tends to neglect evaluation and underutilises the resulting feedback to fine-tune its evolution.

Privatisation covers many possibilities in the transfer of ownership from the state to private entities (see Appendix A) and requires some definition in the context of IMT. Popularly understood, privatisation means divestment – sale of a public enterprise to shareholders from the general public or purchase by private enterprises, following demonopolisation. Neither of these is a possible outcome of IMT. Full privatisation can be 'defined' as the transfer free of charge of ownership and management of entire irrigation systems to a private organisation which may be constituted in a number of different ways. Various forms of devolution of management responsibility and ownership of parts of the irrigation sub-system constitute types of joint management, which some consider to be a form of privatisation.

1.1 Structure of the paper

Although this review attempts to synthesise and present the current state of the art and to analyse key issues, the broader institutional context of water resources management is a prime interest and therefore perspective of the paper. It is structured as follows:

The rationale for IMT is introduced in section 2, which includes a review of the history leading up to its current state. Various models of management transfer are summarised, together with an introduction to the assessment of performance in irrigation and the process and results of management transfer.

Section 3 examines the spectrum of management arrangements in more detail and considers some of the important contextual features that differentiate reform options. It offers a summary of the present situation in a number of key countries and leads in to section 4 which discusses the characteristics of implementation programmes, including the role of legal reforms and incentives, broader institutional arrangements and an analysis of organisational form.

Section 5 attempts to draw together the experience presented at the Wuhan conference and examine various aspects of performance, including funding of recurrent costs and the role of rehabilitation in management transfer programmes. New issues and challenges are presented briefly in section 6 before a summary in section 7.

2. Background to 'irrigation management transfer'

2.1 Rationale

There are many reasons for transferring responsibility and authority for irrigation management to users, but the key factor has been the need to reduce public spending in irrigation operation and maintenance and to enable reallocation of funds to other more pressing uses. Since 1940, 80% of Mexico's public expenditures in agriculture have been for irrigation projects. In China, Pakistan and Indonesia, irrigation has absorbed over 50% of agricultural investment. In India, about 30% of all public investment has gone into irrigation (FAO, 1993). Although a large proportion of this has been in construction, new scheme development has tailed off in the last 10 years as the irrigable area nears its ceiling (Bhatia and Falkenmark, 1992).

International aid agencies have committed in excess of US$2 billion per year over the last 10 years to irrigation projects (Winpenny, 1994). Nevertheless this represents a falling off by 50% since the early 1980s which is mirrored by reductions of more than 40% in China, the Philippines and Bangladesh (de Graaf and van den Toorn). In India the decline has been more muted at 20% and only in Thailand and Indonesia has spending actually increased (Rosegrant and Svendsen, 1993). Few countries are embarking on new programmes of public irrigation development, apart from Colombia (target, 1 million hectares) (Ramirez) and Cambodia, which sees irrigated agriculture as a key to rebuilding its still disoriented nation.

Recent expenditure has largely been in rehabilitation and modernisation of existing infrastructure and support programmes to improve the performance of irrigated agriculture, plus large investments (both private and public) in groundwater irrigation. The continuing burden of rehabilitation and modernisation is subsumed under O&M costs or met by special projects: governments have therefore sought to transfer as much as possible of this recurrent cost to users. The motivation to transfer management responsibility as a means of reducing costs has come into sharp focus with the recent decline in international assistance for irrigation and donor pressure to reduce public expenditure deficits.

It is argued that the costs of service provision should be borne by the beneficiary, but fee recovery has generally been poor, sometimes uneconomic to administer and rarely related to performance or quality of service. Vaidyanathan's paper notes that in India uncovered recurrent costs for large- and medium-scale surface irrigation alone amounted in 1987–8 to 15 billion Rs. (approximately US$375 million). Beneficiary financing under self-management could this result in substantial savings, although there has been little published assessment of the cost and benefits

of implementing IMT programmes. Proponents regard IMT as a way of reducing the need for collected revenue as maintenance tasks are undertaken by user farmers, and for improving the efficiency and scope of collection in the hands of (motivated) local farmer-managers.

There has also been considerable interest in farmer-financed irrigation and recuperation of capital investment in irrigation infrastructure. Payment of depreciation (at highly concessionary rates) has been a feature of IMT in the USA and depreciation on rehabilitation has been included in management contracts between the National Irrigation Administration and water user associations in the Philippines. Since 1984, China has followed a policy of farmer-financed irrigation, assisted by a variety of state subsidies (typically less than 20% of total costs) for rehabilitation, modernisation and expansion of facilities. These aspects of IMT are discussed in greater detail later in this paper.

Other reasons, not so much articulated policy as contributory factors, which are equally important but less instrumental in the emergence of IMT, are summarised below.

(i) *Improved equity and efficiency through participatory or farmer/private management.* There is an underlying assumption that FMIS are managed more efficiently than those run by public officials, and are more responsive to the needs of their users. Staff reduction is also implied in the efficiency argument. It has been hoped, and there is some supporting evidence, that construction quality will improve under farmer management, either by farmers doing substantial portions of the work themselves or through better supervision. It is thus hoped to break the vicious and wasteful cycle of (inadequate/irregular) construction followed by rehabilitation followed by further successive rehabilitations.

(ii) *Improved farmer confidence.* Traditional small-scale irrigation (FMIS) and pilot studies have often indicated benefits in O&M and the development of appropriate investment strategies when users have a sense of ownership and control over irrigation and the choice of crops produced.

(iii) *Improved productivity, food security and welfare.* These are assumed to be consequences of the preceding two points. There is particular interest in enhancing the productivity of water to expand both production and service area, or in reallocating conserved water to other uses. Management turnover programmes in the USA in the 1970s and in Taiwan and Chile in the 1980s resulted in the adoption of water-conserving technology, although it is a moot point how likely this is in other contexts.

(iv) *Underlying international rhetoric for privatisation.* The worldwide enthusiasm for privatisation of services has extended into the irrigation sector, largely due to external pressures and the impact of structural adjustment

preconditions imposed by aid donors and international lending agencies. Private sector irrigation is in fact considerable in many countries, with more than 60% being privately owned and developed in various Latin American countries (for example, Colombia and Peru).

(v) *Economic value of water and market-based allocation.* Rising competition for increasingly scarce water resources has caused much concern. Since the Dublin Declaration[2] and UNCED (1992), the international community has declared that water should be valued as an economic good and allocated accordingly. Irrigation is the predominant use of water in many developing countries,[3] and some analysts (e.g. Vermillion) view the development of farmer- and ultimately privately-owned and managed irrigation as an essential ingredient of rational, market-based water allocation.

(vi) *Democratisation and decentralisation.* Transfer programmes are often interpreted or presented as signs of democratisation, and governments tend to use them as part of their political programmes. However, there is often no real intention of dedicating the effort and resources that such programmes require (Sagardoy). The transition from heavily centralised political environments to more democratic systems has brought profound (sometimes chaotic) changes in irrigation management in Eastern Europe, Central Asia, China and Indo-China.

2.2 Timeframe, history and experience

In the USA, the transfer of the management of USBR-developed irrigation schemes has been mandated for over 90 years, and there is more than 20 years of experience of management post-turnover (Svendsen and Vermillion). Schemes such as the Columbia Basin Project (230,000 ha.) were initially developed on a contract basis between three district-based farmer groups and the US Bureau of Reclamation, with obligations on users to repay a portion of the capital development costs.

Throughout China's 2,000-year history of public investment in irrigation, the contribution of labour and resources by farmers has been considerable under varying political regimes. Irrigation has largely been a local issue, with central government concentrating resources on flood control, drainage and strategic water resources projects. There has always been a complex mix of government or local

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[2] The declaration resulting from the International Conference on Water and the Environment (ICWE) held in Dublin, 1992, in preparation for UNCED.

[3] Typically, Asian countries allocate over 85% of developed water resources to irrigation.

government authority and farmer management, which has evolved rapidly since the introduction of the economic reforms in the early 1980s.

The colonial period in South Asia and Indonesia saw many farmer-developed and farmer-managed irrigation systems incorporated under the *aegis* of the state. In the post-colonial period, this process has continued in many countries with the state providing investments in rehabilitation, modernisation and O&M in order to meet agricultural policy and food self-sufficiency objectives. There has also been massive investment in large-scale public irrigation schemes entirely under state management, often operated successfully under rigid authoritarian rule with minimal farmer participation in decision-making and maintenance. The compass and effectiveness of state management have evidently not been consistent or efficient, and traditional systems included under state control have often remained under *de facto* farmer management, even if self-reliance in financing and maintenance has waned. Thus the present programme of IMT in Indonesia has two broad thrusts: (i) full transfer of management responsibility to users on projects of less than 500 ha., and (ii) full cost recovery of service provision under joint management on schemes larger than 500 ha. (Soenarno). In the first case, responsibility may be being returned to farmers after it had previously been taken away, or in many cases *de facto* farmer managers are simply reclassified on paper and continue to manage as they have always done. Ironically, previous initiatives (starting in the late 1970s) to establish WUAs to improve farmer management sometimes resulted in the agglomeration of small traditionally managed schemes and a nominal increase in state authority.

In the 1950s and 1960s, the Japanese model of the Land Improvement District was adopted in Taiwan and Korea, where inclusive structures of state, farmer and professional management were developed with a strong farm business focus. In Taiwan, the financial imperatives for farmer management have turned full circle, as rural–urban migration and industrial employment opportunities threaten to denude the irrigation districts of labour and agricultural expertise. Government policy has now reverted to supporting essentially autonomous irrigation associations and paying farmers as guardians of the countryside and producers of highly subsidised staples, as in Japan (Shih, 1994).

The key formative experience in IMT has evolved in the Philippines as a direct consequence of the Marcos Government's insistence that the NIA become self-financing by 1985. A phased reduction of government support to the NIA's operational budget was implemented over the period 1980–85 and stimulated considerable efforts in community organisation for self-management of the 'communal' (small- and medium-scale) irrigation systems. The NIA developed a series of contract procedures allocating responsibilities and authority to both WUAs and itself, and WUAs were required to register with the national Securities Exchange Commission. The NIA has balanced its budget in some years since 1985, but the proportion of operational expenditure covered has also fallen to as low as 45% in other years. The NIA has recently expended more effort on joint

management contracts in National Irrigation Systems (NIS), where a large proportion of its operating costs lie. The performance of management transfer in the larger systems has been more uneven, is still evolving, and is currently concentrating on developing incentives for good performance within (autonomous) WUAs (Laurya and Sala).

Substantial research into farmer-managed irrigation emerged in the 1980s, in Asia (Coward), notably in Nepal (Yoder and Martin), India (Chambers), Sri Lanka (Uphoff) and Indonesia (Levine). At the same time, widespread groundwater development revealed the possibilities of private ownership and management and the existence of water markets in Bangladesh (*inter alia*, Palmer-Jones and Mandal, 1987; Aeron-Thomas, 1992) and India (*inter alia*, Shah, 1990). This accumulated knowledge provided much of the impetus to develop WUAs and increase farmer participation and control in management. Diverse project experience with WUAs led logically to *ad hoc* experience with very localised management transfer, which was often set in an unsupportive broader institutional and policy framework. More recently the institutional frameworks and conditions of sustainable local organisation have been analysed (Hunt, 1988 and 1990; Ostrom, 1992) and assessed over a wide range of public and farmer-managed irrigation systems (Tang, 1992). Only a small proportion of this research has applied to large publicly managed irrigation schemes (Merrey) and there has been an implicit assumption that the prescriptions for good farmer management translate effectively from (small) traditional irrigation to large-scale public systems. Increasingly, this assumption is proving to be flawed. Merrey's paper summarises the emerging collective wisdom in the following design principles for local irrigation organisations.

(i) a supportive policy and a regulatory and legal environment, preferably recognising the irrigation community's rights of ownership of the infrastructure;

(ii) capacity to mobilise resources adequate to meet the costs of O&M including emergency repairs;

(iii) benefits exceeding costs of participation, with proportional equivalence of benefits and costs;

(iv) effective collective choice arrangements for organisational control of water by users (Hunt, 1990), which will normally have the following characteristics:

- organisational autonomy, with clearly defined boundaries of area and membership, in which users control both the capture and allocation of water; officials derive their authority from users and are accountable to users;

- financial autonomy – financial resources raises directly to meet O&M costs;
- management of a single infrastructural system by a single organisational entity;
- close connection of maintenance and conflict resolution with the capture and allocation of water;
- transparent arrangements for monitoring performance;
- nested or federated organisational structure at successive scales of operation.

National-scale IMT programmes are a phenomenon of the 1990s. The scale, political commitment and rapid implementation of IMT as part of a much broader economic liberalisation in Mexico has fuelled enthusiasm, especially in the World Bank, for a particular model of farmer management, based closely on US private utility models, operating in a 'rational' economic environment. This is ironic, given that the only example of US management transfer cited at the Wuhan conference is the Columbia Basin Project, where farmers still receive a massive operational subsidy covering 95% of the pumping costs incurred in water delivery from the Grand Coulee Dam (Svendsen and Vermillion).

2.3 Objectives of the conference

The Wuhan conference was conceived as a résumé of current state-of-the-art thinking and practice on IMT in the 28 countries represented. Plenary session papers on key issues and experience were presented to all participants. Three sets of 6 parallel sessions were convened, with no particular themes, to exchange experience and determine:

- key lessons to be learned about IMT
- new issues and challenges
- priority suggestions for transfer policies, programmes and research

The organisers appeared to be promoting the search for a model or methodology of IMT capable of being generalised and leading to the development of fully privatised, financially autonomous irrigation systems. The opening session concluded with an address 'Lessons from the privatisation movement' by privatisation guru Professor E. Savas, previously an adviser to President Reagan. The overriding implication from this presentation and the tone of the supporting

discussion was that private ownership as well as management *is* the end-point of IMT.

2.4 A general model of IMT?

The opening plenary session on the global phenomenon of IMT suggested that a *Blue Revolution* is needed to meet the coming food crisis, which will be solved by intensification and better management of agriculture rather than a technological fix as exemplified by the Green Revolution. IMT was presented as a fundamental component of this revolution and one that required five 'vital' elements to be in place (Vermillion, introductory address):

(i) sustainable and clearly defined, legally upheld, water rights

(ii) an infrastructure compatible with self-management

(iii) a clear definition of responsibility and authority

(iv) allocation and mobilisation of adequate resources

(v) accountability and incentives

These elements will reappear many times in the ensuing discussion as they are common to nearly all modes of management transfer, although they have added significance for private ownership and management. It is worth reporting that the groundswell of opinion amongst conference participants maintained that there is a broad spectrum of possible outcomes in the transfer of management authority and responsibility, and that there is no single end-point which constitutes the ultimate goal. They suggested that governments and farmers together should decide an appropriate goal in IMT that is consistent with local policy and economic context. Discussion groups identified three broad transfer strategies:

(i) wholly farmer-managed systems

(ii) contract (professionally) managed systems

(iii) joint managed systems with incentive structures for good agency performance:

- farmer and agency joint management throughout the system
- defined boundaries of O&M responsibility for agency and user groups
- local autonomy with farmer input to higher-level joint management

The conference revealed only limited experience with private sector investment in irrigation scheme management. Sudanese efforts to introduce commercial private sector managers in the Gezira scheme have met with very limited response, owing to concerns about the stability and direction of government agricultural policy, the quality of the existing infrastructure, access to sufficient finance and taxation issues (Samad *et al.*). Colombia is one of the few countries that is embarking on an ambitious programme of irrigation development and construction. Despite 60% of existing irrigation being in private hands, the US$1 billion investment will be funded by the state, in part to meet equity as well as food production goals. Although elements of private management, in the form of private maintenance contracts and public service concessions, are planned, the private sector is thought to be reluctant because of a lack of clear financial policy on the part of the government (Ramirez). The same author cites difficulties in agreeing terms of transfer with users in irrigation districts which have not been financially self-sufficient, especially where increased O&M costs are likely to be incurred in covering future equipment replacement.

There are a number of countervailing perceptions about IMT, depending on the vantage-point of the commentator. IMT may also be viewed as:

(i) *Shedding public financial responsibility.* Agencies and governments are open to charges of dumping financial responsibility on farmers with little or no ability to pay (Cernea). This is particularly true if only responsibilities are transferred without the concomitant rights and authority (Asnawi), or if the terms of agricultural trade are too poor to allow farmers to meet their new financial obligations (Davila-Poblete).

(ii) *An attack on public sector bureaucracy and job security.* Irrigation department staff may lose their jobs, influence or prestige as a result of IMT programmes. These concerns are documented as still prevalent in the Philippines (Lauraya and Sala) and are common in many states in India (*inter alia*, Vaidyanathan)

(iii) *Empowerment of farmers.* The dominant positive perception amongst practitioners and those working in the field (NGOs, external projects, etc.) is that IMT is part of a process of good local government and empowerment of farmers which is essential for the development of sustainable agriculture. By contrast, in certain situations farmers may simply view it as an unwelcome withdrawal of an effective and subsidised service; examples of this may be found in countries as diverse as Australia (Pigram and Mulligan, 1991) and Nepal (Olin, 1994).

(iv) *Improving economic efficiency in agriculture by restructuring farm size.* There are those who construe IMT as being part of a wider drive to improve agricultural efficiency, if necessary at the expense of equity, resulting in

aggregation of land holdings and 'survival of the biggest'. Evidence is emerging on agricultural restructuring as a consequence of IMT in Mexico (Menchacha and Torregrosa).

(v) *Improving the performance of irrigated agriculture and welfare.* In China the central objective of the transfer programme seems to be improved agricultural performance and rural welfare, whilst restructuring the burden of capital cost and service provision.

2.5 Performance of IMT – perspectives and measures

The preceding paragraphs make it clear that evaluation of performance very much depends on the viewpoint of the assessor and what they stand to gain or lose from IMT. Perspectives include:

(i) *Government.* Extent and economic efficiency of the transfer; reduction in public expenditure; productivity of the agricultural sector; administrative efficiency; equity.

(ii) *Agency.* Financial performance; service provision; hydraulic performance; cost recovery; progress of transfer programme; performance of O&M activities.

(iii) *Farmers/users.* Hydraulic performance; farm productivity and welfare; cost of service; equity of distribution of benefits and costs; performance of O&M activities. Durand's paper suggests other perspectives such as capacity to generate employment and the extent of women's involvement in management and decision-making.

(iv) *Observers.* All the above, but concentrating on comparative management performance before and after transfer, gross economic efficiency and equity. Strictly speaking, equity considerations play an important role in overall economic efficiency. Observers may also look at performance in very different terms, including consideration of the impacts of the turnover on the environment and resource management, which are technically externalities also to be considered in overall economic efficiency.

There is a basic distinction between the assessment of performance at local (project) and regional or national levels. Performance indicators need to demonstrate the impact of IMT programmes on a broad scale, rather than relying on extrapolation from limited case or pilot studies. At the same time, more detailed evaluations are needed at the local level to assess subtle features of the programme, such as sustainability, and to provide feedback to improve implementation. India provides a number of illustrative examples: the Mohini co-operative society is often

given as an example of the improved performance of farmer/co-operative management, but the fact that it is oversupplied with water to the disbenefit of adjacent distributaries is often ignored (Bottrall, pers. comm.). The National Water Management Programme is faced with the problem of assessing improvements in performance due to its activities and those of the Command Area Development (CAD) programme, on very substantial scales: the Sone scheme has a service area of 1 million ha. It is therefore experimenting with remote sensing to assess performance in terms of cropped area and distributional efficiency, coupled with collation and analysis of routinely collected but largely unused flow data (Lath, pers. comm., 1994; National Remote Sensing Agency, 1994).

2.5.1 Measures of performance

Evaluation requires substantive performance indicators on various aspects of management by both farmers and the service agency, plus measures of economic efficiency. There is a continuing, detailed and unresolved debate on the type, validity and application of performance indicators (see Manor and Chambouleyron, 1993; Murray-Rust and Snellen, 1993; Nijman, 1993). The last mentioned authors have borrowed extensively from business management to find indicators to (i) measure the attainment of *specified targets* for *specified objectives*, with (ii) the most effective use of resources. They stress that the design (and as-built construction) of a system imposes limits on what can be attained in practice, and hydraulic and management performance indicators must be used accordingly.

