# Policies, Institutions and Governance Challenges of Irrigation in Twenty-First Century[1]

By
Ganesh P. Shivakoti
Associate Professor
Agricultural and Natural Resources Economics
School of Environment, Resources and Development
Asian Institute of Technology
P.O. Box 4, Klong Luang, Pathumthani 12120
THAILAND
E-mail: ganesh@ait.ac.th

[1]Paper prepared for presentation at the Eleventh Biennial Conference "Survival of the Commons :Mounting Challenges & New Realities" of the International Association for the Study of Common Property (IASCP) to be held at Bali, Indonesia during June 19-23, 2005.

**Policies, Institutions and Governance Challenges of Irrigation in Twenty-First Century**

Ganesh P. Shivakoti

## Abstract

Research on irrigation management has cumulated a rich body of knowledge on irrigation governance, institutions and management. This new knowledge has provided the basis for major changes in irrigation policies in the last two decades, including management transfer programs, assistance to farmer-managed irrigation systems, and irrigation financing. In the beginning of 21st century, however, additional broader related issues have surfaced which include: How to respond to the competition for water resource itself among different sectors; what aspects of institutional reforms deal with related to governance and management of water resources; and how irrigation management can be made pro-poor responding to livelihood sustenance; among others. In an effort address these challenges thoroughly so as to provide a firm foundation for confronting them effectively, following five themes need to be addressed: (1) The processes of globalization, industrialization, and urbanization are all generating immense pressures for a *transition* from earlier political, economic, and social institutions to new arrangements in all sectors. (2) *Competition* for resources-particularly water-will increase throughout the world over time leading to immense conflicts unless substantial innovations occur. (3) *Institutional reforms* are among the most important innovations that are needed to meet these challenges. (4) *Markets* will be a more important aspect of water management in the future that they have been in the past. (5) *Strategic policies* conducive to govern and manage water resources effectively in light of transition, competition, institutional and market reform era. These themes will be discussed in the paper by identifying and documenting the changes of the context of global irrigation management; assessing how these macro changes affect the incentives, opportunities, and constraints of farmers at the local level; and explaining how and why farmers in different settings have adjusted, or failed to adjust, their local irrigation in responses to the changing context.

**Policies, Institutions and Governance Challenges of Irrigation in Twenty-First Century**

## 1. Introduction

During the past few decades research on irrigation management has accumulated a rich body of knowledge on irrigation institutions and management. This new knowledge has provided the basis for major changes in irrigation policies over the periods, participatory planning and decision making about irrigation investments, management transfer programs, new approaches toward assistance to farmer-managed irrigation systems, and joint financing of irrigation systems (Coward 1980, Uphoff 1986, Ostrom 1992, Vermillion 1997, Groenfeldt and Svendensen 2000, Shivakoti et al., 2005).

Over the last two decades, with the assistance of international financial and development organizations, governments in many countries have embarked on strategies to improve the institutional frameworks for irrigation management. Recognizing the limitations of a bureaucratic mode of irrigation management and the value and potential for local governance opened the way for transferring responsibilities from irrigation bureaucracies to user groups. This is not, however, sufficient for developing effective institutions. Solutions require a nuts and bolts understanding of institutional design, as well as the dynamics of institutional development (Lam, 1996, 1998; Ostrom 1990, 1992, 2005; Ostrom, Lam, and Lee, 1994; Pradhan, 1988; Shivakoti, 1992; Shivakoti and Ostrom, 2002; Shivakoti et al. 2005).

The ineffectiveness of many bureaucratic modes of irrigation management does not mean that the state is irrelevant and or that it should be excluded from involvement in governance. Effective irrigation management requires that people understand and develop locally-appropriate institutional arrangements and division of roles between the state, the community of water users and the private sector (Lam, 1999).The continuously changing environment in which irrigation systems operate constitutes another challenge to irrigation management. Rapid economic development, competitive uses of water and changes in the political and social setting pose many new challenges for irrigation management. As industrialization advances and economies develop, irrigation becomes more than simply delivering water to fields in an orderly manner (Lam, 1996; Ostrom, 2005; Shivakoti and Bastakoti, 2006).