Arguments continue about the nature of diagnosis and whether it should be based on structuralist, systems, process or actor-centred approaches; there appears to be some confusion between monitoring for routine management on local and strategic scales and research-based diagnosis of the reasons for under-performance or (more positively) present levels of performance. Performance indicators have intrinsically relative rather than absolute values and need to be used with care. This does not in any way reduce their importance. Once suitable sets have been identified, consistency is probably more important than fine-tuning. Relevant indicators of performance before and after management transfer could include:

(i) *Reduction in net costs.* Payment and collection rates of Irrigation Service Fees and taxes; trends in expenditure by farmers, agency and central government; cost–benefit ratio of implementing transfer. Murray-Rust (1992) suggests that the *performance of management* can be estimated by considering the yield per unit cost of O&M, which would certainly provide interesting league tables of comparative performance. By itself, this indicator compounds human and other yield-constraining factors and serves to illustrate a fundamental problem of performance indicators – part of the validity and meaning of performance indicators is only seen in their relationship with other performance indicators.

(ii) *Improvements in system maintenance.* Proxies include flow rates at critical points in the delivery system (head, middle, tail), length of cleaned channels and the number of operational structures and their density in different service areas.

(iii) *Hydraulic performance.* Flows, distribution and reliability of water delivery (see Bos, 1992).

(iv) *Agricultural performance indicators that are also proxies for hydraulic performance.* Expansion of irrigated area: cropping intensity; output per unit of water; water use efficiency (WUE); system and sub-system average changes in yield, where they can be disaggregated from natural variation (climate) and the effect of other initiatives, such as improved input supply.

(v) *Welfare.* Changes in household net income/food security, distribution of income.

(vi) *Organisational functionality.* WUA representation and accountability – proxies include the number of meetings held, the number of members, the proportion of landowners and tenants who are members, accounting procedures, fee collection rate. Sustainability – accumulation of capital reserves, election and review procedures, registration.

(vii) *Service delivery by agency or private sector.* Qualitative improvements – satisfaction surveys, accountability to water users – contract arrangements and enforcement. Fee collection rates and budget management.

(viii) *Indicators of equity* (Shivakoti). Distribution of cropping intensity and crop patterns, total output per ha., discharge measurements, customer satisfaction.

There may be other highly situation-specific indicators of overall performance, depending on the prime outstanding problems to be solved by farmer management. For instance, the overall impact of farmer management in Xinjiang should be reflected in the extent of water table stabilisation for salinity control (Yuan *et al.*). The indicators of performance are likely to change over time, to an extent becoming measures of the adaptability of functional farmer management. The need for the present government investment in the automation of canal management in Taiwan is a case in point.

3. General observations on the state of the art

3.1 Spectrum of management

There is a continuum of possible management in irrigation which is financed from the public purse (Figure 1). The overall perception of current neo-classical thinking is that IMT would run linearly, but not necessarily through all the intermediate stages, to privately owned and operated systems. However, in practice it appears to have no such end-point, and in the case of the Philippines is experimentally moving backwards and forwards between stages of joint management in an effort to find satisfactory solutions (Bagadion, 1994). Since it is also clear that the irrigation utilities in the Western USA receive not only continuing capital but also operational subsidies, and operate in an environment of agricultural production subsidy, it would appear that the proponents are trying to go one step better in developing countries.

Many other hybrid and intermediate possibilities exist, for instance where the ownership and operation of tertiary-level facilities belong to farmers, who are responsible for all levels of O&M: the government may still own the primary and secondary system and the headworks, and receive payments for their upkeep and operation, whilst they are being directed by a management board dominated by farmers.

3.2 Context specificity

A strong consensus of participant opinion at the Wuhan conference concluded that there is no one model for IMT, and that the problem of developing programmes is highly context-specific. These contexts include climate; political economy; culture and religion; size or population of agrarian sector; education; resource base and competition for scarce resources; and scale of the irrigation system. Those who argued for a privatisation model of IMT pointed out that there are policy and institutional precursors that need to be in place for success. If IMT is viewed as a policy and imperative in its own right, then it is reasonable to adjust other policies to suit. On balance, political considerations and macroeconomic, food and agricultural policies tend to be of prime importance and IMT strategies have to reflect them. The Chilean and Mexican transfer models are largely similar and are set in similar political–economic contexts, with similar goals of export-led agricultural reform from already relatively small farm populations. Industrial development is also significant in both countries, as is the competition for water resources and finance. Asian participants argued that the promotion of this particular model means taking it into different contexts, which may have some common elements, but may also have considerably different agricultural policies

Figure 1 Continuum of management possibilities for IMT

Fully subsidised state-run and state-provided system plus/minus farmer involvement in management decisions

↓

Full state responsibility, paid for by farmers

↓

Localised (tertiary level) management with full farmer responsibility for O&M

↓

Participatory management at local and higher levels, full payment of O&M

↓

Joint management – full payment of O&M plus/minus capital depreciation

↓

Fully privatised operation by farmers or by farmer-paid contractors plus/minus capital payment of depreciation

{↓}

(Privatised management and ownership, ± state subsidies)

{↓}

(Divestment by sale to shareholders or by competitive tender)

or agrarian structures, let alone religious and other cultural complications. There is not necessarily any dispute about the soundness of the farmer management principles outlined earlier in section 2, only about the situation in which they are applied.

The subject of scale frequently arises to confound the idea of straightforward IMT models. The oversimplified classifications of irrigation scheme size (small, medium and large) are not necessarily helpful, as dispute over definitions becomes inevitable. There is already a sizeable literature on the 'optimum' membership of WUAs and the appropriate scale of organisation – outlet, tertiary or system-wide – and whether organisations should be federated or single at the system level. Scale comprises a number of aspects which act in aggregate to establish a context for IMT, notably:

(i) *Number of farmers, owners and/or tenants.* Clearly the dynamics of management in systems with a few large farmers is considerably simpler than in one with hundreds of thousands of small farmers. The number of active farm workers who are in some way involved in irrigation management decisions may be considerably different from the registered landowners (see Ramanathan and Ghose (1994) on the Indira Gandhi Canal in Rajasthan).

(ii) *Capitalisation in the system and extent of ownership or sense of ownership.* For instance, most Chinese systems built during the 'Great Leap Forward' were constructed with low technological and capital inputs and enormous

'contributions' of labour, which has resulted in a lasting sense of ownership amongst farmers. This is one reason given for farmer resistance to increased water and service charges in the People's Republic.

(iii) *Water source.* There are clear differences in the characteristics and scale of management organisation involved in pumped and gravity supplies. In the latter, differences between dam and run-of-river systems are also significant.

(iv) *Physical size and technical complexity.* The actual area, length of canals, types and complexity of structures and operating regimes imply different organisational requirements. Consideration of the organisation for on-demand systems compared with rigid *warabandi*[4] will illustrate this. If automation is introduced, the dimensions of the management problem may change, and with it the context of management transfer.

The size (and therefore managerial complexity) of the irrigation sector varies considerably between countries. The single state of Uttar Pradesh in India has 14.4 million ha. of land under surface and groundwater irrigation, compared with a total of 5.5 million ha. for the whole of sub-Saharan Africa. Three countries that have furnished much of the experience in farmer-managed irrigation schemes have relatively small areas as well – Sri Lanka (0.5 million ha.), Nepal (0.35 million ha.) and the Philippines (1.5 million ha.) (Rydzevski and Ward, 1990).

Clearly, it is important to determine and make comparative analysis of what arrangements fit and do not fit where, and this requires definition of the context and clear specification of the anticipated operational strategy so that successive IMT programmes can be developed which address the 'art of the possible' and recognise the requirements of day-to-day management. (This inevitably brings us back to considering pilot projects and scaling-up.) The distinction made between joint management of 'large' schemes and farmer management of smaller ones in Indonesia, the Philippines and China appears to recognise this.

3.3 Motivations

Given a range of contexts, there are different priorities for transfer, and different stages of transfer may be appropriate for particular cases. Who wants the transfer, how much and when? Morrison and Carruthers' paper considers the institutional requirements for new management models and points out the importance of defining roles for all of the actors involved, in particular defining new roles for the public sector. It also stresses that governments cannot create WUAs simply by

[4] Fixed rotational water distribution system, using a minimum of control structures, typical of the surface irrigation systems of the Indus Basin.

announcing formal rules, and therefore the desire for IMT must be articulated by the farmers themselves. Vaidyanathan's paper demonstrates that a fundamental choice lies in whether broader policy objectives are better addressed by regulation or service provision, making the point that, in the case of groundwater irrigation,[5] IMT and improved service provision are of relatively small importance compared with safeguarding the sustainability of the resource. Yoder's paper reminded the conference that there is a need to distinguish clearly between full management transfer (ultimately privatisation) and partial transfer, although there are clearly more precise permutations in defining the extent of the programme. The US experience in transfer underscores the importance of farmer confidence in taking on management responsibility, convinced that they could do as good a job but at less cost than that delivered by the USBR; the motivation for transfer was thus *mutually reinforcing*, with the government keen to reduce its financial burden and transform its role into more general water resources management and the users keen to take more control (Svendsen and Vermillion).

All four papers note that there is an element of salesmanship, education and confidence-boosting required for farmers to articulate a real desire for more management responsibility. This may manifest itself in concessions within the terms of the management contract (Columbia Basin), or incentives such as the rehabilitation or upgrading of the physical infrastructure to an 'acceptable' standard. There is also the question of political will. Sagardoy's paper notes the importance of ensuring political support for IMT programmes, but many speakers and participants avowed that clearly signalled policy and firmness of intention are important factors in coaxing farmers into feeling the desirability, need and inevitability of such programmes (see, for example, Gerards). A number of presentations illustrated that the higher the level of *operational* subsidy, the more difficult it is to develop mutually reinforcing desire for reform (see Olin).

The extent and form of turnover is effectively determined in consultation with users. Recent Nepali strategy is to transfer management only in systems that are operable, durable and possess demonstrable existing skill and capacity to perform (Rana *et al.*). In Indonesia and Mexico, there has been little choice and the programmes have proceeded swiftly on a national scale. Sagardoy's paper suggests that there are four phases of irrigation management transfer, which may overlap to some extent. He stresses the political nature of early parts of the process which may unearth numerous problems and questions; as a consequence, IMT programmes require considerable time for their execution.

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[5] A large proportion of the groundwater development is in private (individual) or co-operative/shareholder (group) ownership.

Phase 1 – *Ensuring political support for the programme*

- obtain the highest political support
- define the scope of the programme
- ensure the provision of adequate financial resources

Phase II – *Creating a favourable environment for transfer*

- redefine institutional roles
- create a favourable legal framework
- define the phases and priorities for implementation
- define the incentives for transfer

Phase III – *Implementation of the programme*

- define the responsibilities for implementation
- define the conditions and modalities for transfer
- use information media to convey the message to farmers
- undertake training programmes for farmer leaders and the technical staff of WUAs
- redeploy/retrain government staff

Phase IV – *Monitoring and impact assessment*

- establish performance indicators
- monitor impact in selected areas
- monitor the financial viability of WUAs

In practice, IMT programmes take many years to complete, and it is possible to obtain feedback from monitoring which can modify all four phases of the process as applied both nationally and in specific regions or sub-sectors of irrigated agriculture. Many presenters declared the importance of clear and unambiguous signalling of the intentions and nature of IMT at both national and local levels. There was also much discussion of the importance and nature of the incentives needed in implementing a programme, in addition to the implicit ones of improved service, control and profitability of agriculture.

3.4 Country placement in the spectrum

Although there are many different contexts for transfer within individual countries, it is appropriate to consider where various major irrigating countries lie in the spectrum between state and private control of agricultural water management. Table 1 includes Chile and Mexico, which are powerful industrialising economies, since they have been at the forefront of large-scale IMT programmes; both

Table 1: Spectrum of international experience with irrigation management transfer

	Water management system					
Market regulated	Mix of market, user and state					*State control*
	CHILE	**MEXICO**	**PHILIPPINES**	**INDONESIA**	**CHINA**	**INDIA**
Institutional arrangements	Clear institutional framework for water resources management, supported by laws.	Clear institutional framework for water resources management, supported by laws: still in process of development	Clear institutional framework for irrigation management. Unclear arrangements for water resources management	Complex institutional arrangements for irrigation, especially wrt cost recovery. Emerging framework for water resources management	Clear institutional framework for management of water resources. Strong central policy and funding of strategic projects: local funding and management in irrigation.	Water a state subject - national water policy unsupported by states. Development rather than management dominated by sector identities. Complex case law
Water Rights	Transferable water rights with defined ownership	Water owned by state: water rights and transfers not well established	Water rights allocated by state and registered with Securities Exchange Commission.	State owns water. Unclear allocation of de jure water rights	State owns water: Rights clearly established for specified use: re-negotiated if use changes	Water rights not consistent between and within states and sectors. Ad hoc and historically complex
Public investment in irrigation	Minimal development of large capital projects Self-financing, supported by capital subsidies (to 45%) for improved technology	Continued development of large capital projects by state. Cost recovery of O&M, improving but needs evaluation	Major projects state funded. Farmer funding for communal and small scale projects. Cost recovery of O&M + some depreciation.	Continued high levels of expenditure in capital work (gw and rehabilitation) Cost recovery programme in rapid expansion phase.	In principle, beneficiaries pay: in practice fee collection erratic: complex local financing and X - subsidisation: targeted state subsidies for major and special work	Strong policy of construction in irrigation on equity grounds. Limited tariff-based cost recovery: low recovery rates.
Water conservation and efficiency	Significant use of water conserving technology	Largely conventional surface irrigation technology; automation and real time mgmt in major scheme : in transition.	Conventional surface irrigation technology	Traditional technology & Conventional surface irrigation technology	Complex mix of gravity and pump delivery + within system storages. Automation and water conserving tech.	Traditional surface irrigation technology. Local groundwater technology Experimental automation
Management Systems	Commercial management of irrigation.	Limited commercial management of large scale irrigation: mainly joint management. Private gw and small scale FMIS.	Significant FMIS. Clearly specified farmer-agency contracts in joint management	de facto farmer management is widespread, even in large schemes. Significant FMIS	Complex systems of joint managment and ownership; in dynamic period of transition and experimentation.	Centralised management. Limited joint managment and turnover experience in0 public schemes. Strong FMIS in gw

countries have also undertaken specific forms of agrarian reform that are not easily compared with the situation in Asia. The table does not include any developed country experience even though Australia has only started to experiment with corporatisation and divestment of publicly funded systems within the last five years. African countries are also not represented, as the scale of IMT and the institutional contexts for water resources management are not sufficiently understood there, even though IMT programmes are under way in Nigeria, Sudan, Tanzania, Ethiopia and Kenya. The table provides comparisons on the basis of the institutional framework for water resources management, the status of water rights,[6] the level of capital investment and financing for irrigation, the irrigation technology and the dominant forms of farmer, joint or agency management. The Philippines, where there is substantial accumulated experience with IMT and multiple forms of community, joint and agency management, represents a sort of baseline.

Although there might be discussion of the details, timeframe and spatial development of an IMT programme, the four phases suggested by Sagardoy (above) are reasonably universal. He noted that, in some countries, some of these phases may unfortunately have been omitted. Table 2 is an attempt to summarise this observation on the basis of the papers presented at the conference: it should be treated with caution as it is only partially developed and subjective and is therefore open to amendment and comment.

The overriding impression from this exercise is that few countries have paid systematic attention to every phase of the process. Most commonly, wide-ranging political support has not been achieved. In many cases, the creation of a favourable environment for transfer has not preceded implementation, particularly in legal and incentive terms. In Mexico, although there has been a systematic and comprehensive programme of institutional reform, based on new water legislation and revision of the Constitution, there is a continuing need for refinements to water law and codes of practice, particularly with respect to tradeable water rights (IMTA and CNA, 1994). Systematic routine evaluation of IMT at local and national levels is rare and relies heavily on localised studies, often undertaken by externally assisted projects or by international research programmes (IIMI, ISPAN, RAPA, etc.). Although there is some significant experience of national-level transfer, a great deal of evaluation remains on an *ad hoc* or pilot basis.

Both Bangladesh and India have yielded substantial research on privately developed and managed groundwater, and more recently this has been extended to the performance of government-developed tubewells, which have been transferred to farmer management in a variety of guises (Shah, Kollavalli and Raju, Palmer-Jones, Mandal and Parker). The relatively poor performance of co-operative wells, compared with informal tubewell companies (without secure rights to water) and

[6] The status of usufructuary rights, in most cases.

Table 2 IMT worldwide – states of development

Country	Time Govt. interest WUAs	Time formal IMT begins	Phase I	Phase II	Phase III	Phase IV
Australia		1991	x	x	x	Ŧ
Bangladesh	1980s	n.a.	o	o	{x}	x
Brazil			o	o	xx	o
Chile	1980?	1984	x	x	x	?
China	1988?	1984	x	x	xx	x
Colombia	1970s	1976	?	?	x	x
Egypt	1984	1994	?	{x}	x	{x}
India	1970s	n.a.	o	o	{x}	{x}
Indonesia	1970s	1991	x	{x}	xx	?
Mexico	1980s	1990	x	x	xx	?
Nepal	1980s	1986	o	o	x	{x}
Nigeria	1980s	1992	o	{x}	{x}	o
Pakistan	1980s	1990s	o	o	x	{x}
Philippines	1980s	1980s	{x}	x	xx	x
Sri Lanka	1970s	1990s	o	o	x	?
Sudan	1990s	1990s	?	?	x	?
Taiwan	1960s	1960s	x	x	xx	x
United States	1930s	1960s	x	x	xx	x
Vietnam	1990s	1990s	x	?	{x}	{x}

Key: x implemented (xx = broad-scale implementation)
{x} limited experience (Ŧ = too early to assess)
? partially carried out

existing private initiatives, has prompted authors to doubt the fundamental viability of cooperative or group management, especially when sponsored by government and modelled on analysis of traditional farmer management (see Palmer-Jones).

3.5 Parallel continua

Parallel spectra of managerial and institutional forms in both the service agency (Sengupta) and the community management/privatised organisation (Helmi) are briefly summarised in Figures 2 and 3. Again, the authors assume a progressive development from one state to the next, although they do not prescribe a specific 'ideal' state.

Figure 2 Managerial action by the state or its successor

Technocracy of construction and infrastructure provision
↓
Service provision and management and cost recovery
↓
Federated user-groups sponsoring support services – concessional or at cost
↓
Economic provision of service (and infrastructure)
↓
Enterprise culture
↓
(Rural security in industrial societies – subsidy to guardians of the countryside)

Figure 3 Management (and financing) by users

WUAs as extensions of government controlled system
↓
Self financing WUA's
↓
(Small) businesses in irrigated agriculture
↓
Development into more broadly based businesses (multi-function organisation)

4. Implementation

4.1 Programme and process

Although various conference papers (*inter alia*, Kollavalli and Raju) question the need for *programmes* of IMT, it is certainly clear that, in practice, there has been a strong programme focus, with clearly defined (if overlapping) stages. Funding IMT is therefore a major issue and one that is complicated by the (often) poor state and operability of the physical system to be handed over. In most countries, there have been strong arguments that farmers will not accept responsibility for managing dysfunctional and badly built or maintained systems, and therefore rehabilitation is a necessary precursor to transfer. Options in rehabilitation strategy can be summarised as follows:

- Transfer of the system as it stands, with farmer financing of any upgrading or modification.

- Rehabilitation by government-paid contractor prior to turnover ± provisions for farmer input into the design and/or construction and capital repayment.

- Rehabilitation under contract between established WUA and government or third party, with agreed apportionment of financing and terms of repayment.

World Bank loans to finance IMT are based on the assumption that rehabilitation provides a strong incentive for the development of functional organisations, even though local investment is rarely involved. Experience in Indonesia indicates that this will indeed occur if there is substantial farmer input into the design and selection of the upgrading work, and if the farmers can take advantage of the employment opportunities that are generated (Bruns and Atmanto). There are those who argue that contractors should be eliminated and that farmers should be responsible for all the field work as well, both to cement communal activity and to ensure good quality work (Bruns and Atmanto, Helmi) although there can be a problem with sourcing sufficient local skilled labour. However, as rehabilitation costs in small (< 500 ha.) systems in Indonesia may exceed US$500 per ha. under farmer-assisted design (Helmi, pers. comm.),[7] an objective economic analysis is called for. Chinese programmes stress farmer financing of all improvement and upgrading work, assisted by a variety of special grants which normally do not exceed 20% of the total costs. When farmers are providing part or the bulk of the finance for rehabilitation works, the choice of technology and the solutions may often be very different from those selected for external (grant) funding.

4.2 Characteristics of implementation programmes

4.2.1 Functional infrastructure and management prior to transfer

In general, the USA, Japan, Taiwan and Korea experienced the transfer of functional, adequately managed systems to farmers. Indeed, the management by the new owners of the Columbia Basin irrigation districts was assessed to be inferior to that of the USBR during the first five years after the turnover, until sufficient operational experience had been acquired (Svendsen and Vermillion). The farmers also negotiated considerable improvements to the physical infrastructure as a pre-condition of the transfer, which in practice constituted a further subsidy, given the extremely favourable capital repayment terms that were negotiated at the same time. In contrast, many systems in developing countries may suffer from inherent design or construction problems, or may never have been managed effectively

[7] The programme average cost is lower at US$150/ha. (Bruns and Atmanto).

under public administration. Although desirable, it is therefore often difficult to assess the appropriateness of the original design for the capacity of the new management and hence to determine whether design changes or improved management skills are required. When turned over to farmers rather than to contracted professional managers, it is assumed that they can not only take on the mantle of operational responsibility but also make substantial improvements. Ironically, no amount of rehabilitation work will materially improve the prospects for systems with fundamental design or operational limitations (Wilkins-Wells and Prasad; Perry, 1995).

The Chinese approach to IMT is almost unique in concentrating on developing incentives to improve service delivery by technocratic organisations, with only incidental farmer representation.

4.2.2 Social organisation – farmer training versus negotiation

Current IMT programmes stress various forms of social organisation, increasingly via NGO intermediaries, to establish functional WUAs at appropriate levels in the irrigation system. The earlier US experience provides a strong contrast, in that functional organisations already existed and the process of turnover proceeded on the basis of protracted negotiation between equally interested parties, the complexity and cost of social organisation were not encountered at all. In China, the existing commune system has been transformed, largely through economic opportunity, but the cohesion of co-operative organisation does not appear to have been eroded. In the former Soviet Union, the push for democratisation and private enterprise in agriculture has tended to ignore or deliberately by-pass (technically and managerially) competent commune/state structures and reinvent WUAs from the ground up. Berkoff's paper argues for a more pragmatic approach which builds on existing skills and structures, and cites the damaging hiatus in Bulgarian irrigation management as the result of radical but inopportune social reform. Although some may argue that the environmental disaster of the Aral Sea is a direct consequence of poor management, Berkoff notes that it is the result of a distorted economic environment and state planning rather than culpable technical and organisational shortcomings – a basically functional system working in a dysfunctional economic environment. Vietnam is trying out the situation regarding the extent of reform and overhaul of the co-operative system as it affects land ownership, production incentives and irrigation management.

4.2.3 Scale and duration of programmes

Sagardoy and others point out that programmes, including preparation phases, take many years to complete. China has been experimenting with irrigation management reforms for 10 years, although on a national scale. Mexico has pushed through a

nominally complete national reform of the water resources management system, including irrigation, in just 5 years since preparations began in 1989; however, the process is by no means complete in a functional sense, and continuing programme adjustments will be necessary in the light of experience and feedback from evaluation. Indonesia's combined programme, of the full turnover of sub-500 ha. systems and joint management with full fee recovery of larger ones, began in 1989/90, is now in a phase of rapid but staged expansion, and is planned to continue through to 2015. By contrast, India has no national or comprehensive state initiatives and is still largely in the experimental pilot stage (Kulkarni, pers. comm., 1994; Srivastava). In the Philippines, the transfer of communal schemes has been a nation-wide programme, but the transfer of responsibilities in National Irrigation Systems (NIS) has been more limited; both the requirement to register associations and negotiate service/rehabilitation and repayment contracts with the NIA and continued experimentation with the form of contract options have contributed to this more varied experience.

The typical programme schedule is illustrated in Figure 4. Scaling up programmes from pilot projects has not really occurred in Mexico and China, which have embarked on national-scale reforms from the outset, whereas issues of how to replicate experience and scale up programmes are keenly debated in Indonesia, the Philippines, Nepal and India. In Mexico, the transfer started with secondary canal systems and is now moving on to the federation of these organisations to take over entire systems; there has been some indication that the coverage of tertiary-level organisations, and hence 'grass-roots' representation, is not yet complete. By contrast, in China village-level organisations are federated through successive tiers of the canal management hierarchy – 5 levels in the case of Zanghe Reservoir in Hubei province (Vermillion, pers. comm., 1995).

Figure 4 **IMT programmes schedule**

Policy, scale and focus of programme, policy on continued level of subsidy, time-scale

↓

Clear signalling of policy to agencies and users

↓

Policy support – legislation at all relevant levels of jurisdiction, codes of practice, agency re-orientation

↓

Trial implementation at appropriate levels

↓

Monitoring and performance assessment

↓

Widespread implementation

Irrigation areas in Australia are being turned over to community-based management boards in a process which follows this broadly specified outline in some detail (Prathapar *et al.*). The management boards are established prior to turnover, and options of corporatisation and privatisation are selected as appropriate. The process in New South Wales is guided by a steering committee at the level of the state government, made up of 6 teams that are responsible for: irrigation business assessment, land and water management, legal aspects, marketing and communications, negotiations (irrigator boards), and negotiation between state and federal governments. The new autonomous boards are established with four cornerstones of accountability: a comprehensively specified operating licence, bulk water entitlement, and drainage licence; a land and water management plan; a memorandum of articles of association, specifying relationships between the board and shareholders; and financial independence, contractual arrangements and published accounts. The precise form of productivity and performance indicators is still under review but will also include environmental performance measures.

Further interim stages in the implementation of management transfer are possible, as illustrated by the policy in Gujurat, India, of leasing wells to prospective owner–managers prior to sale or full handover (Kollavalli and Raju). In this particular instance, the leases have been at a minimal cost, but as the administrative overheads of securing them have been very high, they are not viewed as a success. Also in Gujurat, the penalty of threatened closure for poorly performing tubewells was used to signal the state's intention to hand over management to farmers and drastically reduce its operational costs. In other countries, new water legislation and publicity campaigns have been used to signal government intentions, often supported by incentives in the form of subsidies to new investment or the sale price of the capital investment.

4.2.4 Legal reform

Legal reform is widely held to be an essential component of preparing for reforms in the management of natural resources, including IMT programmes. New water legislation preceded the extensive reforms in Chile, Colombia and Mexico, although continued modification has been found necessary in the latter two instances: in Colombia this relates to the specification of water rights and in Mexico it concerns support for tradeable water rights and the integration of local with federal laws. In Indonesia, the enabling legislation for IMT was passed as a Presidential Instruction on Water User Associations in 1984. Although an IMT strategy for small schemes was declared in 1987, it only became a practical reality in the 1990s and a certain amount of ambiguity persists about the rights and legal standing of WUAs. A National Water Law was introduced in India in 1989, but has not been ratified in any individual states and, in common with many previous national initiatives (viz. on groundwater) looks likely to be ignored since water is a 'state subject'. In China a National Water Law was conceived for the first time in 1988, at least four years

after the start of substantial reforms in water resources and irrigation management: it consolidates the reality of a more pluralistic approach to water resources management and has established seven river basin management organisations covering the entire country.

WUAs are characterised by their juridical nature (Solanes, 1993, p. 4). It is worth quoting the following (emphasis added):

> Although they can be organised under public or private law, most countries rely on public law organisations rather than private ones. In Europe, private associations and co-operative contractual arrangements do not, in relative terms, play a prominent role in local water management. Furthermore the requirements of water management (*decisions binding on minorities, no right to secede, compulsory spreading of costs and assessment of dues and fees, rule-making authority for water management, condemnation powers, etc.*) call for some sort of public organisational device. This is the principle of the Spanish Water Law of 1985, and of the German and Taiwanese legislation.

Consideration of this paragraph, notably of the requirements of local water management, will expose serious shortcomings in the constitution of many developing country WUAs. In addition, although it is clear that well specified laws and codes underpin reforms, and in particular privatisation, the key factor is not that they exist, but that they can be implemented and at reasonable cost. Considerable ambiguity remains in the case of compliance with, for example, water quality obligations attached to water rights in Mexico and the establishment of rights to ownership of infrastructure and capital items in Indonesia.

4.2.5 Role of incentives

Many IMT programmes incorporate subsidy elements in rehabilitation, operation and the cost of transfer. There is an underlying suspicion that the tangible incentives of better and more timely water delivery, improved crop productivity and rising income are insufficient to motivate farmers to develop communal or private management institutions. Yap-Salinas' paper discusses the trade-offs between economic incentives and self-realising benefits by considering Maslow's pyramid of farmers' hierarchical needs – from fundamental needs (food, water work) through various social needs, leading up to self-development at the pinnacle. He sets against each level a scheme of escalating incentives within an IMT action plan, implying that economic subsidies are required in the reduction of risk, cost and effort in satisfying fundamental needs.

Rehabilitation and modernisation fall into the last category, but different approaches are evident in different countries. In Indonesia the government pays all rehabilitation costs and there is considerable pressure to increase farmer

employment opportunities and responsibility in the rehabilitation itself. In Nepal, between 5% and 25% of rehabilitation costs are in theory contributed by the farmers, but in practice the construction schedule takes over and contributions are not collected before the work is carried out. In China, most rehabilitation and modernisation work is now paid for by the farmers, with a variety of subsidies available for capital costs; increasingly this too is paid for by farmer contributions of cash. However, this system has only started to take effect after five or more years of rising farm income following the liberalisation of agricultural production and marketing. The following types of capital subsidy and subsidised loans are available (Lishan and Xieqin):

A. Central government support

(i) Interest-free loans for major water-conservation projects with 5–7 year payback term.

(ii) Drought mitigation subsidy (nationally only US$11.5 m.).

(iii) Fund for special projects for grain production (US$115 m. for small farm irrigation).

(iv) Special fund for comprehensive development of agriculture (US$1.2 bn. nationally – 50% for irrigation and drainage) 50% repayment within 5 years

(v) Subsidised credit for water-saving irrigation technology.

B. Provincial administration

The provincial administration provides a similar scheme of loan finance from local taxation, with additional subsidies for the operational and repair costs of high-lift pumping stations, micro hydro-power and rural water supply. Local administrations also provide loans for subsidies and for on-farm work, where all the earthwork and some finance are contributed by farmers.

In the Philippines, there are a variety of contract options which specify the terms of repayment of rehabilitation costs, although relatively few associations (< 9% of contracts) have adopted the Type III contract (see section 5) with full repayment of depreciation.

Operational subsidies are not always visible to farmers, but are widespread in groundwater irrigation through concessionary pricing of electricity (for example, in India, Bangladesh and Mexico). Where the total cost of pumping has been funded by the state (in Bhairawa Lumbini, Nepal), it is difficult to develop any

meaningful incentives to farmer management with full responsibility for payment (Olin). Subsidies can be re-routed and diminished at the same time to meet complementary water resources objectives: in Mexico, the energy subsidy is being removed and a portion of it redirected to encourage purchase of water-saving micro-irrigation technology, in an attempt to stabilise groundwater mining (Chavez-Guillen, pers. comm., 1994). It is clear that farmers are often unaware of the level of subsidy they receive. On learning that water charges paid for only 30% of the total cost of the provision of irrigation water in Victoria, Australia, a common response was to decry the wasteful and inefficient public sector operations. Since the corporatisation of the Rural Water Commission with a considerably increased role for the farmer-dominated management boards, the reality and necessity of these costs and the true element of subsidy have become more evident. The level and form of subsidies in irrigation are obviously policy tools and governments should make this clear to recipients and critics alike.

4.2.6 Catalysts in farmer organisation

There is widespread evidence that farmer involvement in design and construction is an important factor in achieving tangible improvements in irrigation management and service delivery. This is particularly true for water-course development. Bruns and Atmanto's paper emphasises the sense of ownership generated by farmer input in design and construction on small irrigation projects in Indonesia, and Vermillion (1994) has documented the differences in engineering solutions preferred by farmers compared with standard agency designs in Sumatra and Java. Shah's paper observes that the extent of canalisation and piped distribution in private tubewell systems in Gujurat is considerably more dense than in public well commands. Vecco and Ampil show that farmers also need to learn about system operation and design in order to make useful contributions to its development in Kampuchea. In the Madura groundwater irrigation project, farmers were involved in the design and layout of canalisation from the time of the survey onwards: even after two meetings to mark out alignments and structures, there were often additional changes to be made at the time of construction (Turral, 1989). Clearly farmer knowledge of topography and drainage is extremely important for the adequate design and layout of systems, even in areas where there is no *a priori* expertise in irrigation. Equally, design and layout of tertiary systems is an evolving process. Further discussion on evolutionary design can be found in Willet's paper and more generally in Ubels and Horst (1993) where there is a fine balance between the cost-effectiveness of rapid initial construction/coverage and incremental development.

Ownership and legal rights to use water are usually presented as a *sine qua non* for sustainable irrigation development. Clearly, specification of individual rights in large surface irrigation systems, such as the Sone in India, presents almost insuperable problems. Thus, contracts specifying water rights, where they are made at all, are with WUAs or larger federated Irrigation Associations (the Philippines,

Taiwan, Korea and Mexico). Shah and his colleagues provide a dissenting viewpoint by demonstrating that the tubewell companies in Gujurat are clearly more efficient and equitable managers than co-operatives, even though they have no legal standing or recognised rights. He points out that the internal rules of association, particularly the difficulty of withdrawing share capital in less than 15 years, are more instrumental in developing a sustainable and functional organisation.

A more common problem relates to ownership of the infrastructure and its influence on the sense of responsibility for timely and adequate maintenance. Poor functioning or sustainability of WUAs in surface and public groundwater irrigation has been attributed to the reluctance of governments to transfer the ownership of parts or all of the system to farmers. There is varying, conflicting and incomplete evidence on this, but it is clear that lack of collateral for loans is a major problem in turned-over systems. In Madura, the local government retains the ownership of pump-sets, thus denying otherwise very functional WUAs access to credit as they have no collateral. Similar problems are raised by Asnawi's paper concerning pump irrigation projects in Sumatra.

Pumps and motors are useful collateral, but civil works, such as weirs and other structures, are fixed assets and have dubious potential as security against loans. Wilkins-Wells and Prasad's paper highlights the implications of poor access to rural credit for WUA sustainability in Nepal, especially in financing O&M and rehabilitation depreciation payments. They assert that WUAs will always have a collateral problem, and suggest that banking institutions should be encouraged to accept their creditworthiness. In practice, this implies a new form of state–irrigator relations in the provision of credit, backstopped by public funding. It must be admitted that experience of credit provision by public rural development banks has been far from happy, with many cases of malpractice in loan allocation and poor debt recovery rates. Vincent (pers. comm., 1994) notes that there were, and still are significant problems of competent technical screening in the provision of rural credit. It is noteworthy that state – or local government – supplied credit is common in rehabilitation and modernisation in China, but that debt collection is rigorous, even if the rates of interest may sometimes be concessionary. Sourcing local finance beyond the limits of direct farmer contributions remains a key issue to be tackled in management transfer. Inadequate attention to credit and finance is a common theme in Thailand, Laos, Nepal, India, Bangladesh, Indonesia, Mexico and many other countries.

4.2.7 Organisational form

Debate continues about the form of organisations in irrigation management. There appears to be a clear dichotomy between those in the private sector, co-operative or 'not-for-profit' organisations such as WUAs, and those of joint management.

These distinctions are most evident and most discussed in groundwater irrigation, where private initiatives are most clearly developed. The large irrigation associations in the USA and Mexico retain many structural similarities to state irrigation departments, but with different codes and practices of audit and accountability. The organisational structures in China, Taiwan, Korea and Japan are inclusive of state and farmer interests and representation, within a nominally autonomous Land Improvement District or Irrigation Association (see Appendix C for an example of a Taiwanese IA). It is hard to separate the public and the private in these organisations, which makes them quite distinct from those most commonly promoted under IMT programmes.

Chinese management structures are perhaps the most complex, and may still not be clearly understood. Understanding is complicated by the intricate cross-linkages between farmers, corporatised state units and the local government, plus vestiges of the parallel Communist Party administration. Many variations were presented at the conference, based on the parallel responsibility of village committees and contracted professional management at the system level, overseen by the Ministry of Water Resources via River Basin Administrations at the national level. The basic parallel structure is shown in Figure 5 (Ge and Guanhua).

Variations on the form of contracted responsibility at the village level include:

(i) Management by a professional team of all systems within a village unit – a utility which is self-financing from service fees.

(ii) Contract between the village committee and a contracted professional management team for each system, which may operate as a profit-making enterprise.

(iii) Direct management by village committees – contracts between village and township.

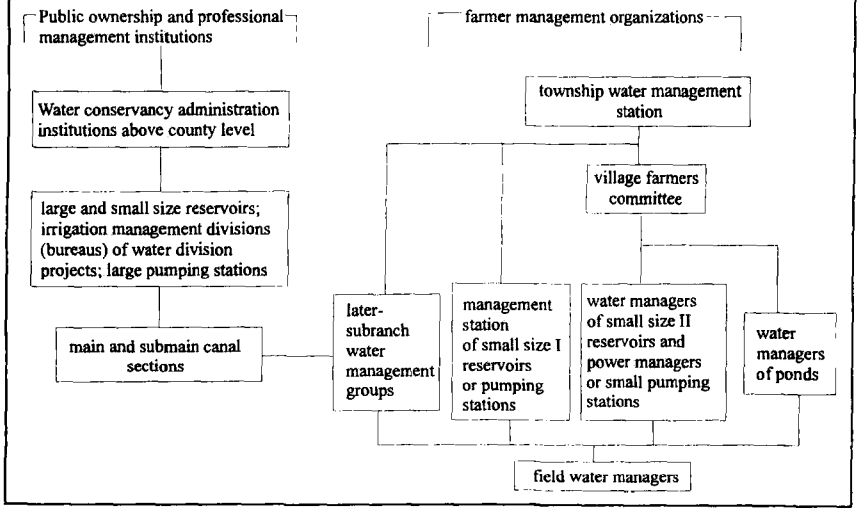
(iv) Collectively owned facilities managed by individual farmers – shallow well areas.

The most common form of contract is (iii), but as ownership by the township is not separated from management responsibility, it has been criticised as being a centralised management form (Yan and Ma, 1994). The cross-subsidisation by diversified enterprises is mainly developed in this system.

4.2.8 Multi-functional organisations

The provision of multiple services (farm inputs, marketing, even credit) would in theory strengthen WUAs and assist in their sustainability. There is much interest in whether organisations should begin as single or multi-functional operations and

Figure 5 Parallel organisational structures of irrigation management in China



whether it is possible to minimise duplication in village institutions by including water management with other services. The evidence is mixed, although previous experience with the development of agricultural co-operatives as water managers has rarely been successful. There is some broad agreement that water management is a specialised role, and WUAs need to be capable and functional water managers above all else: the real question is whether they can evolve into multi-functional organisations in order to improve their economic security and hence sustainability, without compromising the quality of their water management. Experience thus far is highly situation specific and does not allow generalisation or prescription, except to state the obvious, that a fully functional irrigation management organisation is the priority requirement. In time, it may be possible to identify patterns in this experience which will allow more cogent analysis to develop better policies on the promotion of single or multi-functional organisations.

4.2.9 Single or multiple organisations

Similar uncertainty surrounds the issue of single entities versus federations of organisations, particularly in large surface irrigation projects. Much evaluation of water user groups in India, Indonesia, and the Philippines points to ideal sizes of 40–50 ha. and memberships of less than 200, although it is hard to conceive of federations involving hundreds of turnout-level WUAs managing a 15,000 ha. system, let alone one of 500,000 ha. At the other end of the scale, the Irrigation Associations in Mexico are constituted over a complete hydrological system –

covering possibly many tens of thousands of hectares. There is mounting evidence of dissatisfaction and poor performance at the water-course level, and need for further organisational development to improve the quality of service provision and broad-based farmer input to system management. Merrey's paper offers a matrix that relates autonomy and dependence relative to government to the management of multiple or single complex irrigation systems:

(i) Single systems managed by autonomous agencies – e.g. IAs in Taiwan, Mexico and Argentina.

(ii) Single systems managed by a dependent agency – ORMVAS in Morocco or the national multi-use systems of the Punjab and Sind in Pakistan.

(iii) Autonomous agencies managing multiple systems – NIA in the Philippines.

(iv) Dependent agencies managing multiple systems – most of India, Sri Lanka, Nepal.

This classification is muddied by the many examples of stable and accountable jointly managed systems in Japan, Korea, Taiwan and the USA, and thus limits the scope of the following hypotheses developed on the likely relationship between these principles and performance:

(i) Fully autonomous organisations managing single schemes will exhibit the highest performance, will prove most adaptable to changing conditions and will therefore be most sustainable.

(ii) Autonomous agencies managing multiple systems may be innovative and customer oriented, but 'dispersal' of attention to multiple schemes will limit accountability and therefore performance.

(iii) Partially autonomous organisations have only limited accountability to users, which will limit their performance.

(iv) There may be a modest degree of accountability in single systems managed by dependent agencies, but there is also considerable room for corruption. Increasing autonomy should increase performance.