Economic development has substantially changed farmers' cost-benefit valuations of irrigation management. As agriculture becomes less lucrative, farmers face fewer incentives to invest in irrigation management. It is not uncommon to find a decline in collective action for irrigation system management, especially in areas close to cities. Declining incentives to invest in irrigation systems is not only confined to farmers; governments in many countries are also becoming less willing to invest in irrigated agriculture. This lack of attention is unfortunate since government support will be essential to enable institutional changes that will be necessary in the future. From past experience we know that good management of irrigation systems is one of the major factors that have contributed to global agriculture development (Itty, 2000). However, declining rates of increase in crop productivity, brought on by declines in the productivity of irrigation, could lead to rising food prices and worsening malnutrition. And, it is widely recognized that most of the needed future increase in food production (to meet the needs

of ever growing populations) will have to come from irrigated land. Hence, irrigation still has an important role to play in sustaining food security and meeting the economic and livelihood needs of the rural poor.

Significant advancements have been made over the past two decades in understanding what is involved in improving the management and governance of irrigation systems. Now, at the beginning of the twenty first century, additional water related issues are emerging. Some of these include: How to respond to the rising competition for water among different sectors? What kinds of institutional reforms appear to have the best potential for coping with future demands for more intensive governance and management of water resources? and How should irrigation management be changed to better address the needs of the poor? The irrigated agriculture will have to face three basic challenges related with competition for water; accountability and new partnerships; and, reform, synergy and economic productivity.

This paper tries to address the following five major themes as an effort to describe the abovementioned challenges thoroughly;

1. Globalization, industrialization and urbanization are generating immense pressures for a *transition* from earlier sector-specific line agencies to multi-sectoral organizations or clusters of organizations capable of coordinating integrated water management and use within irrigation systems and river basins.
2. *Competition* for resources – particularly water – will increase throughout the world over time, leading to immense conflicts unless basic reforms and new governance forums are created.
3. *Institutional reforms* are among the most important innovations needed to meet these challenges.
4. *Markets* will be a more important aspect of water management in the future than they have been in the past.
5. *Strategic policies* conducive to govern and manage water resources effectively in light of economic diversification and integration, demographic transitions, rising competition for water, and requirements for institutional and market reform.

These themes can be addressed by identifying changes in the context of irrigation management during the last two decades, by assessing how these macro changes affect the incentives, opportunities, and constraints of farmers at the local level and by explaining how and why farmers in different settings have adjusted, or failed to adjust, their local irrigation institutions in response to the changing world around them.

## 2. Changed global context and challenges of Irrigation management

Irrigation management in the new millennium is facing new challenges that were unknown to irrigation policymakers and irrigators two decades ago. These challenges have to do with the fact that irrigation management is becoming more and more integrated with its environment—bio-physical, socioeconomic, political and global. An implication of the increasing external integration of irrigation with the wider basin environment and global economy is that irrigation systems must compete with other sectors and be represented in regulation and governing forums at higher hydraulic levels. Problems associated with rising external integration have

serious implications for the present design of irrigation institutions. The degree to which irrigation management is sustainable in the future will depend on how effective water users, policymakers, technical experts, researchers, NGOs and other stakeholders will be in designing future irrigation institutions that will be able to cope with future complexities.

### *2.1 Global integration: Institutional transition*

With the advancement of technology and the increasing interaction among peoples around the world, physical distance no longer poses as major a constraint to human cooperation as it did in the past. Perhaps an even more important driving force for a higher degree of integration is the development of trade. The development of the WTO is a strong force for economic integration. For farmers in developing countries, however, agricultural trade is a two-edged sword. On the one hand, rural areas are not likely, by themselves, to generate growth in demand for agricultural products unless they trade. Without increased demand for agricultural products, the agricultural growth needed to generate employment and reduce poverty in rural areas will not come about. Agricultural trade also means connecting local agriculture to the division of labor of the global economic system, which means making local agriculture subject to world competition. Whether the benefits of agricultural trade can be reaped depends on whether the countries are able to make necessary adjustments to their agriculture sectors so that they are able to find a niche in the global economic system (Shivakoti, Lam and Pradhan, 2005).