(v) Dependent agencies managing multiple systems will be least accountable to users because of the large number of stakeholders. Performance will predominantly be low.

The examples given suggest that all these hypotheses are broadly true, although Merrey stresses that the word 'autonomous' is not to be confused with 'private', as government authority is still needed to prevent the 'capture' of systems by

influential minorities and to manage and conserve common resources. Local authorities with specific government mandates for the integrated management of particular systems, whose charter of authority derives from users, appear to be an effective solution. The Argentinean experience in Mendoza province provides a good example of this type of arrangement. It is clear, however, that the simple recommendation of increasing single agency autonomy is difficult to implement in practice and also runs into problems with institutional arrangements for water resources management at basin and national scales.

Experience in groundwater irrigation very much favours arguments for privatisation, to the point that Palmer-Jones questions any role for government in its routine management and development. His thoughtful paper cites examples from many countries but is primarily influenced by the Bangladesh experience, where groundwater is abundant, close to the surface and does not require complicated technology for extraction. Some of the arguments employed tend to ignore the effect of subsidised energy on private sector groundwater, the need for (complicated and capital-intensive) deep tubewell technology in limestone aquifers, and the problems of regulation of groundwater mining where recharge is less generous than in Bangladesh. But it remains hard to dispute the logic of his argument in the context of plentiful shallow groundwater. As noted earlier, Shah and his colleagues present clear evidence in their paper that member companies provide better services than co-operatives in groundwater irrigation in Gujurat. It is worth quoting their conclusions in full.

> Member companies of Mehsana which serve the same purpose as the tubewell cooperatives of Kheda are more robust and vigorous as organisations because: (a) they self create and self propagate; (b) they actively guard their design sanctity; and (c) they adapt and self-correct. The primary features of their design that account for their superior performance include (a) complete autonomy and self-governance; (b) acceptance of the proportionality principle in capital contribution, landholding within the command, patronage, share in profits and in risk; (c) implicit recognition of the agency problem vis-à-vis the honorary manager as well as a paid operator; (d) vesting all powers of the general body (stakeholders) in the manager and the managing committee; (e) costly exit from membership.
>
> Aspects of the design concept that make tubewell co-operatives fragile and inferior farmers organisations include: (a) limited autonomy; (b) compulsion to get approval from the district registrar/corporation officials for most financial and administrative decisions; (c) violation of the proportionality principle so that small land-holders are required to subsidize large holders in capital supply; (d) externally imposed rules of surplus application which strongly discourage capital accumulation and encourage unduly low water prices; (e) myopia imposed by conditions of lease; (f) low exit cost. In conclusion, they suggested that lease rates increase to an economic rent and full financial and organisational autonomy be granted to co-operatives in exchange in order to improve the performance of turnover.

This experience mirrors institutional arrangements made in traditional farmer-managed irrigation systems based on hydraulic tenure, and demonstrates the management benefits of autonomy. A key organisational problem in IMT appears to be how to establish greater autonomy and accountability in large surface irrigation systems with complex technical and operational characteristics and very much larger numbers of members, many of whom are tenants and very few of whom have any capital equity in the system itself, apart from ownership of their own land. Research needs to focus once again on this issue and to recognise that the lessons of FMIS and private groundwater irrigation have reached the limit of application to larger publicly managed systems.

4.2.10 Institutional setting

The institutional setting for IMT was rarely explicitly discussed in the presentations of programme and field experience at the conference. Three papers focused exclusively on the institutional arrangements in agricultural development; government and water resources and aspects of agricultural policy (mainly markets) received passing attention in a sprinkling of papers. The development of IMT strategies in Mexico, Colombia and China are part and parcel of wider reforms in economic management and are clearly conceived within an institutional framework for water resources management and agricultural policy generally. In other countries, it is evident that transfer strategies are developed with less attention to governing forces within the economy and imperatives for responsible natural resources management.

Graaf and van den Toorn examine the interrelationship of the physical, social, financial and institutional factors in 'reshaping the triangle' (farmers, agency, system) in IMT. They note that while high-level political commitment to power-sharing in irrigation management is evident in many successful and some as yet less successful IMT programmes, the capability and involvement of *local* government are often overlooked. Gerards tells how the joint management initiative with full service fees on larger systems in Indonesia was obliged to recognise that the Ministry of Home Affairs was the only agency empowered to collect money from farmers. Relations between this 'outsider' agency and the Ministry of Public Works which oversees irrigation had to be reworked and massaged into a workable strategy, but yielded strong benefits in close co-ordination with local government. The NIA in the Philippines is promoting greater participation with local government as a way of sustaining IAs in joint managed schemes, particularly in providing continuity through leadership changes in these groups after community organisers have been withdrawn.

Graaf and van den Toorn also raise the importance of market prospects in underwriting improved irrigation performance and management reforms. The organisation of buyers, sellers and intermediates, marketing arrangements, transport

and storage facilities, access to credit and banking functions all affect price-setting and therefore the incentives to all parties, not least the irrigators. If one accepts the idea that IMT is a process of assisting farmers to improve their livelihoods through improved management (rather than organising them to 'participate' in the O&M of the irrigation department's infrastructure), there are three corners of the institutional triangle – government and agency; farmer and community; and private sector and the market (Helmi, forthcoming). Up to now most IMT programmes have ignored the market possibilities in terms of the freedom of the farmers to use water for whatever economic benefit seems most appropriate – staple crops, high-value crops, fish ponds, or the sale of water by low volume users to more demanding ones. Similarly, local understanding of markets and private sector support and opportunities is rarely factored into the programme.

Shivakoti cites examples of insufficient demand and the difficulty of marketing for high-value produce as a limitation on the development of autonomous management in Nepal, and reinforces the point that irrigated agriculture in particular is a responsive undertaking very much controlled by market demand and price; intensification to the point of cropping three times per year, and investing physical and financial capital in an extra season's cropping require considerable returns (or very strong self-sufficiency pressures) and secure markets. Few studies have been made of the required returns to management and the value of 'lifestyle' or leisure to small-scale producers; this is a frequent oversight in productivity forecasts following rehabilitation or management reforms.

Regional and international trade agreements have a much discussed impact on the rural economy. In an irrigation context, NAFTA is expected to have adverse consequences even on large-scale farmers in Mexico, who are insufficiently capitalised to compete with US-based industrial farming groups. The impacts on smaller farmers are predicted to be severe by IMTA, although some view this as a conscious decision by the government to concentrate land and resource ownership in the agricultural sector.

Agency capacity to implement IMT programmes is sometimes neglected, in particular the process of re-orientation and motivation for an enterprise that may result in loss of employment or status. The NIA in the Philippines is still finding it necessary to conduct extensive training/re-orientation programmes for its staff as well as needing to supply incentives for good performance. Capacity in supporting agencies may also be restricted, for example within the legal system or agencies involved in granting and formalising articles of association – an almost universal bottleneck in India.

A detailed and prescriptive process for placing IMT within the overall context of reforms in water resources management was outlined by Hal Fredericksen of the World Bank in the opening session of the conference, although many participants appeared not to have understood the significance of setting irrigation management

and planning within this broader framework, encompassing competing demands, environmental quality and non-irrigated land-use management. Professor Vaidyanathan summarised all the key institutional issues, while considering an Indian perspective to IMT and the consequences of a highly fragmented and inconsistent institutional framework in water resources management, partly deriving from conflicts between state and federal jurisdiction. He argues that the state often has the choice between transferring the management of publicly developed irrigation and regulating private and public enterprises, especially in regard to groundwater. He goes on to show that effective groundwater conservation has rarely occurred, even when the state has had the capacity to implement controls, because of conflicting incentives (subsidised power and credit) and poor institutional linkages. He points out that China has historically always had a clear water resources policy and that, in stark contrast to India, decentralised irrigation development has consistently taken place within a strategic national policy dominated by issues of flood protection and drainage.

Similar dilemmas about the role of government and appropriate institutional settings are arising out of a general competition for scarce water resources between agriculture and other sectors, principally urban and industrial demands. The role of water rights predominates in this discussion and surfaced in many papers, although often only to make a call for a legal underpinning and enforcement of this legislation. Experience in Mexico, where the state retains ownership of the water but allocates usufructuary rights, indicates that legal support and requirements are very variable across the country, especially those which support tradeable water rights. Donath (pers. comm.) describes IMTA's programme of regionalisation in tariffs and supporting legislation as an evolutionary process, despite the basis of the new national water law, supported by a change in the Constitution. Water rights in Mexico are coupled with legal responsibilities to meet quality standards in discharges to ground or surface water, although enforcement to date seems to be lax or ignored. As noted earlier, Chinese water legislation was only enacted after 4–5 years of reform of water resources management (and experiments in irrigation management), and again the state retains ownership of the resource whilst awarding contracts for a specified use. The rights specify quantity, reliability/scarcity management prescriptions, and timing and location of use, but, if the use changes, the right ceases and must be renegotiated.

The legal backing for, and administration of, water rights remains a significant problem and one that is exacerbated by the emergence of large numbers of autonomous WUAs and IAs (Turral). Registration of water rights can hardly be claimed to be rigorous or consistent, and is often based on inadequate information on actual and allocated flows and the availability and security of the resource. Instances were mentioned where the rights of traditional schemes were ignored because they were not legally titled (Nepal, Indonesia and India); this has highlighted the potential insecurity of customary rights in a changing institutional

environment. Allocation of rights by government agencies is also prone to the sort of corrupt practices that IMT is in part attempting to erode.

Individual rights do not exist in many recently built systems, although individual allocations by share or time are specified in many indigenous FMIS throughout the world and in old *warabandi* systems in Pakistan and India. Informal transfers and swaps at local level are often erroneously cited as examples of water markets (for example, in Pakistan) but are not comparable with seasonal or in-perpetuity sales of water rights, since money rarely changes hands and rights are *de facto*, not *de jure*. Specification of secure individual water rights is clearly only possible in industrial societies where land holdings are large and the total number of potential allottees is small. In most developing country situations, rights can only be realistically allocated on a group (bulk entitlement) scale. Micro-marketing of water in surface or groundwater is also not analogous to a tradeable water right, since in most cases no specified or secure right has been awarded to the vendor. There are clearly many steps to be taken in the technical and institutional preparation of tradeable water rights, and most of these should precede IMT, as has been nominally the case in Chile, Mexico and the Philippines.

Two-way contract obligations are specified in these three countries and in China, although there are few recorded instances of agencies being taken to arbitration or court for failing to fulfil their supply contracts. In the USA although IAs have been in a position to make apparently advantageous sales of water rights in California, this has not happened to a significant extent and is the subject of continuing investigation and policy adjustment (Rosen and Sexton, 1993). Similarly, in Australia, the number of transfers of irrigation water rights between individual farmers in Victoria and New South Wales has been far fewer than expected and the trade has largely been limited to auctions of new water from the storages (Musgrave, 1994).

The emerging role for irrigation agencies as water resources managers instead of construction enterprises was common to presentations from Australia (Prathapar *et al.*), the Mekong Basin and the Mekong Secretariat, the USA, and Mexico. Water allocation and registration, water quality enforcement, conflict resolution and enabling community action are among the new functions. This parallels developments in Spain, Korea and Taiwan earlier in the post-1945 period.

5. Synthesis of experiences presented at the conference

5.1 Performance of turnover

5.1.1 Realities

Assessment of irrigation performance has always presented difficulties, particularly in the attribution of agricultural productivity, which is affected by many factors such as crop variety, climate, agrochemical and energy input use and costs, water supply and management. Determining the performance of irrigation management is difficult if all these factors are to be disaggregated. Performance of management indicators such as changes in productivity per unit of O&M costs can be compromised by questions such as: 'was the money collected and disbursed on paper actually spent on whatever task or infrastructure upgrade was recorded in the books?'. In many cases, the answer to this is negative and immediately undermines the accuracy and relevance of the measure. In practice, assessment of irrigation performance needs to be made on the basis of a number of indicators of financial, agricultural, and operational hydraulic performance, with some estimate of their spatial variation throughout a system or region. Confounding factors such as inter-annual climatic variation, pest and disease epidemics and so on mean that trends over a number of years give better indications of performance than single-year comparisons or even averages (see papers by Kloezen; Asnawi and Berkoff, 1994, *inter alia*). Similarly, it is difficult to disaggregate changes in hydraulic and agricultural performance after the rehabilitation or modernisation that often accompanies management turnover programmes. System discharges quadrupled in one large Terai system in Nepal (Rana *et al.*), as a result of de-silting activities undertaken as part of an IMT/joint management initiative: if channel cleaning and maintenance is sustained, there is a case for arguing that this is an impact of IMT, but as it stands it is entirely due to a one-off, maintenance activity.

Clearly much of the experience presented at the Wuhan conference involves pilot projects or action research, with outside agents supplying technical and financial assistance, and therefore may be considered as special cases of uncertain relevance to full-scale programmes. This does not mean that these exercises are not useful in promoting understanding and insight, only that extrapolation to system-wide performance is often not possible. Experience with the transfer of management on seven large projects in Colombia (Garces-Restrepo and Vermillion) also illustrated the great variations in individual scheme performance, something which is even more evident in groundwater irrigation.

Such variability reinforces the idea that there is no substitute for routine monitoring and evaluation which tells managers how, on aggregate, a system or sector is performing and provides a basis on which to assess changes in performance

resulting from changes in management, such as those resulting from IMT. China has clearly established routine performance assessment on a national scale; in addition, irrigation management stations and village management groups are scored on multiple aspects of performance, which in turn determines the levels of bonus or penalty applied to staff salaries. About one quarter of the performance figures provided at the conference came from Chinese projects. Historically, performance monitoring has been strong in the USA, Taiwan, China and Korea and minimal in most other situations: a key common component has been routine monitoring and recording of flow data throughout the delivery system. The adage 'no management without measurement' is particularly true in large surface irrigation systems: there is therefore a close link between technology (measuring systems), data recording and provision and the institutional aspects of good service provision and financial self-sufficiency – a link which many countries appear to be ignoring.

It is no easy matter to choose adequate and representative performance indicators, which give a genuine picture at minimum cost. Much detailed performance monitoring and comparison was presented on the Bayi and Nanyao schemes in China, but the conclusions on water management and financial efficiency (resulting from land and administrative reforms) were severely compromised by the omission of information on the costs and benefits of significant groundwater use within the Bayi command area.

As the performance of many systems prior to IMT may often be poor, programme managers may hope that improvements in a whole range of indicators will be apparent within a few years of turnover, namely, increased cropped area and cropping intensity, rising real per capita incomes, improved efficiency of water use and productivity per unit volume of water delivered. In practice, the impacts may take a lot longer to manifest themselves. Alternatively, the distribution of these indicators may change, classically between the head and tail of a large irrigation system or the reaches of its subsystems. National-scale performance monitoring is inevitably less refined and relies on aggregate measures of system performance provided by the local managers, set against national economic factors such as expenditures.

5.1.2 Assessments of performance – worldwide

The impact of IMT programmes can be determined by comparison of 'before and after' and 'with and without' situations, providing they have broadly the same macroeconomic, market and climatic conditions. Reference to the table in Appendix B reveals that, on the information presented at the conference, only 25 of the 100 papers ventured any performance data relating to turnover. Four of these presented data making 'before and after' comparisons and one made comparison of 'with and without' transferred management at the same time. Others provided comparisons between private sector/FMIS and agency or joint managed systems (*inter alia,*

Shivakoti) or a comparison of turned-over (co-operative deep tubewell) performance with that of private companies (Shah *et al.*). The remainder of the data provides performance measures post-turnover, with no reference to previous levels nor attribution of probable causes for any changes. The fact that few examples present more than two or three performance indicators accentuates the difficulty of attributing improvements to management rather than technology, rehabilitation, improved use of inputs and so on. The number of papers indicating national performance of IMT programmes was 5 (the Philippines, Nepal, Vietnam, Colombia and Mexico) and none of them ventures to estimate the cost-benefit ratio of conducting an IMT programme or the returns to management (kg output per unit cost of O&M).

The paucity and lack of consistency in performance indicators gives a fragmented picture and allows little of genuine substance to be said about the impact of IMT on livelihoods, agricultural production and the effectiveness of service delivery. Surveys, rather like customer satisfaction polls, have been conducted in Mexico, India, Nepal and Egypt amongst others, possibly as an alternative method of assessing the impact of IMT on management and livelihoods. There is often the possibility of learning what one wishes to hear from surveys, depending on the sampling and the type of questions asked. The inconsistency between 'official' and private/NGO perspectives on Mexico's national programme of water reforms is a case in point.

However, significant benefits may accrue to farmers as a result of becoming managers of their irrigation systems, which are not immediately evident. Musa's paper tells how in Nigeria farmers no longer have to irrigate at night and have adjusted the operating schedules of large schemes within the Hedejia-Jamare River Basin to meet this preference.

Expansion of command area or increased cropping intensity were recorded in 14 of the cases listed in Appendix B, with the largest being a 97% increase in cropping intensity in a previously poorly serviced water course within a large irrigation system in Andra Pradesh (Rao). Yield improvements of up to 200% were claimed in 10 examples, although there may well be multiple factors involved. The Chinese were keener on yield per capita as a measure of agricultural productivity, rather than output per ha. which has risen dramatically since 1984. Improvements in water-use efficiency and increased output per unit volume were registered in many Chinese examples.

Fee collection rates are very variable and positive differences between agency-managed and 'transferred' schemes are most convincing in the Philippines. Fee collection rates in China seem to be very high in some areas and highly erratic in others. There was a lot of conflicting evidence as to the proportion of operating costs recovered due to: multiple sources of financing; continued subsidies; low water pricing; differentials in capacity to pay; confusion between payment of O&M

with depreciation and operational costs only; resistance to paying water charges, because of a deeply held sense of ownership resulting from massive inputs of labour in the past as well as money contributions to capital costs. By contrast, fee collection in Huruluwewa in Sri Lanka has collapsed to almost zero within three years of transfer to farmer management, although this is attributed to inadequate preparation for and implementation of the transfer process (Kloezen). Similar experience is implied in Nigeria, although the situation is complicated by recent massive deflation.

Lack of expertise amongst new managers seems to be fairly common; Svendsen and Vermillion's paper notes that it took 5 years for the new managers of the Columbia Basin District to achieve similar levels of performance to those of the USBR. Similar declines in performance and service delivery have been observed in some cases in Colombia (Garces-Restrepo and Vermillion) and farm business returns under fully private management in the Sudan's Gezira have dropped considerably compared with former levels under parastatal corporation administration, for the same reasons (Samad *et al.*). The Grameen Krishi Foundation in Bangladesh has taken on nearly 1,000 deep tubewells to be operated under commercial/co-operative management. This is largely externally financed and the GKF is finding it impossible to run the wells at cost, resulting in a steadily increasing 'overdraft' on the venture (Mandal and Parker) it is too early to say whether this is terminal or can be recovered by better management as the GKF and its staff gain experience.

The most disturbing negative impact emerging around the world is that farmers are keen to price down irrigation water, even to the point of seriously neglecting routine maintenance and ignoring strategic investment in research, data collection, monitoring, etc. related to system operation. This has been recorded in the USA, the Philippines (Laurya and Sala), Colombia and Australia (Malano, pers. comm.), and there is much incidental evidence of declining irrigation fees (in real terms) after transfer. Laurya and Sala note that continuing efforts in IMT in the Philippines should focus on developing self-assessment in WUAs in order to improve management and accountability. The consequences for sustainability have yet to emerge: there is an implicit assumption that the government will be able to backstop rehabilitation or deferred maintenance, either by direct intervention or by subsidies and credit provision when the time comes. This will prove an acid-test of the effectiveness and reality of the transfer of ownership and management. A recent report on privatised irrigation in Senegal (*Agsieve*, 1994) attributes rapid increases in water-logging and salinisation to complete neglect of good O&M practice by new farmer-entrepreneur managers.

5.1.3 Agency performance

Few data were presented on budget-balancing by developing country irrigation agencies managing IMT, apart from China and Colombia (Garces-Restrepo and Vermillion). The major thrust of Chinese reforms in irrigation management is to develop an inclusive structure of motivated and well-rewarded professional management with farmer participation and financing. Considerable effort has been directed towards developing incentives to improve agency performance through the contracting-out of system management by open tender. In theory, anyone can apply for management contracts but, in practice, it is rare for farmers to 'qualify' on grounds of technical competence and formal qualifications. Thus the Township Irrigation Management Offices replace the previous state units as contract managers; they may sub-contract management responsibility to other groups and may often employ the same people who were doing the job before. Diversified enterprises have been introduced largely to cross-subsidise operations and pay bonuses for good performance, although the value of this revenue is in fact small in comparison with the value of irrigation fees. The capital for establishing diversified enterprises such as concrete products factories, agricultural processing and marketing operations, is provided via zero- or low-interest loans from national or local government. The Chinese aim to maintain good professional services and management in these quasi-state units, whilst devolving local responsibility to farmer-dominated village management units. Local responsibility extends to fee collection and farmer financing on the principle of 'those who benefit pay'. One cannot fail to observe that this system is still backstopped by a pervasive authority and relies on the long tradition of communal management and endeavour in the Middle Kingdom.

IMT is viewed with considerable alarm in many states in India, where it is considered as a threat to job security and professional status. These arguments are advanced by some writers to account for the weighty institutional inertia and indifference to the idea of 'service provision' in many irrigation departments of the sub-continent. The same issue is revealed in the Philippines, even after 15 years of substantial reform in irrigation management and serious commitment to self-financing, service provision and turnover of communal irrigation systems; training and continued programmes of internal re-orientation are suggested by a number of authors. Opinions differ widely as to the capacity of irrigation departments and construction-minded engineers to embrace a change of role to become managers and service providers. In the USA, alarm about job security was allayed by the transfer of staff to other areas or to the professional management core of new farmer-owned utilities; it also coincided with a reshaping of the USBR's role as a water resources planning, management and regulatory body. In Mexico, four major IAs have been effectively fully privatised on the US model and the remainder (37) are 'associations of limited responsibility' where the CNA (National Water Commission) still retains ownership and operational responsibility for major components of the infrastructure. There is already concern that the emerging private

sector is draining competent staff away from the state to a few well-paid commercial IAs and that overall management will suffer as a consequence.

The costs of managing and implementing IMT programmes have not been clearly analysed, in part because of the incorporation of substantial rehabilitation and modernisation in some programmes. The World Bank should be in a position to produce overall programme costs and cost:benefit ratios, as it is providing loans to many IMT initiatives such as those in Mexico, Indonesia, Vietnam and China. FAO-assisted WUA training in Indonesia incurred estimated costs of US$50 per ha. in preparing farmers for IMT (Geijer *et al.*). The joint management programme in Nepal is preparing a financial analysis of the costs of the IMT programme, but the results have not yet been published (Rana *et al.*).

5.1.4 Equity and efficiency

Equitable access to irrigation water is a prime concern of much recent social-anthropological study in irrigation and often concentrates on imbalances in water supply between the head and tail of irrigation systems. Head-tail problems are easily detected and even quantified by remote sensing techniques, but inequitable distribution is less commonly evaluated within tertiary blocks or at other points relatively far from the primary and secondary canals, although it is also a frequent occurrence. Traditional design in irrigation systems (outside China) tends to assume that land that is not serviced because of topographic conditions is outside the 'command area'. The obvious equity differences between those who have access to irrigation water and those who do not are reduced to a clear-cut technical and physical boundary and accepted as facts of life by irrigation departments. The Chinese take a different view. Their approach to management is almost unique in using within-system storages and widespread use of pumps to service land lying outside the gravity command, but within the overall command area. It is thus common to find multiple pumping stations supplying canals within a surface irrigation system, thus resulting in a highly complex management regime. There is evidently an element of cross-subsidisation resulting from the average pricing of water charges to cover the extra operating costs of the mixed system.

Although conjunctive use of privately developed groundwater in the Punjab (Pakistan and India) has allowed similar flexibility and improved water availability and access within surface systems with limited fixed rotational supplies, it has been a spontaneous development, often against opposition from the controlling irrigation department. It is, of course, limited to areas of shallow and good quality groundwater, which is far from evenly distributed. As conjunctive use supplements surface supplies it does not interfere with the existing operating rules and does not contribute to the same level of complexity as in Chinese mixed systems.

A second feature of Chinese irrigation management which is potentially instructive is that rotational supplies begin at the tail and work back to the head. This, of course, does not stop water stealing, although the penalty of a doubled water charge is strictly applied to those found taking water out of turn. As many Chinese systems do not experience the sort of water shortages evident in the conditions of the Indian sub-continent, the success of these measures may be exaggerated.

Gross inequity in water distribution usually occurs when well located élites override the nominal operating rules of the system as it was designed. It may result from the inability of the irrigation department to manage and police its system properly, but also often involves complicity and corruption or, more rarely, various forms of physical or financial coercion. An intention of participatory management and IMT is to break this relationship and establish better and more productive water distribution, which results in more efficient use of the resource and the capital used in its development.

Rao's paper provides a good example of where head-tail equity in water distribution has been improved post-IMT in a minor distributary in Andra Pradesh, with net increases in area irrigated *and* in the productivity at both head and tail commands. This is a clear improvement as a result of management, since the total volume available to the whole sub-system is more than twice the calculated gross demand. However, similar head-tail adjustments are clearly harder to make if total available flow does not match the total demand for part or all of a season. The fact that productivity actually improved in the upper reaches (due to reduced water-logging) also shows that there are cases where improved equity is *directly* accompanied by improved efficiency. Similar head-tail improvements are reported in Nigeria by Musa.

However, IMT does not necessarily improve the overall or individuals' equity in system management. Examples were given of ghost WUAs in which élites control or constitute the *de facto* organisation: this results in the retention of profits by key controlling actors in the WUA (Gujurat – Kollavalli and Raju) or servicing major landowners (Philippines – Oorthuizen). Two Filipino phenomena in IMT were not mentioned: (i) the 'back-account' (where ex-landlord-dominated WUAs collect water charges but then do not pay them on to the NIA), and (ii) the re-mortgaging of holdings to ex-landlords in exchange for inputs or payment of outstanding water charges.

Ramanathan and Ghose (1994) attributed poor command area development and low productivity to skewed landholdings and a large amount of illegal tenancy in the Indira Gandhi Canal area in Rajasthan. Irrigators in many cases were not landowners, and could therefore not legally obtain registration or membership of WUAs. The case is probably unusual today, as it involves land settlement on a large scale where the indigenous nomadic inhabitants have often been dispossessed without compensation and there is widespread evidence of corruption in obtaining

land allocations. There are also major physical problems with the system (Bottrall, pers. comm.) and with the general provision of basic infrastructure, which further exacerbate water scarcity and encourage irrigators to break whatever allocation rules nominally exist. More generally, it is not unusual for insecure tenancy and tenure divisions to weaken WUAs as is the case in much of Latin America and in (older) settlement areas in Sri Lanka and the Philippines (Vermillion, pers. comm., 1995).

It is also clear that land consolidation is a consequence of IMT in Mexico, where land is increasingly concentrated in the hands of fewer, larger and more 'modern' farmers. Little research has been done on this topic, although it is much discussed amongst professionals and researchers. Menchaca and Torregrosa's paper discusses this problem in passing, but they are not yet in a position to provide figures and analysis.

Effective IMT may not always benefit the agency and enhance the funding of irrigation services. Rao's successful WUA in Andra Pradesh falsified the flow records to reduce the amount paid in service fees and retained the difference from the full charge for the association's benefit!

5.1.5 Dynamics and sustainability of local organisations

'Nuts and bolts' issues of the sustainability of user organisations were not high on the agenda of the conference, although they emerged in 7 presentations – (Rana *et al.*, Srivastava, Patil and Lele, Anil Shah, Tushaar Shah *et al.*, Yuan *et al.*, Vecco and Ampil). The principles attributed to Ostrom and Hunt (see section 2) in relation to sustainable institutions of management in FMIS are by and large assumed to hold true for emerging organisations following management transfer. Nepal's FMIS are more productive and efficient on a number of indicators compared with agency- and joint-managed schemes, but Shivakoti's paper concludes that created organisations, even if modelled on these principles, are still in the process of evolution and need support, particularly in coming to terms with their individual contexts. He therefore recommends a strategy of 'turnover and serve' (a changed form of joint management) rather than 'turnover and forget'.

A key difference that emerges in the case of joint and community management in complex irrigation systems is that the number of actors and linkages involved dramatically increases. The probabilities for 'rule-breaking' increase with size, as the probability of detection and sanction decreases. Systems are no longer 'well-bounded' in the physical and membership sense of a traditional farmer-managed system, and the authority for the application of sanctions is no longer extant within one community: if local social, tribal and ethnic rivalries are taken into consideration, it is clear that the transparent but pervasive authority of one or more external agencies is called for. This appears to be a crucial difference between US

and Australian systems (where numbers of actors are fewer, living and educational standards are on average high and backed up by an effective (if expensive) legal system) and most other situations. The existence of such an external and relatively even-handed external authority underwrites Chinese, Taiwanese and Korean success in the joint management of large and complex irrigation systems, and in the past backstopped the operation and equitable distribution of water in the northern India of the Raj. At the present time in India, Pakistan and Indonesia (among others), the legal system is neither transparent nor efficient and is inaccessible to most small irrigators or even to their representative associations.

However, whilst it is possible to observe that good management and efficiency are underwritten by authority to police common rules, this is hardly a recommendation for authoritarian government. A key challenge for most countries currently undertaking IMT programmes must lie in the development of transparent, acceptable, accessible and effective authority systems to backstop the resolution of disputes, allocation of water, propriety in management and water distribution, and effective and open accounting within user groups and between them and the state.

Particular attention is required to the provision of arbitration that does not involve recourse to expensive and protracted legal contests. It is rare to find independent auditing of construction (quantity and quality surveying), agency budgets and WUA accounts, although the evolution of construction, maintenance and service contracts between WUAs and agencies goes some way towards tackling these problems (the Philippines, China, and most recently Nepal). Performance and service contracts are a common feature of Chinese irrigation management in the 1990s, although no examples have surfaced of dissatisfied customers seeking compensation for inadequate services. NGO initiatives in Maharashtra (Mula) are experimenting with contract bulk deliveries and volumetric water pricing (Patil and Lele), but again there is limited experience of the consequences of breach of contract by either party.

It is unlikely that the margins in irrigation fee collection at the micro and macro levels are sufficient to fund independent financial auditors in many cases, although provision of annual audited accounts is mandatory for associations in the USA, Colombia, Chile and Australia. Independently monitored financial systems may be closely tied to cost-of-provision water charges, but it would be good to see research and initiatives emerging in this direction.

Many conference papers continue to stress the importance of enhancing the sense of ownership of a system, in China and Vietnam where it has a particular new-found resonance, as well as in India and Indonesia. Concrete ways of enhancing ownership in IMT revolve around shareholding arrangements. The improved performance of member companies in tubewell irrigation in Gujurat has been discussed earlier, but a number of other papers dealt with shareholding systems in large-scale surface irrigation. Wilkins-Wells and his colleagues gave details of how

share systems modelled on IFMIS can be translated effectively into schemes covering 10,000 ha. in Nepal's Terai. Shares in the available discharge are allocated per unit area, based on the annual average system flows and total area, and are allocated in proportion to landholding. Payment of water charges and maintenance and rehabilitation commitments are also proportioned accordingly, and water measurement therefore becomes of prime importance to farmers. Special provisions are made for periods of lower-than-average flows. The irrigation agency has a role in establishing the format of the share system and providing technical information on water resources and conveyance losses to support it. This leaves the micro details of organisation and provision of O&M to the farmers themselves and is instrumental in creating an awareness of the extent of resource mobilisation required to manage a system effectively. Trainers from established FMIS have been used to explain the concepts and detail of the share system, and perhaps to provide ideas for the management system that farmer groups adopt. Record-keeping and accounts assume a new importance under share systems and this requires considerable training input and support from an agency. Shareholding at successive levels of irrigation management is a key component of the economic reforms in China (Jiang) and has many of the features noted above, plus the possibility for non-landowner/cultivator ownership where profits accrue in cash terms, rather than in kind as for cultivators. This possibility arises because shares are not allocated in proportion to the water but in relation to the value of all the fixed assets within the system, and apportioned according to labour and financial contributions in the past development of the system. Shareholders can be individuals, communities or enterprises. The Chinese also emphasise the importance of water measurement in management (Xueren and Renbao), especially in share systems, and a nationwide programme of water measurement has been implemented over the last 10 years, although serious efforts in water measurement began as early as the 1950s.

Representation and WUA financial management are key areas of importance to the sustainability of turned-over systems and are discussed in further detail below.

5.1.6 Representation

Zwarteveen's paper notes that development theorists and programme designers tend to have a romantic vision of communities and to assume that WUAs are philanthropic social entities ensuring distributional equity amongst their members, whereas this is often far from the case. This rings very true in the ears of field workers and provides the practical complement to Ostrom's more analytical prescription of the nature of successful institutions of common property management.

Many WUAs are organisations existing only on paper, formed and forgotten by government: Helmi's paper estimates that as few as 10% of the WUAs in Java may be truly functional. Although this is a micro and context-specific issue, it is clear

that adequate representation of irrigators/cultivators is still a major issue requiring considerable effort. The most obvious problems arise when there is no representative membership and the WUA is little more than a front for an élite interest-group. Kollavalli and Raju observe that legal registration of user groups does not allow differentiation between genuine representative organisations and fronts put up by individuals, particularly in groundwater exploitation. Share systems obviously address this problem head-on but, if allocated on the basis of land-tenure, may neglect a considerable proportion of actual irrigators – women, tenants and share-croppers. Who is eligible to be a member of an association and who represents the membership? In many traditional systems, the head of household (usually a man) who is a landowner is also entitled to become a shareholder or member of an association. This is also the case in many newly formed associations in India, Indonesia and elsewhere and may specifically exclude tenants and share-croppers: by contrast, anyone who cultivates *or* owns land may be a member of most Filipino systems. Women who are landowners in their own right may become members, but a considerably larger number of active farmers may be women, even if they are not the titular owners (Zwarteveen). If membership is restricted to one nominated individual, actual representation or 'voice' at general meetings may be lost, if illness or other commitments prevent attendance. Indian NGOs in Tamil Nadu and elsewhere are experimenting with household representation rather than by nominated individuals. In practice in many traditional organisations, other family members may represent the head of household, and this problem can therefore sometimes be somewhat artificial.

Zvarteveen also makes a good case for improving women's representation in management organisations on the basis of improved efficiency: women are the main irrigators in the later stages of crop growth in Nepal, and in many other rice-based farming systems. Women may be wage-labourers irrigating other people's land, and they may control the household finances, marketing, seed storage, varietal selection and other factors of direct relevance to irrigation management. O&M labour contributions are often made by women and if service delivery is to be improved by establishing a clear link with the payment of fees, women who irrigate must be represented and must have a significant voice in running local and regional organisations. Zwarteveen provides an interesting insight by recounting how men in Nepal maintained that there was no water stealing (because they were not in the field), whereas women were able to provide a detailed account of exactly what was happening. Few other papers raised gender issues, and there is a clear need for more substantive work in IMT programmes to define women's true roles in irrigation management and to improve representation and voice on pragmatic and efficiency grounds. In Andra Pradesh, there is an interesting division of labour, with women becoming the sub-system operators when the men leave the area to lobby the irrigation department for better deliveries in the minor canal (Rao). In many countries, seasonal male migration to seek work in the cities is commonplace, and this leaves women almost entirely in control of irrigation – for instance in West Madura (Casey, 1991).

In Tanzania, women are specifically excluded from membership of traditional irrigation groups and are even banned from visiting the source (Kagubila). Similar exclusion is expected in strict Muslim societies, but a recent article in *Land and Water International* details how an appropriate gender strategy has been developed in Baluchistan (Pakistan) for rural water supply and sanitation (Reijerkerk, 1994). There may be much for the irrigation community to learn in gender aspects of community organisation from initiatives in the water supply sector.

There is a continuing role for external agencies in supporting WUAs post-transfer in order to ensure that the rules of association are enforced and the election of office-bearers and the selection of paid employees are in accordance with the needs and wishes of the membership. In traditional systems, the water manager may be an inherited position, with much prestige and concomitant responsibility attached to it (*wazee wa mfongo* in Tanzania and *Reis/Wadera* in Pakistan). In new WUAs, although a sign of poor institutional development, the functionality of organisations is often very dependent on the energies and integrity of key representatives and leaders (*inter alia*, Bautista *et al.*). Where these are not evident, provisions must exist (and be followed) to replace ineffective or self-serving 'leaders' and revitalise the organisation. Many papers touch on the need for continued effort to support the establishment of a soundly based representative organisation, and earmark it as a key area of NGO expertise (*inter alia,* Bagadion).

5.1.7 Financial management

Substantive field experience increasingly highlights deficiencies in the ability of WUAs to manage finances and keep accounts. Not only is there a need for incentives and penalties to be applied to encourage account-keeping, there is also a strong need for training and co-operation in establishing accounting systems (Bagadion). Selection/election of a WUA treasurer needs to recognise ability and capacity and the necessity of rewarding what is effectively a time-consuming and skilled job.

Key issues, some already discussed in passing, include:

(i) Entitlement to a bank account – tails of security of access and withdrawal.

(ii) Access to credit as an organisation: acceptable forms of collateral.

(iii) Basic book-keeping skills – plus independent auditing.

(iv) Incentives to collect and pass on water charges to the service agency.

(v) Investment and risk-hedging advice.

(vi) Setting of water fees in autonomous organisations – local determination of capacity to pay and realistic assessment of all component costs.

(vii) Establishment and adherence to acceptable payment schedules and charging systems (flat area or volumetric): responses to non-payment.

(viii) Financial responsibility for rehabilitation and capital replacement funds.

(ix) Subsidies and sideline revenue.

It is interesting to note that, even in large gravity systems in China, water fees are collected prior to delivery and persistent fee-evaders are denied water until their accounts are settled.

5.2 Funding of O&M

Broadly speaking there are three categories of funding for O&M: (i) full payment in the form of a tax to central or local government or a tariff to the government agency or private management board; (ii) self-financing by users; and (iii) joint systems of self-financing and payment to an external agency. There are two levels at which funding activities take place: (i) within the user organisation itself, whether autonomous or not; and (ii) payment to an external agency. Many authors have for a long time espoused the concept of 'payment-for-service and service-for-payment' as a crucial feedback loop between performance and financial sustainability. In the minds of most economists this implies the use of tariffs, usually consumption-related (volumetric water charges or a proxy thereof), for total or part payment of service fees. There is a large literature on the pros and cons of volumetric charges versus flat area taxes, and an established truth that direct payment to the service agency induces good performance if it is to be successful in recouping its O&M costs.

Land area taxes are relatively easy to administer and do not require the added complication of reliable and accurate flow measurement needed for acceptable volumetric pricing; although time of irrigation is often used as a proxy for volumetric delivery, it is susceptible to dispute because of the variation in 'normal' flow rates and the differential effects of conveyance losses between the head and tail of water courses. In countries like Australia, individual farm deliveries are routinely measured and charges paid only for what is consumed (± 4–6%), but this is clearly an impossible task with multitudes of small farmers. This, in turn, has led to the concept of bulk-billing for volumetric supply to a water-course within a system, which must then match its internal fee scheme to meet the bulk delivery charge. Compound tariffs are increasingly recommended, with a basic flat rate per unit area irrigated (corresponding to a land 'rent') supplemented by a volumetric

charge (Gulati and Svendsen). Split tariffs are currently used in Colombia, Mexico and China and have been piloted, without much success, in India.

Area taxes are normally applied in India, with differential costs according to the type of crop grown, and the cost of flow measurement is often used as an argument against volumetric pricing. The cost of collection assumes great importance in some cases, usually where the absolute level of water charges is very low in relation to the actual cost of provision; there have been reports in the past of costs of collection exceeding revenue and therefore being 'uneconomic' (Bhatia and Falkenmark, 1992 on Bihar). In India and Indonesia, the taxation system is run by the civil administration and revenue is returned to the general purse and then re-allocated to the service agency to pay its O&M bill, hence breaking the direct link between service and payment. Furthermore, in India the notion of equitable access to irrigation water has gone as far as setting uniform prices between gravity and pumped irrigation, regardless of the cost differential in the provision of water (Kollavalli and Raju). The Irrigation Service Fee programme in Indonesia is claimed by its progenitors and an independent study to be a success, despite having the characteristics of a taxation programme and involving no direct link with the irrigation agency (Gerards). A comparative evaluation in Kediri-Nanjuk, East Java, between ISF and non-ISF programme villages revealed improved transparency, substantial delegation of functions and the emergence of staff incentives plus increased farmer satisfaction with the service in the ISF areas (Paul, quoted in *ibid.*). The programme is posited on the theme 'voice in return for payment', but may in part owe its success in achieving its very high payment rates to the highly developed sense of Javanese community responsibility. It is not clear whether such an indirect 'voice' would be acceptable in, say, India or Pakistan.