Global agricultural trade often results into lower prices of agricultural produce as in the case of lower grain price in many Asian countries. Similarly, labor-intensive mode of farming and generally small land holding do not give agriculture sectors much competitive edge in the international market. In countries where the industrial and business sectors have developed, farmers will not have incentives to put much effort into agriculture. Those who are more willing to take risks and have the necessary capital will tend to shift to higher value commercial crops. But the majority of small farmers will tend to give up on full-time farming. Whether a shift to commercial crops has happened or not, irrigation system is facing growing challenges. In areas where agricultural production has shifted to commercial crops, irrigation systems originally designed for grain production will have to modernize their management and possibly their infrastructure. In areas where a shift to commercial crops has not happened, farmers have declining motivation to invest in irrigation.

In less developed countries, where agriculture is economic lifeline of the economy, the adverse impacts of agricultural trade are particularly significant. Farmers in these countries find that their agricultural production is not competitive and value of agricultural products is gradually declining. With falling grain prices, farmers are getting worse off by day. Additionally, economic incentives for shifting to commercial crops are likely to drive away small-scale grain production. Unemployment, under-employment and poverty could become more widespread in countries where a majority of rural people live on subsistence farming.

### *2.2 Economic integration: Competition for water resources*

Irrigation consumes around 70 percent of total developed water supplies. A projected 2.7 billion people will live in regions that will experience severe water scarcity within the first quarter of this century (Seckler et al., 1998). Water shortages could lead to conflicts in Middle

East and North Africa but are likely to impact most severely on poorest segments of the population in South Asia and Sub-Saharan Africa where incidents of poverty are already high. However, the shortage of water will be pervasive, extending well beyond the semi-arid regions and affecting even populations in well-watered areas. Expanding demand for water is draining some of the world's major rivers, leaving them dry throughout most of the year.
The growing scarcity and competition for water is dramatically changing the way we value and utilize water and the way we mobilize and manage water resources. With growing municipal and industrial demand for water and needed water requirements to protect the environment, there will be less water for agriculture in the future. We must produce more food and agricultural products with less water. Many people believe existing irrigation systems are so inefficient that most of the water needs of all sectors could be met by improved management of irrigation and transferring the water to the non-agricultural sectors. Others argue that the potential savings from new or improved management practices is not as great as frequently assumed.

Similarly, rapid economic development has brought about a new context for irrigation management. With advancement of industrialization and diversification of economy, irrigation is not simply about delivering water to fields, but is increasingly concerned with articulating with its external environment. Perhaps the important issue is increasingly fierce competition for water among different economic sectors. Traditional community based irrigation has focused on best utilization of available water to maximize agricultural production. Management focus has been put on the costs incurred in making water available, the marginal cost or economic value of water *per se* is seldom a concern. So in systems where an irrigation fee is levied, level of fee is calculated largely on the basis of costs of operation and maintenance involved in managing water delivery, without regard to economic value of water (Shivakoti, Lam and Pradhan, 2005).

Growing populations, industrialization, and environmental concerns have all put pressure on the water consumed by agriculture. The situation becomes more complicated as the industrial sector develops and hence requires increasingly large amounts of water. In economic terms, the productivity of each unit of water for industrial use is much higher than that for agriculture. Water has come to be considered as a scarce production factor for agriculture as well as other economic activities. Hence, many argue that the allocation of water should be made in accordance with the criteria of physical efficiency and economic productivity. The agriculture sector often finds itself in a weak position in this debate because in many developing countries, irrigated agriculture takes 70 to 80 percent of all diverted freshwater while it produces a decreasing minority share of the national GDP.

So far the debate on whether water should be transferred from the agriculture sector to other economic sectors has largely been framed as a choice between economic efficiency (water to industries) and livelihood of rural population at the cost of an efficiency loss (water to agriculture). In fact much attention has not been given to the possible complementarity between irrigation and water use in other sectors. Although irrigation systems are built to produce irrigated crops, many irrigation systems are "integrated" into larger water management arenas in many countries. These systems not only provide water to non-agricultural uses, in some instances they are even an integral component of the cycle of water use. For example, in some

parts of Taiwan irrigation canals serve as sewerage system where as in other cases it provides water to industrial use (Lam, 1999). In densely populated areas of Indonesia, India and Pakistan, irrigation systems are used for fish ponds, cattle washing, domestic water supply, sanitation and flushing salts out of soil. Recognizing the possible complementarity between irrigation and other uses of water is of major importance in designing water policy.
As water becomes scarce and the value of water rises, government agencies, communities, and farmers respond in different ways either to conserve or reallocate water or to expand supplies. Molle (2002a) developed a framework which shows the various individual and collective options for responding to water scarcity. Responses to water scarcity are extremely varied and come under three different categories: (a) augmentation of supply, (b) conservation of water, and (c) reallocation of water. There is normally little if any coordination or communication between farmers and government agencies. That is to say, decisions of both entities are made quite independently. For example, most government irrigation agencies are involved in the operation of canal systems and do not have information on the number of privately operated wells and pumps even within their own command areas. However, the response to water scarcity (whether drought or chronic shortage) tends to increase the interaction between parties and the potential benefits from collaboration.

There has been a serious lag in the development of appropriate institutions to deal with the new environment of water scarcity. The challenge ahead lies in creating the institutions that can: (i) allocate water equitably among competing uses and users, (ii) integrate irrigation management at farm, system, and basin level to reduce upstream-downstream and head-tail conflicts, (iii) integrate the management of ground and surface water irrigation, and (iv) address problems of irrigation development (including use of waste water) in environment and health.

### *2.3 Challenges of political integration*

Last decade witnessed contradictions between state and irrigation systems. At irrigation system management level, state has begun to retreat from the irrigation sector in many developing countries. This is a retreat in both financial investment and direct operation of irrigation systems. At the policy level, however, irrigation, as a major factor of production for agriculture, continues to be a major policy issue of concern for politicians. In some countries, the politicization of irrigation, with refusal of politicians to support institution of water charges and political criteria used in selection of sites for rehabilitation projects, has already brought about considerable disruption (Shivakoti, Lam and Pradhan, 2005).

Reasons for retreat of the state from irrigation management are many. Main reason is the failure of state to find a proper role for itself in irrigation management. The fad of implementing management transfer in many developing countries is to a large extent a response to excessive state intervention in irrigation management in earlier times. The bureaucratic mode of irrigation management so often proves to be ineffective; however, it does not mean that the state is irrelevant and should be excluded from the sector. Institutional studies about social capital have provided a theoretical foundation for designing institutional arrangements that have potential to create synergy between the state and society in reaching development objectives, including management of irrigation and other types of natural resources. The cases of irrigation management in East Asian countries have shown a positive relationship between institutional arrangements between state and farmer communities and irrigation performance. In fact, in

countries which have gone through industrialization and become middle income countries (as Malaysia and Taiwan), state has increased subsidies and management roles in irrigation and agriculture sectors (as a response to profitability decline of irrigated agriculture but the national policy objective of maintaining a minimum level of food self sufficiency).

In some countries, the retreat of the government from irrigation is largely based upon political-economic considerations. In these countries the government's support to the irrigation sector is often a component of a broader rural-biased policy package that aims to support agriculture. A frequent characteristics of such policies is that subsidies are given more for political than economic reasons, so there is no "objective" way for the government to determine the "right" level of subsidy. The level of government investment in irrigation in these countries is often an outcome of political bargaining and exchange, and is subject to changes in highly variable political economic conditions.

In order to continue to support an agricultural sector that is increasingly economically non-viable, governments are facing increasing pressure to justify subsidies. In the irrigation sector, it may be unrealistic to expect any significant increases in government investment. This is unfortunate because even in those countries where farmers have long been playing a key role in irrigation management, the financing of irrigation infrastructure has always been heavily dependent upon government funds and international donations. Whether irrigation will be sustainable in the future will largely depend on how costs are shared between the public, community and private sectors. Brisco (1999) suggests that a possible solution to the financial constraint effecting irrigation (and other water systems) is to encourage private investment in public infrastructure, including irrigation systems.