O&M costs are usually lumped together (as total variable costs), although experience worldwide with autonomous irrigation management indicates that IAs cover operational and administrative costs, but that maintenance costs are undervalued in an attempt to minimise water fees (Colombia, Garces-Restrepo and Vermillion; Philippines, Laurya and Sala; Australia, Malano, pers. comm., 1995). It is rare for breakdowns of the operational, administrative and maintenance costs to be given (Morrison, pers. comm.), although Palacios-Velez provides a number of comparative figures for Societies of Limited Responsibility (joint managed systems) in the Rio Mayo, Mexico (see Table 3). It is interesting to contrast the breakdown of O&M costs between modules (water-course managers) and the society which is the representative body for all the modules within the system. Interesting points to observe are that the responsibility for maintenance funding is devolved by low-level user organisations to the umbrella body which has largely subsumed the CNA's previous managerial responsibility, but that the proportion of actual operation costs incurred by the modules is higher than those for operating the entire system.

Table 3 Breakdown of total variable costs in joint management in the Rio-Mayo, Mexico

Function	Module	Soc. of Limited Responsibility	National Water Commission	Total
OPERATION	20.9	17.3	4.4	42.7
MAINTENANCE	7.6	29.1	4.3	41.0
ADMINISTRATION	9.8	4.8	1.7	16.3
TOTAL	38.3	51.3	10.4	**100**

Source: modified from Palacios-Velez.

Sources of finance for O&M may go beyond direct payment of fees in cash or kind (usually grain) so that labour contribution must also be factored into the calculation. In many Chinese systems the labour account is substantial, with household contributions of up to 40 days per year required for mainly off-season channel-cleaning and construction. The total labour input into primary, secondary and tertiary channel maintenance is astonishing in comparison with other countries: Lishan and Xieqin quote 19,000 man-days labour supplied on 1,000 ha., on Yanqing Irrigation System in South China, compared with less than 1,800 days for 4,000–5,000 ha. in the Paliganj distributary of the Sone in India (Srivastava). The Chinese have the most innovative systems of financing O&M at both user-association and umbrella-administration levels. Local managers are provided with irrigated land, free or low-priced water and concessions to profit from fish-ponds and trees planted along the canals. The Township Water Management Stations are cross-subsidised by profits from diversified industries and enterprises, now including tourism, which provide bonus payments for good performance. In addition, tariffs may be levied on sales of all high-value crops (particularly cotton) and credited to an O&M or rehabilitation fund at system level (Ge and Guanhua). In the Columbia Basin Project in the USA, the energy costs of pumping water out of the Grand Coulee dam are cross-subsidised by hydro-electricity sales, but this is in effect a government subsidy as the lost revenue represents a real cost to the state. Special funds for rehabilitation and emergency maintenance are common in traditional irrigation systems and rely heavily on labour contributions. In China, this practice now includes cash and material contributions, plus valuation of transport services and artisanal skills provided by individuals within the community.

In principle, many governments would like to include a depreciation charge for capital investment in the construction of the system, or failing this for rehabilitation, especially that associated with the IMT programme. In practice, it has often been expedient to settle for second-best. Water users have negotiated very favourable terms for concessionary repayment in the USA (Svendsen and Vermillion; Rosen and Sexton, 1993). In Australia, outstanding debts, construction costs and loans were written off in the corporatisation of the Rural Water Commission of Victoria. In the Philippines, the number of associations opting for capital repayment according to Type III full management turnover contracts (see below) with the NIA is less than 9% of the total (Laurya and Sala), and there is also poor and declining amortisation repayment. Chinese estimates of capacity to pay indicate that full O&M costs ought to be relatively easily funded by users, even though this is far from the case over much of the country. However, repayment of depreciation on major fixed assets such as dams is not feasible and is complicated by the enormous labour input made by farmers in construction in the past (Wang and Qian, 1994).

Following management transfer, future capital and rehabilitation costs have to be funded from revenues, and many longer-established user associations prefer to defer this, possibly with a shrewd judgement as to the extent of subsidy they are likely to be able to obtain in the future. In Korea, self-financing of irrigation through joint management by semi-autonomous Farm Land Improvement Associations has been realised over time via a combination of sanctions and rewards (Gulati and Svendsen); construction and development services are provided by the Agricultural Development Corporation, which finances its operations from revenue collection. However, widespread automation of the irrigation system is under way, with a substantial subsidy from the central government justified on the basis of 'inadequate' management performance in the past, even though some might consider it exemplary by their own standards (Lee Seung-Chan, 1994). Since 1989 all major rehabilitation and drainage work has been financed from government subsidies, and the irrigation associations have covered only the cost of minor repairs to the infrastructure (Solanes, 1993). The impetus for renewed government funding, as in Taiwan, is due to dwindling rural populations as industrial and other employment opportunities develop.

A variety of maintenance and management contracts are in use in joint responsibility systems, and those in the Philippines provide the most robust developing country experience to date. An important feature of these contracts in the Philippines and China is the return payment of (typically) 15% of revenue to the WUA by the service agency, if a specified target in the collection rate (typically 85–90%) is met. This is one way of mitigating the costs of collection and providing workable incentives, although the Philippines case studies show that if targets are not met a downward spiral in fee collection may ensue (Laurya and Sala). The Chinese practice of requiring payment prior to delivery undoubtedly eases the cost of fee collection.

It is to be expected that share systems (see section 4) would encourage proportional and efficient payment of O&M costs because of effective peer pressure and other local sanctions. There has to be consensus amongst the farming community about the level of payment; this can benefit from their own appraisal of real needs but may also suffer from collective resistance to paying higher fees, as was evident in transferred systems in Colombia (Garces-Restrepo and Vermillion). Share systems can be unbalanced if major shareholders default on maintenance payments, which results in a gradual deterioration in motivation for the other shareholders. A possibly atypical example is provided from traditional *karez* (*qanat*) irrigation in Baluchistan, where the Kalat State Union became a shareholder in many systems following default in tax payments by landowners. The maintenance obligations attached to these shares were not met some 10–20 years later, with a resulting neglect of *karez* cleaning and therefore reduced discharges leading to poor system performance and productivity (SISDP, 1986).

Management Turnover Contracts are the culmination of a process of WUA organisation in the Philippines' National Irrigation System, which includes: (i) the organisation of Turnout Service Area (TSA) farmer groups; (ii) the federation of TSAs into and IA at a secondary canal level; and (iii) registration of the IA with the Securities and Exchange Commission. Early contracts have been overhauled since 1988 (Bautista *et al.*), but were categorised as:

Stage I – Maintenance contract for irrigation-canal maintenance at an agreed fee rate within the IA area.

Stage II – Joint system management contract – IAs assume full responsibility for O&M within the service area.

Stage III – Full turnover contract for the whole National Irrigation System, including repayment of amortisation costs.

The new contracts focus more on the collection of Irrigation Service Fees (ISF) and aim to improve incentives to the IA to adopt full turnover contracts:

Type I – Maintenance contract – as above but with revised conditions on cost levels and links to payment of ISFs by the IAs.

Type II – ISF collection contract – IAs assist in or conduct ISF collection, obtaining up to 15% of the total revenue (over a sliding scale) for 90–100% collection rates. There is an additional incentive of 25% for the settlement of outstanding accounts.

Type III – Full turnover contract.

In the Bicol region, ISF collection rates under Type I and II contracts were less than 50% in both dry and wet seasons in 1992. The NIA has apparently failed to meet its maintenance obligations in the main systems because of budgetary constraints and incomplete ISF collection, which has in turn led to disenchantment on both sides (Laurya and Sala). The declining efficiency and mutual dissatisfaction have sparked new training initiatives in system and financial management and an interest in developing IAs into multi-functional organisations to improve viability. Interestingly they have also reinforced calls for full turnover, in spite of similar declines in collection efficiency and repayment of amortisation.

In conclusion, it can be seen that much more experience is needed before successful farmer financing becomes a reality in most countries, with or without IMT, and that low-cost systems with legitimate authority are vital ingredients in the collection of service fees. Little has been said on the subject of farmers setting the levels of fees, the mechanics of doing so or its relative advantage over external pricing. It therefore remains a good subject for field research.

5.3 Role of rehabilitation in IMT programmes and cost of IMT

Rehabilitation is certainly not an essential component of IMT programmes, although it features strongly in many. It may be necessary to ensure that the system functions as designed or to address major deficiencies in its operation due to poor design, bad construction or legitimate wear and tear. Alternatively, governments may view modernisation and rehabilitation as suitable forms of incentive for farmers to take on management responsibility in publicly run systems, or as a vehicle for fostering community participation in its own right.

It is tempting to view the substantial rehabilitation component of Indonesia's IMT programme as 'construction as usual', which in no way alters the *status quo* in engineering- (rather than management-) oriented agencies. However, the extent of farmer input into design and, increasingly, into construction and contract management modifies this point of view. It has to be admitted that the 1980s initiatives in WUA formation based on construction have shown fairly rapid degeneration once that focal activity ceased, leading some commentators to assert that as few as 10% are now functional. It is well documented that functional WUAs in Pakistan's Punjab and Sind have quickly evaporated following the completion of water-course improvements and construction in which they played an energetic and significant part, as there was no business development to consolidate their financial position and role.

An excellent example of the initiation of functional WUAs without rehabilitation was provided by Srivastava, based on the restoration of the operational regime of the Paliganj distributary within the Sone Irrigation Scheme in Bihar, India. Walk-through surveys were conducted to determine where and why the system was not

operating correctly, and farmers were mobilised, through an action research programme, to operate the system to its original design rules, which had been effective in earlier times. An understanding of the operation has led to the establishment of maintenance priorities, and farmers have made selective improvements, such as desilting and clearing blockages, repairing structures, etc., to restore operational capacity. This approach appears to have been very successful, especially after higher-level political support emerged for what was initially a localised initiative. The programme of predominantly farmer-to-farmer training and mobilisation, plus improvements has cost only US$40,000 over 6 years, involving 24 villages which were notorious for interfering with water distribution covering a gross cultivable area of over 12,000 ha. Hard performance statistics were not presented, but some persuasive photographic evidence was on show.

Wilkins-Wells and Prasad's paper extracts the key point at the centre of these two experiences with its plea that rehabilitation work should be affordable for farmers who have to mobilise resources or pay back amortisation costs through irrigation fees. It further suggests that the O&M costs resulting from a particular rehabilitation strategy should be carefully considered. The share system is invoked as a good way of farmers understanding the operational requirements for capital improvement and allows them to determine sensible priorities accordingly. Farmer financing and access to credit assume further importance if this approach is followed to its logical conclusion. The following example illustrates the mismatch between capital funding for a rehabilitation-based IMT programme and current and probable farmer-financed maintenance funding. An Asian Development Bank loan of US$12.9 m. supports the US$20 m. IMT Project in Nepal, which is predicted to increase irrigated area from 32,000 to 50,000 ha. and increase cropping intensity by 30%. Assuming it meets this target, the per ha. average cost will be US$400 compared with the current O&M provision of 100 Nepalese rupees (approx. US$2) per ha. and a 'true' cost of 300 NRs/ha. (Nangju). Average cost recovery in 1984–5 was 9 NRs/per ha. (US$0.50) and the current theoretical minimum ISF is still 60 NRs/ha. (< US$1/ha.), fixed since 1976. The predicted overall Integrated Rate of Return for the project is 22%, with sub-project values as high as 48%, but it will be instructive to see how these figures turn out in practice and what that implies for O&M and the cost-effectiveness of the programme. If the cost of this programme is more rigorously attributed to the incremental area and production, the figures will look even more absurd.

Experience in Gujurat with projects assisted by the Agha Khan Rural Support Programme (AKRSP) has also shown substantial reductions in rehabilitation costs through farmer involvement in design (Anil Shah), whereas Indonesian farmer input has raised costs because of a more subtle appreciation of the need for more and better placed outlet and cross-drainage works (Bruns and Atmanto; MGIP, 1989). The difference between the two examples is that farmers and the NGO funded the former, whereas external agencies funded the latter.

Three of seven major irrigation systems transferred in Colombia were rehabilitated prior to transfer, on the basis of need and some consultation over the effectiveness of the service already provided. In the Columbia Basin districts in the USA, substantial publicly funded rehabilitation was negotiated by water users prior to turnover, but substantial investments in water-conserving technology were made by them after transfer which radically improved tertiary-level irrigation efficiency (Svendsen and Vermillion).

In the Philippines, farmer financing of rehabilitation as a means of establishing sensible priorities and levels of investment is achieved in the turnover contracts employed by the NIA for communal systems and also in Type III contracts with IAs on national systems. In China, farmer-financed rehabilitation, with selective public subsidies, has allowed the transfer of management to occur fairly rapidly, whereas staged programmes involving substantial external finance for rehabilitation (e.g. in Indonesia) have a 15–20 year timeframe.

5.4 Improving agency efficiency and service delivery

Service delivery and system management, regulation and planning are all new roles for irrigation departments during, or as a consequence of, IMT. Transforming the corporate thinking and ethos from construction to service provision is not easy and has largely been neglected in IMT programmes. Participatory action research, conducted by IIMI in Sri Lanka to assist in inter-disciplinary co-ordination and understanding of actual system operation, improved the response to farmers' needs (Karunasena) and has resulted in enhanced credibility for the agency and better farmer discipline. Srivastava also emphasises the importance of trust-building through genuine partnership in management and problem-solving.

There is little doubt that staffing of turned-over surface irrigation tends to decrease (Colombia, Mexico, Nepal) and, as noted earlier with regard to India, there are genuine fears about job security and status. Strong resistance is shown to relinquishing the dominant role of construction, due to the professional perceptions of civil engineers and the considerable reduction in financial benefits arising from contract management. There may be some options for redeployment in new roles in water resources management and regulation, but absolute reduction in staff numbers is unavoidable in many situations. Training and up-grading of skills becomes important both for re-orientation and for professional development within transforming agencies (Sagardoy).

Institutional responses to changing roles take the following forms:

(i) Development of contracts between agency and users with incentives for good performance and penalties for neglect (Philippines, China, Vietnam).

(ii) Introduction of training and examination systems for professional competence (China).

(iii) Dynamic lead from the top of the administration (Philippines and Mexico).

(iv) Competition in service provision with the private sector (groundwater in India and Bangladesh) and NGOs.

(v) Corporatisation of the service agency (Australia, Vietnam, Philippines).

Organisational reform, based on performance contracts, is in the process of continual evolution for the Zhangye west main canal in Gansu province, China (Gong) and has covered the following steps:

- An inventory of the assets of the entire system.
- Evaluation of management capacity and manageability of all parts of the system.
- Setting the basic terms of contracts for management.
- Tendering for contracts amongst all the irrigation cadres and other eligible parties.
- Selecting contractors by vote.
- Distributing contract targets to all sub-contractors and sub-divisions within the system.
- Implementing performance monitoring based on 10 indices – area irrigated, project precision, balance sheet, crop yield and production value, water-use efficiency, irrigation quota, rehabilitation, safety, technical advice and training.
- Awards of bonuses of up to 3 times the average annual base-wage for good performance and 10% reductions in mean wages for poor results; dismissal of contractors who under-perform over two consecutive years.

There are plenty of opportunities for the development of appropriate performance incentives and monitoring within agencies, and more scope for action research programmes to accumulate experience for wider application.

5.4.1 Technical innovation

Clear complementarities exist between technology and reforms within service agencies and also on a wider scale within IMT programmes. The function of technology is as a tool of management and not as a substitute for poor management capacity and structure. Graaf and van den Toorn present a figure by Takase which shows an S-shaped relationship between Japanese rice yield/ha and year throughout the twentieth century: the stage of most rapid development is predominantly attributed to technical water control and agronomic improvement, with later stages attributed to institutional development. In many developing countries, the need for institutional development is apparent before many technological aspects of water control have found their footing.

Flow measurement is a pre-requisite of improved scheduling and delivery; of contracted bulk supply and volumetric pricing, and of efficiency-based maintenance and modernisation strategies. Flow measurement requires appropriate measuring devices, reliable measurement taking, recording, transmission and storage. All these activities involve new skills (requiring training) for staff and finance for hardware and software, although systems can increasingly be automated cheaply and reliably. Similarly, management is seriously compromised if there is insufficient knowledge about the status of the system: major structures (open, closed); where flows are in the system; what are the values and duration of discharge; and the expected time of arrival of flows at a given turnout point. If IMT programmes develop contracts to deliver specified volumes of water at specified times (within an acceptable margin), this information must be available to managers, as must the means to communicate between users (WUAs/TSAs) and system operators. Good communication is essential in very large distribution systems, where reaches are long and travel times correspondingly slow. If there is rain and/or temporary flooding within one part of the downstream command area, near real-time control is necessary to regulate flows and avoid compounding the problem or having to waste water which farmers do not want and will 'manage' accordingly.

There is good potential for selective use of automation in large surface systems in India, and the World Bank has supported three pilot projects in Maharashtra to experiment with automation (Baudelaire, pers. comm., 1994). The Chinese have concentrated on upgrading communications systems to improve management as a precursor to selective automation, while Korean and Taiwanese IAs are starting to make widespread use of automation to fine-tune operations and reduce staff costs. An interesting gap in research in management transfer concerns the effect of fully automated on-demand systems on the need for, and form of, user groups. Indeed, comparative performance assessment between such systems and manually operated rotational regimes is rare, apart from the conflicting claims made about the Block H experiments in the Mahaweli in Sri Lanka. North African experience of using French automation systems would be valuable in this context.

There is growing potential for the use of effective computer models both in day-to-day management and in planning services that are more responsive to farmers' needs (FAO, forthcoming). Models need careful calibration and considerable patience before they can be used with confidence, and this process in itself can improve management capacity (Boonlieu, 1993). Irrigation forecasting and scheduling is being introduced into irrigation systems in northern China and controlled-depth irrigations for wheat and rice are claimed to save up to three irrigations per year with the additional benefit of an extra 20–30% in padi yield. Remote sensing and Geographic Information Systems (GIS) are emerging as useful monitoring and decision-support tools for management in Taiwan (Shih) and India (Lath, pers. comm., 1994).

Technology forms a considerable part of improved on-farm water management, either through the adoption of water-saving application methods (sprinkler and micro-irrigation in Chile and increasingly in China: for cotton in Uzbekistan) or through improved conveyance (pipes) or better water-level control involving different land preparation and levelling techniques (bed, furrow, micro-basin). Remodelling of the 'traditional' *mesquia* channels and substitution of *saqqia* lifting wheels by pumpsets is claimed to have made great improvements in field and water-course efficiencies in Egypt, as part of the IMT programme (Abdel Aziz). Subsidies to finance desirable technology uptake to conserve water are evident in China, Mexico, Chile and Australia, and substantial investments in such technology have been made by farmers in the USA and Chile following IMT, facilitated by export-led agricultural policy and small numbers of relatively well capitalised farmers. An increasingly important function for service agencies is in providing local adaptive research and training in appropriate technology for adoption by autonomous water user groups.

The Chinese practice of installing within-system storages and using pumps to service out-of-command areas could be of great relevance in other countries under either farmer or joint management.

5.5 Groundwater

Groundwater remains a special issue in IMT. There is a fairly broad-based opinion that public promotion of deep tubewell irrigation has been flawed and that development and management are better undertaken by the private sector in a suitable environment (Shah *et al.*; Kollavalli and Raju; Mandal and Parker; Palmer-Jones; Johnson and Reiss, 1993). Certainly the positive impact of water markets on equitable access to irrigation water is indisputable in Bangladesh and parts of India. However, the severity of groundwater mining in Mexico, India and northern China casts a shadow over the long-term sustainability of unfettered private development, and the longer-term impacts on new-found equity will be adverse and considerable.

Exceptions to the nostrum of private development remain in dry regions where there are few alternatives to full specification deep tubewells (such as the limestone aquifers of east Java, Madura and some of the eastern archipelago of Indonesia) and some form of capital subsidy or financing is required to implement development. In India, there are an enormous number of publicly developed tubewells (for instance, 28,626 in Uttar Pradesh alone, irrigating roughly 2.8 million ha.) which clearly would benefit from private/co-operative organisation, free from the fetters of bureaucracy but working within a cohesive regulatory and economic framework. Whatever the merits of private development in comparative performance, continued work such as that of Tushaar Shah and Kollavalli is of great assistance in unravelling the important constituents of ownership, membership and financing that result in a sustainable and effective transition from government ownership and operation. Doubting the viability of any *organised participation* may ring true in groundwater development, especially if 'enforced' (see Palmer-Jones), but is hardly a practical position for solving real-world management and fiscal problems. The need for strong commitment to full local empowerment is more immediately evident in groundwater compared with surface irrigation, as the volume of day-to-day financial transactions in management is high and the need for a capital replacement fund for pumpsets is crucial over the 15–20 year term. Legal access to bank accounts, transparent financial arrangements and full ownership of pumpsets and infrastructure are central issues to be addressed: the private sector is quite capable of providing mechanical support services, provided there is an adequate and open market and government agencies do not try to retain the role of monopoly supply and support.