The modalities and implications of rent-seeking behavior are well-known in the literature. This threat will not go away as long as irrigation involves public investment. Yet in recent years, democratization in many countries has posed additional challenges to irrigation. When election influence the distribution of power among politicians, politicians may have incentives to dwell on any issues that could help them achieve their political purposes. Since irrigation affects the livelihood of a majority of the rural population, it is not surprising that irrigation issues have been used by politicians as a tool to mobilize farmers' support. In fact, as water has become a scarce production factor, it takes on even higher political values from the perspective of politicians. Politicization often brings about disruptions in irrigation management.

## 3. Institutional reforms in irrigation sector

In the area of institutional reform, the devolution of management and financial responsibility from irrigation systems managers to local users' group has gained prominence. The public intervention in irrigation management has a history of more than 50 years. The irrigation management reform has gathered momentum during past two decades. Irrigation management reforms are a key component of government policy in almost all countries with a significant irrigation sector. The overall experience has been varied and mixed in the approach adopted in designing and implementing the reform, the extent of the reform, and the impacts of reform on irrigation system performance as well as on farmers. Since mid-1980s, the centerpiece of the reforms invariably has been the transfer of management (in rare cases, along with ownership) of irrigation systems, wholly or in part, to Water Users' Associations (WUAs) or other non-

governmental agencies, combined with the downsizing or withdrawal of the government role in operation and maintenance (O&M), fee collection, water management and conflict-resolution. The driving force behind reforms is the need to reduce government's recurrent expenditures for irrigation. This was mainly due to the low performance of public irrigation systems in developing countries which even failed to cover the operation and maintenance costs.
The transfer of management responsibilities to the users in the Philippines is probably the first reported case on the process of intervention and turnover (Joshi et al. 2000). In the Philippines, since the late 1970s, the National Irrigation Administration (NIA) has been adopting the policy of transfer of management responsibilities to irrigator associations (IA) integrating into an institutional development program. NIA and IAs jointly manage most of the National Irrigation Systems (NIS) (Wijayaratna and Vermillion 1994). However, it is pointed out that although National Irrigation Administration (NIA) of the Philippines has been an international leader among government agencies that have introduced participatory approaches to irrigation development and management, NIA is currently engaged in transferring ownership back to farmers to improve the performance of NIA irrigation systems.

In this context, it is better to review the genesis of Participatory Irrigation Management (PIM) and Irrigation Management Transfer (IMT) in order to understand the process. PIM refers the involvement of Farmer Organizations as full partners with government agencies in managing irrigation systems (Groenfeldt and Svendsen, 2000). IMT refers the replacement of government agencies with farmer organizations or other private-sector entities in managing irrigation systems, either at the subsystem or system-wide levels (Geijer et al., 1996). Transfer of management from government to farmer organizations took place in the U.S., France, and Taiwan in the 1950s, 1960s and 1970s, which turned out to become a national strategy in developing countries in the 1980s and 1990s (Geijer et al., 1996). Many industrial countries, namely, Australia, Japan, Spain, and United States adopted PIM policies where irrigation management has largely been transferred to the control of user themselves (Groenfeldt, 2000). Similarly in Turkey, IMT program for large irrigations to locally controlled organizations began in 1993 and within a short span of 3 years, about 61 percent of the publicly managed irrigation country was transferred to local government units or Irrigation Associations (IA) created at the local level (Svendsen and Nott, 2000). The government of Sri Lanka adopted a policy of transferring full responsibility for the operation and maintenance of minor irrigation schemes to farmer organizations and jointly managing the medium and major schemes by the farmers and agency personnel (Samad and Vermillion, 1999).

International Irrigation Management Institute (1986) put major effort to document public intervention in FMIS in different countries. The most important findings of that study was that before intervention, intervening agencies understood how the existing FMIS were organized, the way they carried out irrigation activities, and the environment in which they operated. Since then, several variations in interventions and in performances of irrigation systems and major policy lessons have been documented extensively (Ostrom and Benjamin 1991; Bruns and Amato 1992; Shivakoti, 1992; Tang, 1992; Lam, 1998; Shivakoti and Ostrom, 2002).

The interest in transfer of responsibility to user groups rests in large part on the desire of many governments to reduce expenditures in irrigation. IMT has become one of the cornerstones of World Bank water management policy (Groenfeldt and Svendsen, 2000). Recent experiences in IMT suggest that there has been considerably more success in transferring management

responsibilities in more advanced countries such as Turkey and Mexico than in the developing countries (Samad, 2001)**.** Where implementation has been successful, government expenditures and number of agency staff has declined, maintenance has in some cases improved, but there is little evidence yet that IMT has led to an increase in the productivity of irrigation water (Samad 2001, Murray-Rust and Svendsen, 2001).

Early arguments in favor of irrigation management transfer (IMT) were based on the reported successes with private irrigation. It is widely documented that private pump irrigation from groundwater and surface water bodies is far more productive and financially viable compared to public irrigation systems (Shah et al., 2002). Much of the early discussions envisaged that farmer management of public irrigation systems would enhance their performance and bring about wide-ranging socioeconomic changes enabling farmers to substantially improve farm incomes. In more recent years, management transfer was considered to be beneficial even if it just saved the government money, improved cost-effectiveness of operation and maintenance while improving, or at least not weakening, productivity of irrigated agriculture (Vermillion, 1997). The drift of IMT discussion has been more towards getting irrigation off the back of governments than towards improving the lot of the farmers and the poor.

Similarly, Shah et al. (2002), based on the comparative study of the experience of several countries, suggested that irrigation management transfer works provided certain preconditions are met: like, supportive legal policy framework; secure water rights; local management capacity building; and an enabling process to facilitate management transfer. However, they noted that in the context of African smallholder irrigation only facilitating preconditions is unlikely to work. They pointed out the need for institutional alternatives which can deal with the entire complex of constraints facing the African smallholders. Rather than focusing only direct transfer of irrigation management, the African governments should focus on institutional alternatives by enhancing the wealth-creating potential of smallholder irrigated farming by strengthening market access, promoting high value crops, and improving systems for providing extension and technical support to smallholder irrigators.

## 4. Political economy of irrigation governance

Water resource development is largely a political phenomenon. The political dimensions of water resources development are abundantly clear and much discussed in cases like the Nile, Jordan and Tigris–Euphrates rivers, and also evident in many other basins in the world (Mollinga, 2001). The institutional reforms in irrigation management is associated with changes in power and/or benefit distribution which inevitably create considerable political opposition. The conventional view of institutional change is that it is either in the interest of economic efficiency, or it merely redistributes income (Bromley, 1989). In this regard, interest groups form and attempt to impact the decision-making process so that the end result best serves their interests.

Powerful vested interests of political groups may slow, divert, or even stop a desirable reform. The larger the number of interest groups, the more complicated the implementation process is likely to be. Recent resource-development and resource-use-improvement projects emphasize the combination of physical and institutional investments (Cummings et al., 1996). In such

projects the sustainability of infrastructure investments is dependent on the performance of the institutions which manage them. Therefore, it is important, in such projects, to analyze the level of political risk associated with the implementation of the suggested institutional reforms. In this regard, Eggertsson (1997) stresses the need for approaches that allow interaction of economic, political, and social activities, in order to improve the design of economic policies and minimize the likelihood of policy failure.

Recently there has been an increased emphasis on institutional reforms in water resource development projects in many countries. These changes have been caused by several factors; increasing awareness regarding water availability; second, most suitable sites for construction of large dams and reservoirs have already been developed; third, the increasing demands for fiscal austerity in most countries have resulted in growing interest in least-cost alternatives for meeting water needs; fourth, increased awareness about the environmental impacts related to the construction of hydraulic infrastructures; and fifth, competition by various sectors for scarce water resources has increased as a result of growing population and increased economic activity. These changes have caused a fundamental shift from relying on additional construction as a means for solving water needs, to improving water resource management and institutions of individual countries. There are several examples of water-related projects which combine infrastructure investment, with components of either institutional reforms, or other non-structural interventions like water pricing reform (World Bank, 1995; 1997).