The role of the public sector is (or should be) much more clearly defined in terms of regulation, licensing and enforcement of regulations to allow sustainable and safe groundwater use in irrigation and other sectors. The means of effectively doing this are far less clear, although adjustment of energy prices is a clear option as concessionary charges are widely employed. Enforcement of statutory regulations has been dismal in countries like India (see Moench, 1992) and the administrative task of licensing existing wells – 2 million alone in the north China plain – is daunting, to say the least. Pumping quotas and variable power tariffs have been impossible to enforce and new forms of community-based regulation are indicated. The relative success of community-based salinity management plans in Australia points the way to self-management of complex and fragmented water resources problems. Similarly, the spontaneous efforts in the Philippines to establish catchment–management agreements between IAs and upland users indicate that regional management initiatives are possible. Controlled energy pricing can also be supplemented by positive incentives to adopt water-conserving technology (Chavez-Guillen, pers. comm.) and/or cropping systems as a means of reducing total groundwater withdrawals: this is most strongly evident in Israel, where water-intensive export fruit crop areas have declined dramatically in the last 5 years (Allan, 1994).

Conjunctive use of groundwater within surface irrigation systems has provided a solution to problems of water-logging and erratic or insufficient water supply from canals in northern India and Pakistan, at least where water quality is sufficiently good for sustainable agriculture. The development of shallow and deep tubewells within such systems was initially viewed with great suspicion by many irrigation departments (including those in the Philippines, where groundwater development within the NIS was technically illegal), whereas Bottrall (1992) observes that it is an almost ideal solution to the changing circumstances of protective irrigation systems in northern India. Private groundwater development effectively superimposes multiple FMIS on agency- or joint-managed systems, and the main roles for government lie in monitoring water quality and water table level, regulation, and providing technical support and possibly optimisation strategies in water delivery.

6. Future challenges

6.1 Key issues not on the conference agenda

Some of the issues not raised or discussed in plenary sessions of the conference emerged in discussion and have been addressed earlier in this paper.

- typology of transfer – types, scales, contexts, extent
- conditions for transfer – timing, motivation and need
- cross-subsidy and subsidy policy
- analysis of the dynamics of developing strategy and its relation to major policies
- macro-level water resources management issues affecting IMT
- technology/management interactions
- development of self-sustaining organisations within large-scale public irrigation schemes
- programme funding and fund management

6.2 New issues and challenges

A number of new themes and challenges arise:

(a) *IMT with minimal organisational and investment costs.* Determination of working incentives, such as better service in quantity and timeliness of supply to encourage participatory and farmer management. Food security policy and accompanying investment in irrigation assume that under-performance is due to either technical or socio-managerial problems and that, given the means to produce more, farmers will do so. This assumption needs to be tested by dispassionate analysis of farmers' risk-aversion behaviour and the real required returns to labour/management of intensification in irrigated agriculture. It can lead to analysis of the probabilities of better productivity and efficiency in fully functional self-managed systems, allowing investment of effort and finance to be directed on the basis of probable outcomes.

(b) *Financial management.* (i) Credit provision and creditworthiness, collateral for water user groups, management and enforcement of loan repayment; (ii) auditing and financial responsibility within user and supporting organisations. Autonomous financial activity by WUAs/companies; (iii) training in accounting and investment/money management; (iv) matching investment in rehabilitation and operation with realistic ability to pay: farmer financing and farmer decision-making on investment.

(c) *Need for continued specialist support.* Training in technical operations and in water conservation for system management; asset management; financial matters; low-cost local dispute resolution; provision of specialist equipment and support for maintenance.

(d) *Articulation of clear subsidy policies associated with IMT.* Local-scale value and national-scale cost: farmers should understand that subsidies will not continue as of right, particularly for routine O&M, and that whatever subsidies apply are clearly delineated

(e) *Operational methods.* Design for operation and management; arguments about authority and reliability. Objectives in operation – *pucca* and *kaccha warabandi*; demand-based (technical) systems; conjunctive use; complex (Chinese) mix of diversion, on-line storage, drainage and pumping.

7. Summary

Many practitioners and researchers in irrigation management are uneasy with the idea of producing lists of recommendations that can, unthinkingly or unwittingly, become blueprints. There is no real substitute for a methodical, wide-ranging and inquisitive assessment of the prevailing situation in public, private and community life before specification, development and implementation of social engineering experiments such as IMT. Although experience with various forms of management transfer goes back more than twenty years, the process is still regarded as a young 'science': the dominant reason for this apparent contradiction is that there has been insufficient monitoring and evaluation of performance at appropriate scales.

7.1 Key lessons from IMT

(i) There is no single model or group of models for IMT: the situations are context-specific, even within individual countries. The extent and scope of the transfer programme needs to be clearly articulated from the outset.

(ii) Monitoring and evaluation need to be incorporated into the fabric of the process and to be conceived and executed consistently to allow meaningful comparisons of performance in (a) before and after transfer, and (b) with and without transfer situations. The national- and local-scale impacts need to be assessed and more attention needs to be paid to the interrelationship of equity and efficiency. Where a number of transfer strategies are in use, some assessment of their comparative performance is also necessary. Farmer perspectives on performance should be matched against broader inclusive measures. It is helpful to distinguish between performance monitoring as a local management technique, on the one hand, and as a tool in national economic planning on the other. There needs to be development of low-cost but effective monitoring systems on both scales, with careful consideration of minimum standards for quality and quantity.

A minimal set of performance indicators is required which integrates hydraulic efficiency, welfare, agricultural productivity, financial sustainability and maintenance activity.

(iii) There is an often substantial cost in IMT which should be clearly evaluated and objectively compared with other options in improving management and productivity. There are indications that functional management of irrigation systems is in general necessary before transfer programmes are initiated. Rehabilitation is not necessarily an essential component of the transfer process and should be determined and funded on the basis of farmer input,

farmer financing and impact on improving system function; there are considerable possibilities for the application of asset-management techniques such as those used in other sectors of the water industry. Programmes would benefit from closer integration of technology, operational management and social/institutional factors.

(iv) The IMT process and programme benefit from clear statement of government policy and strategy, backed by supporting legislation at national and local levels. National and local (state) policies should ideally be congruent and mutually supporting and should define clearly what benefits are realistically expected to accrue to the actors concerned. Particular attention needs to be given to price-setting for agricultural water supply, based on negotiation with users, realistic assessments of capacity and willingness to pay and a commitment to raising rural income and welfare.

Clear definitions are required for the continuing roles of the state in management and service provision, regulation, planning, advice and technical support. However, legislation needs to be implementable and enforceable; to date, there is too much experience of inappropriate or unenforced legislation, particularly with regard to groundwater use.

(v) Experience so far suggests that programmes have concentrated on the formation of community/user organisations and neglected complementary reform within state-owned service units. The need for incentives to performance in both quarters is evident, but there is less clarity about the form of appropriate incentives, penalties and subsidies. There is a strong need to develop a culture of service provision and accountability to users ('customers'). Although this is inevitably a slow process, successful initiatives should be presented and analysed for others' benefit. The commitment to empower farmers and consolidate their management expertise should be clearly visible; merely dumping extra costs and responsibilities is unlikely to show sustainable results.

Other issues that need to be drawn out include – (a) water rights and ownership, particularly recognition of customary rights and the problem of adequate intelligence in registration; (b) more action research on viable joint management methods and 'institutions' for large complex surface schemes; (c) markets for produce, and terms of agricultural trade.

7.2 Conclusions

Improvements in natural resource management are being sought worldwide and in many sub-sectors of the economy: irrigation management transfer programmes are being undertaken as serious reforms in more than 25 developing countries. It is too

early to make unqualified assessments of the successes of the various approaches pursued in individual countries, but there have been positive and encouraging experiences in Chile, Mexico, China, Colombia, Nepal and Indonesia. That contexts of transfer are different is not perhaps surprising, but the resulting solutions defy simple classification. These concluding remarks reflect on the emerging issues.

There should be a continuing partnership between the state and the farmer in irrigation management, and the real goal of IMT programmes should be to define the nature of that partnership and to reinforce it in a substantive fashion. The scope for genuine privatisation of irrigation scheme management and ownership appears to be limited, particularly in large, complex surface water systems. There is clearly a need for more professionalised management as exemplified by Irrigation Districts in the USA, but whether this is better done through corporatisation (reform within the public sector) as in Australia, or by transfer to private ownership depends on the context and the strength of privatisation in more propitious sectors of the economy in question.

Substantive partnerships involve the continuing evolution of appropriate technical and financial inputs in conjunction with institutional development on local and macro scales, with a clear focus on performance, productivity and welfare. The variation in physical, economic and political contexts outlined in this paper precludes the prescription of a few simple models of changes in ownership and management responsibility. The balance of efficient local or user-based management and ownership with strategic goals in natural-resource allocation, food security and public expenditure has many possible outcomes. These outcomes specify different regulatory, enabling and management roles for the state and the extent to which community participation and local autonomy can be invoked and sustained. There is little comparative experience on the relative costs and effectiveness of reforming public enterprises as compared with various degrees of privatisation, especially in regard to recovering costs *and* achieving sustainable irrigated agriculture.

The Mexican experience with privatisation and devolution in irrigation management is viewed as an exemplary success by the World Bank and is being promoted as a model in other developing countries (in South and South-East Asia). There are clear contextual reasons why this is at best simplistic, but there is also little proof of the sustainability and efficiency of the Mexican privatisation, the requirement for macroeconomic stability as a bedrock for successful privatisation being one example where recent market turmoil in Mexico will have considerable impacts on the rural sector. The reluctance to analyse the equity and poverty impacts of irrigation privatisation in Mexico limits assessment of the model and therefore the advisability for transfer elsewhere. The model itself is based on US experience, where farmers continue to receive considerable direct and indirect subsidies in agricultural production: in Mexico under NAFTA, terms of trade are declining, even for large-scale farmers. Mexican farm size is relatively large and the gross

farm population is small in absolute and percentage terms compared with Asian countries. In many Asian countries, the price of staple irrigated crops is still controlled and price liberalisation, as has occurred in China, would be required before serious cost-recovery and/or privatisation could be contemplated. This points to caution rather than gung-ho promotion of the Mexican model to other situations.

Since water is a natural monopoly, and the supply of irrigation water is a local monopoly with additional constraints imposed by the delivery system and its operating rules, it is hard to see how the competitive efficiency of the market can be introduced by transferring ownership to private hands, especially when the new owners are handed the system as a gift. Are there compelling reasons why managers of monopoly systems should perform better than the public sector, if they have no responsibility either to shareholders or to make a return on their own equity invested? Privatisation may be a success where it is carried out well, but this self-defining truth is equally applicable to public sector management reform. Political realities in many developing countries mean that privatisation reforms are no less immune from capture by local élites, particularly where the formalisation of rights and executive power are concerned.

It is often stated that IMT programmes should be consistent with overall economic policy, food and agricultural policy and water resources management issues at regional scales. This may be difficult to achieve and anyway may be in a constant state of flux, but there is much evidence of opposing momentum in the allocation of increasing responsibility to producers in continuing hostile commodity price, financing and marketing environments. Another example of this inconsistency in practice lies in the momentum for privatisation within information-poor and market-poor contexts.

To date, there is a widespread deficiency in performance measurement in IMT, although this is in part due to an existing long-term deficiency in performance assessment in irrigation management itself. There is still considerable scope for international research initiatives to assist in the establishment of routine and functional monitoring and evaluation at appropriate scales, as it is currently extremely difficult to make objective assessments of the impact of IMT programmes.

There has been little discussion of farmer perspectives and views in formulating and implementing IMT programmes. The problems of achieving genuine farmer participation and representation in the management of complex surface irrigation schemes are still considerable and are not necessarily addressed in the privatisation of their ownership. Although the farmer organisation model has historically been more important than privatisation, there is still a dearth of substantive experience and analysis of the characteristics of and 'nuts-and-bolts' requirements for sustainable organisations, especially those developed within large, complex publicly developed irrigation schemes. The gender issues in representation and management

efficiency are also clearly under-researched and need swift but contextual articulation so that a meaningful gender focus can be applied, where appropriate, in IMT programmes. There may often be an inherent contradiction between participation according to the existing norms of a given society and the promotion of women's roles in irrigation management. Whilst it may be possible to construe that gender-sensitivity is a new form of Western cultural imperialism, there are clearly significant disbenefits from ignoring what is often considerably more than half the active farming population. The professionals of irrigation development may need to look elsewhere in the water and agricultural sectors for appropriate models of women's participation in nominally awkward situations.

As the various approaches to devolution and privatisation of management and ownership proceed, little concrete information has emerged on equity and poverty impacts; these issues have long-term implications for the success and sustainability of management transfer and provide useful feedback for improving the mechanics of implementing transfer programmes. Efficiency and equity are more closely entwined in irrigated agriculture than in some other economic activities, and rising inequity is not an acceptable cost of private efficiency in the short term.

A third area where there is a need for more substantive detail is in the process, techniques, innovations and incentives in sponsoring internal reform, especially the development of a 'service culture' in irrigation agencies. The further step of changing from being an implementing (constructing) and service agency to becoming a regulatory body and strategic resource manager provides fertile ground for insight and investigation.

Researchers and practitioners look to experience with FMIS to inform IMT strategy on large-scale/complex publicly managed projects, whilst simultaneously trying to introduce external ideals of equity and democratic representation, which are not necessarily features of traditional systems. Water rights in FMIS are commonly specified in relation to land-holding and historical contribution to the development of an irrigation scheme (hydraulic tenure). In FMIS, the scale of tenancy and share-cropping is minimal or in a different league from large surface schemes where the organising principles based on hydraulic tenure may not apply and the frequency of large land-holders is proportionately greater. The problem of authority within and between component organisations making up a system-wide Irrigation Association has no parallels in FMIS. Similarly, regional water management by effectively competing autonomous or semi-autonomous IAs requires a new institutional framework and authority, for which FMIS experience is clearly inadequate.

Evidence in the USA, Australia, the Philippines and other countries is starting to indicate that farmers may not necessarily be better managers than the state, particularly with respect to maintaining and financing repairs to the physical infrastructure. Desire for the minimum possible water price seems to neglect

longer-term considerations or implicitly assumes that the government will always step in to finance deferred maintenance. This possibility needs to be given greater attention in emerging IMT programmes.

The IMT process does, in most contexts, require a long time for completion and should be costed and managed accordingly. In particular, there is scope for improvement in farmer financing and farmer financial management. Transparent but effective systems of accounting, auditing, credit financing and collateral provision need considerable research and development, both within farmer and public organisations as well as between the two.

Successful implementation of IMT goes beyond transfers and badges of ownership if it is to result in improved rural livelihoods and productivity at a lower cost to the state. It should improve the management, accountability and sustainability of irrigation services through appropriate mixes of public and private enterprise, making maximum use of market-like instruments and functional but practical public participation.

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Appendix A – Privatisation and irrigation

It is perhaps wise to look at privatisation in a more general light in order to set a context for the more awkward case of irrigation services. Therefore, we summarise here other commentators' broader experience with the privatisation of public enterprises in developing (and developed) countries.

General definitions of and conditions for privatisation in developing countries

Although a rigorous definition of privatisation implies a shift from public to private ownership, in practice the term is used to describe a wider range of shifts in the operation, context and ownership of public enterprises. For example, Killick (1994) provides the following summary.

The defining characteristic of privatisation is that it involves a shift towards a more market-oriented management of assets initially held within the public sector. This can be achieved by a number of means, arranged below in roughly ascending order of extent of change.

Reform. Retention of a public enterprise (PE) within state ownership but the re-orientation of its objectives and management in a more commercial, profit-oriented direction.

De-monopolisation. Opening up a public enterprise to competition from the private sector when it initially has a legal or *de facto* monopoly.

Contracting-out a public enterprises' management or other functions; or leasing out the entire enterprise.

Franchising. A system of competitive bidding for the right to operate an enterprise remaining within public ownership (usually a monopoly) for the delivery of minimum quantities and qualities of output specified in a contract.

Mixed enterprise. Partial sale, converting a PE to the status of mixed public-private enterprise, with or without the transfer of controlling ownership.

Divestiture by the state of its ownership of a PE, or some of its assets/operations etc. This is the sense in which 'privatisation' is most commonly used. Sale by the state can be by public means (e.g. sale of shares to the general public, or by auction) or by private sale (e.g. sale to an existing private enterprise, or management buy-out)

Liquidation. Placing a PE into liquidation and cessation of business. This may be thought of as privatisation in that it is presumed that private enterprises will fill the gap thereby created.

Savas (1994) includes the marketplace, voluntary organisations and the family among the private institutions of society and defines three categories of privatisation: delegation (franchises, contracting-out etc.), displacement (gift to not-for-profit organisations) and divestment. He notes that, in a strict sense, collective goods have to be supplied collectively and cannot be supplied by the market, although market-like institutions and instruments may be developed.

Killick notes the paradox of the state promoting the market, when in some cases the state has seen the market as the opposition. He lists the following requirements to develop an institutional framework that is favourable to markets and hence economic efficiency:

(i) Specification of reliably enforceable property rights to create confidence that contracts will be observed or actors will have legal redress.

(ii) Lack of arbitrary state interference in the private exercise of property rights.

(iii) A policy framework that includes a consistent long-term taxation policy on profits and one that supports and is founded on macroeconomic stability.

(iv) An appropriate balance between necessary regulation of the private sector and detailed interference in the operation of markets (e.g. price control).

It has commonly been argued that, in privatising centrally planned economies, the priority is to create space for the development of private institutions and the market, whereas in mixed economies the focus is on widening the scope and signalling the seriousness of pursuing a more pro-market policy stance. Candidates for privatisation should be those with obvious comparative advantage, such as the denationalisation of small-scale firms and enterprises in sectors characterised by the absence of market failure – i.e. those which have no social or economic justification for public ownership. Alternatively, candidates for privatisation are determined by allowing the market to do what it can, whilst recognising that it cannot do everything and therefore redefining the precise role for the state. This latter approach is clearly both more malleable and more ambiguous.

Killick's review of the African experience with (externally imposed) privatisation highlights the problem of trying to satisfy multiple objectives, such that the chief motivations lie elsewhere than in actual market development, namely in:

(i) reduction in public expenditures, or adding short-term revenue by divestment;

(ii) raising economic efficiency – strengthening enterprise management incentives and supervision;

(iii) rewarding political supporters;

(iv) compliance with the conditionality of external donors/lenders.

The most important conflict is a major developing country objective of reducing poverty and inequality, which is often an early casualty of market development, since 'potential pareto-optimality' (nobody loses) is an idealised abstraction. Practical privatisation involves a politically acceptable trade-off between the benefits to winners and the disbenefits to losers.

Killick states 'powerful though it is, the budgetary motive imparts biases to the privatisation process which are liable to be inimical to its use to promote market development'[8] (p. 16) and argues that divestment requires careful selection and preparation of PEs for sale. He observes that overcoming the resistance of interested parties, especially where there has been 'private capture' of public enterprises, entails extra transaction costs and that these costs need to be analysed and covered by privatising governments.

The lessons learned from privatisation can be summarised as follows:

(i) Political factors (e.g. public acceptability; capture by private interests that already have a stake in public enterprise (Craig, 1990)) dominate outcomes.

(ii) Budgetary and non-efficiency goals assume priority among the objectives of privatisation and dampen rather than enhance market development (competition and economic efficiency).

(iii) Public support is necessary for successful and sustained privatisation. Killick notes a strong contrast between internally sponsored Latin American privatisation and externally induced developments in Africa.

(iv) All privatisation transactions should be transparent, in part to enhance public acceptability but mainly to ensure administrative efficiency in divestment.

(v) Successful privatisation requires a supportive economic and policy environment.

(vi) Privatisation is likely to be market-promoting when it enhances competition, and therefore the prime candidates require little or no public interest regulation.

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[8] Examples of this are over-hasty divestment or transfer before suitable market and institutional capacity exists, or without appropriate regulatory frameworks; conversion of public sector to private sector monopolies; effective liquidation of enterprises that perish without continued (or temporary) public subsidy.

(vii) Regulatory frameworks and agencies need to be in place before privatisation.

(viii) Privatisation programmes should begin with 'small' enterprises first and should break up larger monopolistic enterprises, unless these are natural monopolies.

(ix) Divestiture should not be confined to loss-making enterprises.

(x) Unsaleable, non-viable enterprises should be allowed to go into liquidation.

(xi) The state should retain reserve powers (golden shares) in clearly specified matters of public interest.

Public-enterprise reforms have rarely been viewed as successful, in part due to the problem of having to satisfy multiple objectives, which replace the simple commercial bottom line of profitability applied in the private sector. Indirect approaches between complete divestiture and public-enterprise reform (de-monopolisation, contracting-out, franchising and creation of mixed enterprises) have also underperformed, leading the World Bank (1992, unpublished report) to assert that privatisation of management is a less than perfect substitute for privatisation of ownership but may be a useful first step. The middle path is not free from features of public ownership, as shown in government-imposed investment and pricing policies in the semi-privatised public water supply in Côte d'Ivoire. Indeed, recent restriction on the rate of price increase for services from the UK's privatised water companies is considered to be a price cap, instituted by a government nervous of the political fall-out resulting from rapidly rising consumer costs, sizeable dividends to shareholders and excessive 'rewards' to managers of privatised local monopoly enterprises.

Privatisation and Irrigation

Seckler (1993) lists four benefits claimed by proponents of privatisation in irrigation:

i) *Cost savings* for the public sector, by forcing farmers to incur O&M costs themselves or to pay for public *(or private)*[9] sector services they receive.

ii) *Increased on-farm irrigation efficiency* through volumetric pricing. Currently the marginal cost of water to most farmers is zero, encouraging them to use more than the economic optimum, whenever possible.

iii) *Increased allocative efficiency* of water use through water markets to enable farmers to trade among themselves or with urban, recreational and industrial users and environmental groups.

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[9] Added by this author,

iv) *Improved management of irrigation systems.* If irrigation agencies (or their private successors) depend on water sales for revenue, there is a strong inducement to improve the service and responsiveness to clients' needs. Similarly, the behaviour of clients is expected to improve in the knowledge that legal action or other regulated sanctions will be applied when agreed contract responsibilities are not met or are broken.

This list is one of multiple objectives, the dominant one in practice being the reduction of public subsidy and expenditure in the O&M of irrigation systems, occasionally extending to recovery of a portion of the capital development costs. In the light of the generalised experiences noted above, is privatisation of ownership of irrigation likely to be effective in promoting efficiency and reduced costs, without negative impacts on equity and poverty?

The question of market competition does not arise in surface irrigation schemes as the intrinsic natural monopoly characteristic of water (see Winpenny, 1994) is compounded by the local monopoly of supply from one source (dam, weir, reservoir, etc.) via a fixed infrastructure that is constrained by detailed and relatively inflexible operating rules. Market competition is a possibility when there is a high density of privately developed and owned groundwater bores (shallow or deep), although sustainability of the resource poses problems for long-term market stability and generally introduces the need for regulation in the public interest.

Utility models can be developed such that government can award limited-period franchises, open to competitive tender, for the bulk purchase and onward vending of water to consumers, but there is little experience with this so far. More usually, privatisation in irrigation most closely conforms to the transfer model where the infrastructure is granted to the new owners (either at nominal repayment of capital costs over a specified period or with all capital costs written off). It is almost universally true that irrigation privatisation is never carried out in the form of divestment, where the enterprise is sold at (or near) its capital and enterprise value. It would be interesting to determine whether the enterprise value of an irrigation system exceeds its capital value: if its enterprise or sale value is less than its capital value, it could in theory be broken up and sold, but the infrastructure has no intrinsic value for other purposes, unlike building or land owned by industrial enterprises. The estimated £20 billion capital value of Britain's water infrastructure was gifted to the new PLCs for this reason, and the equity raised by public flotation was required to meet new investment costs, to comply with EC directives on water quality (see Briscoe, 1994, for detailed discussion of why privatisation does not result in economic efficiency in this case).

Ownership is a key difficulty in irrigation systems, as governments still retain (often for compelling strategic reasons) ownership of the headworks (dam, etc.) and possibly the primary canals. In this case the government agency remains in the position of a monopoly supplier and lies at the centre of a mixed system. Irrigation water has many characteristics of a common property resource (Ostrom, 1990), which are difficult to

surmount in developing countries where the scale and complexity of irrigation schemes are great and there are enormous numbers of individual users (both landowners and tenants) with relatively small holdings. Although specification of individual rights has been possible in the USA and Australia, due to relatively small numbers of farmers with large individual land holdings, it is hard to conceive of the same thing happening in developing countries. The administrative burden and transaction costs involved would overwhelm the benefits. Indeed, in the USA it has been possible to divorce rights to water from the ownership of land, whereas rights in Australia are still attenuated (Musgrave, 1994). Even in the USA, Leigh-Livingstone (1993a and b) notes that the transaction costs of water marketing based on individual rights can be excessive and cites as an example the expensive and costly litigation that has brought rural to urban transfers to a standstill in Colorado. In contrast, the administrative system used in New Mexico employs economic principles in the valuation and clearance of applications to make transfers with much lower transaction costs and rapid resolution.

Group ownership is a possible alternative, but the development of internal institutions for effective and sustainable water management has been the subject of much research and public investment for the last 20 years, and highlights the dilemmas between private and common ownership and management of resources. Group ownership is as prone to rent-seeking, élite domination and corruption as agency management, and it is questionable whether it is harder to institute the necessary safeguards in public than in group ownership. For instance, the use of independent, well-paid auditors, with ability to prosecute illegal activities, would provide similar assurances of accountability in public or private settings.

Ostrom (1992) points out that the competitive market itself is a public good and that individuals can enter and exit freely whether or not they contribute to the cost of maintaining and providing it. Many competitive markets are supported by strong underlying public institutions, which have evolved over considerable periods of time in developed countries and are still in the process of refinement (viz. responses to the recent collapse of Barings merchant bank, where the market (rather than the individual player) is underpinned by the Bank of England).

The scale and riskiness of investment in irrigation infrastructure are reasons why the state became involved in financing it in the first instance. In Chile, since the government withdrew from financing the majority of infrastructure development costs in the early 1980s there have been no major large-scale water projects undertaken, which in turn has stimulated the adoption of water-conserving technology. By the same token, the state may not wish to relinquish ownership of major infrastructure (e.g. Hoover and Grand Coulee dams in the USA) when it has made substantial unrecovered contributions to its construction.

The development of market-like institutions and incentives to economic efficiency find a setting in irrigation which inevitably intermeshes private and public institutions. Added to this is the complexity of as yet incompletely understood externalities such

as salinity and water-logging, which imply the need for regulatory and voluntary codes of management. Such externalities also raise considerable difficulties in valuation and for incorporation into financial transactions governing appropriation and use of water.

Seckler (1993) observes that privately owned and managed irrigation systems look attractive (to economists and policy makers) to reduce problems of governance and improve the development of reciprocal feedback arrangements between supplier and user; this, despite having argued that the problem of governance must be solved before privatisation in developing countries can be effective. The allocation of rights (on individual or group bases) by the state is a clear case where rent-seeking and corruption of the 'old system' can impinge on the development of a 'fair' market. The requirement of public support for successful privatisation has obvious relevance in terms of ensuring transparent and equitable allocation or formalisation of rights. Public support in developed countries is often dominated by the non-agricultural taxpayer, whereas in most developing countries of Asia and Africa (to a lesser extent Latin America), the general public is the farming public and will be more likely to resist privatisation if it entails higher costs of production and exaggerates equity and poverty problems. Governments have the unenviable task of balancing low-priced food supply for a powerful urban lobby with the economic interests of a more slowly responsive rural community. The present Zapatista rebellion in the Chiapas in Mexico is largely based on the issue of further distortions in power and land-holding due to the privatisation of *ejido* (communal) lands.

Taiwan has regularly been cited as an example of the effectiveness of private ownership and management in irrigation. Moore (1989) shows this to be a myth and convincingly demonstrates that the acknowledged managerial efficiency of the Irrigation Associations has little to do with 'dispersed competition' inherent in the ideal models of the market and electoral democracy. IAs are in fact controlled by local political interests and a professional technical bureaucracy, and are supported by considerable public finance for both operational and rehabilitation activities, which has at times isolated the managers from the consequences of poor fee collection and mis-allocation of water and IA revenues. The Provincial Water Conservancy Bureau, since a period of significant fee defaulting in the early 1970s, has assumed responsibility for financing IAs and oversees them and their 'working stations'. It has monitored the rate and speed of fee collection as indicators of managerial service, which has shifted the balance of local bargaining power in favour of water users. The political underpinning for the effectiveness of this policing role is that the PWCB and the higher governmental bureaucracy have been dominated by mainlanders, whereas the IA administration is native Taiwanese and closely integrated in the client community.

The conclusion of this analysis must therefore be that what now passes for privatisation in developing country contexts is in fact a devolution of authority to manage (and sometimes own) parts or all of an irrigation system and therefore contains all the uncertainties of mixed systems outlined above. At its crudest, what currently passes for privatisation by devolution of authority and ownership to users could be more correctly considered as a form of decentralisation in a highly centralised local administration (the

scheme), where the existing bureaucracy maintains significant authority, too frequently uncluttered by defined contracts and detailed rights and responsibilities. One might wonder if privatisation is just a new name for continuing the attempt to find appropriate institutional arrangements for the management of public irrigation schemes, which incorporate financial responsibility, customer service and use of market-like instruments. If privatisation of public irrigation is stuck in this middle ground, the focus then changes to determining the optimum combination of institutional, organisational and market-like arrangements suitable to specific contexts.

Appendix B: Performance indicators in IMT

Paper/Country	Crop area CA (Ha) [%]	Intensity CI (%) From to	Water use WUE %	Water use Reduction in m3/ha	Yield kg/ha	Prod. Kg/m3 water	kg/$O&M	Maintenance activities	% O&M covered by charges Gravity Pump	Equity other indicators
Sumatra Sumani Pump *Asnawi*		130 200								
Hebei c/s PRC (North) Nanyao			53%						107 mixed	
Bayi *Jintang*	3600-5567 +55%		72% Fewer events	17,000 m3/ ha/yr to 10,000 (-41%)	+62% 7500/ha - 12150				135 mixed	
Vietnam (Nguyan) & Red River exmpl	+14% all +27.5%	170 250 R/River ex	from 50 to 81%	-36% 8000-5120	+9% 3190-3490				50-60 30	
Sri Lanka Kaudulla *Wijaratna*		140 ('84-89) 200 ('90-94)					inc technical performance performance		(on basis of rehab.) dec.	financial/maintenance
Philippines (Joest) Subsystem 180 Ha							not really comparable before and after			
Zhangye PRC *Datian*			45% (1984) to 58% (1994)			0.5-0.72 89-92		41%-82% complete 76%-94% ('84		
Nepal JMP *Rana et al*	+41% summer +17% winter				-150 - 200%			O&M cost/ha 600-300Rs/ha		
Shandong, PRC Shou Zhangji, *Zhenmin*	1724 (1980)- 1347, +22% ('82) 2334, +72%)('93)		40% (1980) to 67%(1992)	18,000 ('80) to 9150 ('85) to 6090	+61% 5925-9518 (+130%/caput)					
Niger *Lonsway*	4000-11,000 mainly season 2 expansion	? 200 (80-81)			+25% 4000-5000					
Philippines *Bautista*		DS growth rate 40% + MTP 20% no MTP	Dry season only		increase no figures				lower O&M + MTP 60% of nonMTP('81) 70% in '91	Personnel costs - 72% 200/ha - 280 ('81) 340 - 450 ('91)
Mexico *Palacios-Velez*			+10-20% in CE%							Survey - better service but no figures
Nigeria (HJRBDA) *Musa*		+80% in DS						variable exp		
Egypt 3 studies *Hvidt*			40% to 70-80% post imp. w/c head - tail but not summer water		+10-14% grains + 16.5% sugar cane				Opn reduced 44%-63% after new tech & WUA	Maintenance too early to measure impact
Uzbekistan FSU *Berkoff*			54%	1720mm/ha to1260 ('80-92 (-26%)	Hard to tell above world average					
Gujarat, India *Tushaar Shah*	+30% to +45%									
Laofangqiao Town PR *Zhajang*										
GKF in Bangladesh CADP prog.	Full year area 13-18 ha compare. 11-13 ha for BDWB	+44%	43%		Similar 3400-4500 both groups					
Colombia Garces-Restrepo 7 dist (Coello/Saldana)			From 44-86.1% post IMT		+23% 5500-6800					No before and after except staffing
Saharda Sahayek India *Sinha*	Rabi & Kharif 209- 260 ha Avg=+25%				2500-3300 W 2450-3530 R					Improved head to tail disparity
A.P India Godavari Pilot (2086Ha) *Rao*	+17 to + 97% + changes in crop comp'n		increased 40 to 49%							16% area unirrig. in WS 35% area unirrig. in DS inc equity between minors
Nepal *Shivakoti*		H 195 L 177 248 238 216 202	AMIS FMIS JMIS		4940 5560 4290					
China - Manas River *Yuan*			From 60-70 CE% (1991-93) better FE%	better (no figures)	+21.6% grain (91-93) +10% cotton			Newly built & upgraded channel etc.		gw declined to 2m from 1.5m, positive impact on waterlogging
Columbia Basin USA *Svendsen*			decline conveyance effy since 1978						95% subsidy	

WUE = Water Use Efficiency
CE = Conveyance Efficiency
FE = Field Efficiency

w/c = water course

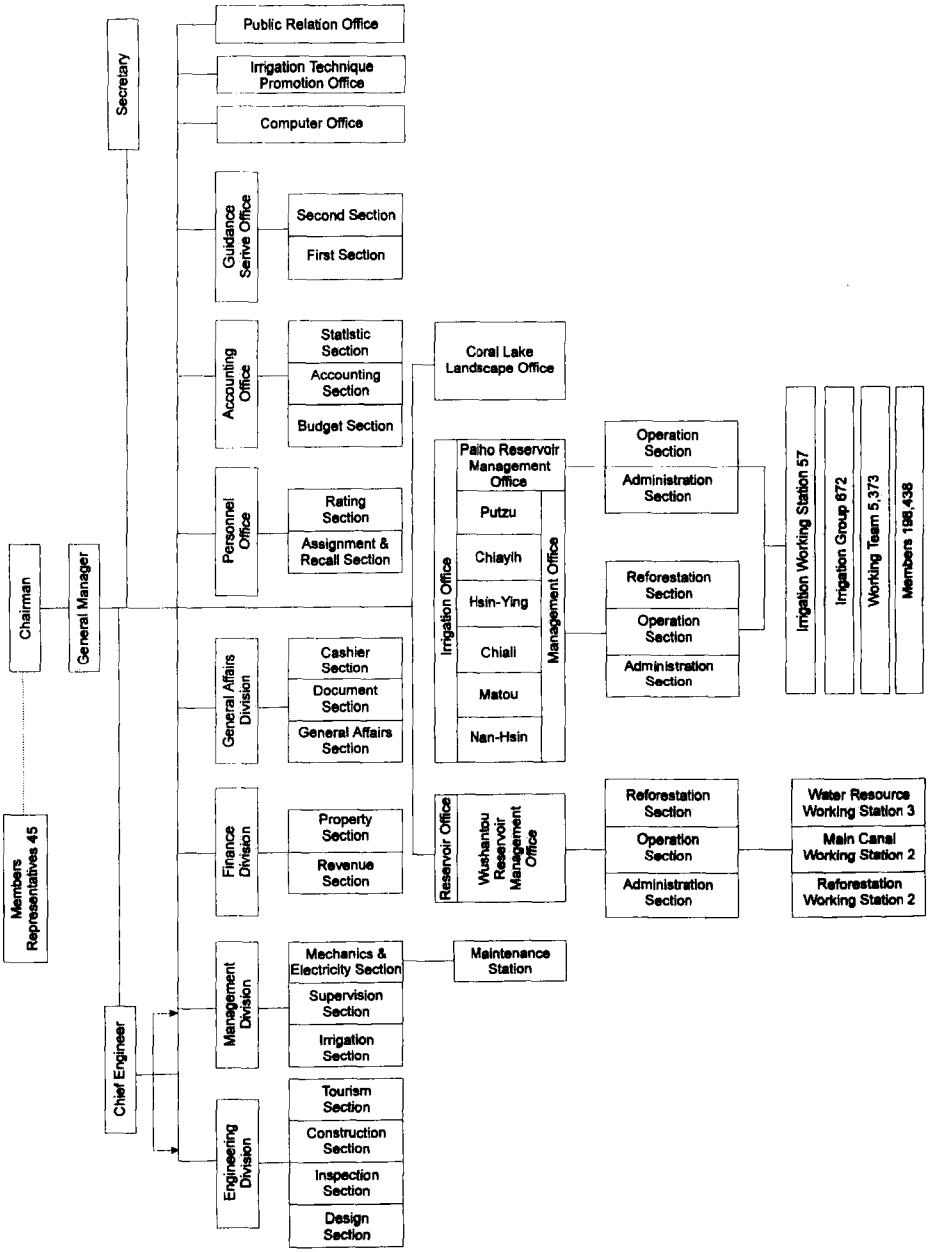
MTP = Management transfer Programme
H = Hill area
L = Lowland (Terai)

(c) = constant prices

AMIS = Agency managed irrigation system
FMIS = Farmer managed IS
JMIS = Joint managed IS

Paper/Country	Av. income per caput	Net returns /ha *	Owner: share croppe income	Fee collection rate	Av depth /ha	H/O date	ISF Full cost	O&M only $ Lab	Other	Notes
Sumatra Sumani Pump *Azmawi*	+227% {c}	+113%	only 65% of owner/ operator	N/A		1986	70	35 (1990)		Power performance on gravity
Hebei c/s PRC (North) Nanyao	+ 100% '84-94 marginal {nc}			preIMT 30%-70 after 90 -97%	750mm	1984-		38 +11 md	3y/100m3 + 1.5/mu aggregate 15y/mu	
Bayl *Jinxiang*				90% advance paymt	750mm conflict in data	1984-		93 +15-20 md (official '93)	36y/mu (vol)	IIMI Performance rating system routine
Vietnam (Nguyan) & Red River exmpl				70-80% 43-60% ('91-93)		1990			180-300 kg padi per ha	WB pilot project
Sri Lanka Kandulla *Wijarana*			mixed	performance not perf of IMT					53 Rs/ha - zero in 1991+	lots of system ?? big decline in O&M money used eslewhere
Philippines (Joest) Subsystem 180 Ha				variable 40-36 -80 (91)					50kg/ha/season amortization	
Zhangye PRC *Datian*	+50% (87-92) {nc}			can't assess but less than costs		1984-				costs > revenues
Nepal JMP *Rana et al*		Mainly due to maintenance - desilting? (US money/initiative) some local resource mobilization								+Rehab &desilting +400% water supply fractured
Shandong, PRC Shou Zhangji, *Zhenmin*				deficit in 92 excess 90, 91		1984-		21 41	120yuan/ha	90,000 ha no perf.
Niger *Lorsway*						83-87				inc. transplanted rice
Philippines *Bautista*				60% in MTP 43% non MTP 61% return on on 83% of area						competition between transfer and non transfer projects
Mexico *Palacios-Velez*							40-50 50$/ML		dec. in staffing 40-50%	no real before and after stats
Nigeria (HJRBDA) *Musa*				50%			750/ha/yr costs 95$/ha/yr (massive deflation)			15,000 ha
Egypt 3 studies *Hvidt*	inc 60USD/yr {nc}									Survey - not measured did ???
Uzbekistan FSU *Berkoff*										
Gujarat, India *Thakaar Shah*							-45-50% after MTP but private marginally more exp: 20 more hrs		proportion of potential pumping hours	Private versue h/o well
Laofangqiao Town PR *Zhajang*				Near 100% of not v.much			38%subsidy 50% Div.Ents 8-10$/ha	12% only	Subsidies needed due to energy cost of pumping	High impact of water magmt technology
GKF in Bangladesh CADP prog.									Warning - more of a disaster, micro & macro losses under GKF mgnt	940 DTWs Electricity Subsidy
Colombia Garces-Restrepo 7 dist (Coello/Saldana)	No before and after except staffing					(1976)	1955-75 90% of capital repaid	declining volumetric fees + area fees	maintenance problems constant prices	little before & after very different between schemes
Suharda Sahayek India *Sinha*						1987 (co-op)		Paid 50% of income	Excess water	water co-op and survey tampering with water measurement
A.P India Godavari Pilot (2086Ha) *Rao*									O&M grant 8USD/ha	390,000 Ha Equity minor distributory
Nepal *Shivakoti*								50%		Agency AMIS/FMIS/ JMIS comparison
China - Manas River *Yuan*										No real before & after comparison
Columbia Basin USA *Svendsen*	$/ha inc steadily (1982$) {c} 200-750						12% of capital 88% xsub HEP			powerful lobby 'private' with big subsidies

Appendix C: Irrigation Management in Chia-Nan Irrigation Association



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