It is necessary to know how the stakeholders (also called interest groups or players) are affected by the institutional reforms, what their interests are, and their ability to impact the reforms. It helps to assess the political risks associated with institutional reforms. Although the literature contains a rich set of studies on the political economy of institutional reforms in general (Bromley, 1989; Haggard et al., 1995), and in agricultural sector in particular (Krueger et al., 1991), very few studies exist that address the political economy of reforms in water sector.

### *4.1 The politics of water resources policy*

Many countries have overall and sectoral water policies, which imply investment programs for infrastructure creation and maintenance, and the establishment of institutions for the management of the infrastructure and the resource. In a conventional approach the politics of this are thought to lie only at the level of policy formulation: politicians working within a parliamentary or other framework make decisions on policy priorities and programs, after which the administration implements. In practice both formulation and implementation of water resource policies can be highly contested. Different interest groups attempt to influence both, through official-legal–institutional and through other means. Policy is negotiated and re-negotiated at all levels, and often transformed on its way from formulation to implementation. The nature, intensity and effects of this process differ from case to case. This political struggle takes place within state apparatuses, but also in the interaction of state institutions with the groups directly and indirectly affected by the policies.

We can trace out the following themes in literature regarding this aspect. The first and most general theme is that of the wider political significance or meaning of particular water resources programs: what are the political reasons for governments and other agencies to invest

in water resources development. Lynch for example identifies building support and improving the likelihood of political stability as the main objectives of Peruvian governments to undertake small-scale irrigation projects in the Sierra region, rather than strictly economic motives (Lynch, 1988 cited in Mollinga, 2001). The second, much publicized, theme is the popular resistance against government water policies, notably against dam construction (McCully, 1996 cited in Mollinga, 2001). This debate is generating a rich literature on public action and social movements in relation to water resources development.

Another important theme is the internal dynamics of state apparatuses in the water sector. Though there are some strong statements on the nature of these institutions from a rent-seeking perspective detailed studies of actual internal dynamics are very rare. Wade (1982) analyzed the system of administrative and political corruption in a South Indian state. The dynamics of institutional reform processes constitute another theme. In irrigation sector these started in the Philippines in the 1970s and 1980s and are now ongoing in countries like Mexico, Turkey, Colombia, Pakistan, India, Egypt, Zimbabwe and others, with varying speeds and scope. Most publications in this field are highly prescriptive, present models for desired end stages and list policy recommendations (Johnson et al., 1995).

The next theme lies at the interface of the politics of policy and the everyday politics of water use. It is the analysis of the policy transformation process that takes place "on the ground" when policies are implemented, particularly how the lower level implementing staff deal with pressures exerted on them by their administrative bosses, water users and other actors, like politicians. Another category of literature dealing with this interface is the evaluation of (donor assisted) development projects in the water sector.

### *4.2 The political economy of water pricing reform*

The political forces have significantly influenced the water management sector especially in case of pricing reforms. Due to the political forces, most of the developed economies have highly subsidized their agricultural sectors in contrast to those in LDCs (de Gorter and Tsur, 1991). The increased water scarcity and quality concerns have generated new approaches to water management and reform. From the diverse literature on the theory of political economy of water pricing and reform, it is possible to identify three main approaches. The first is the interest group approach where political decisions are viewed as the outcome of a struggle between pressure groups. Second is the politician-voter interaction approach where the interaction between voters and support maximizing politicians result in policy (de Gorter and Tsur, 1991). Lastly are the bargaining process models where policies are determined via bargaining process with players of different power (Finkelshtein and Kislev, 1997). The recent extensions to these approaches incorporate environmental aspects of water management. These include cooperative game studies looking at incentives for individuals to participate in group management schemes (Bardhan, 1993) and in the exploitation of common property resources (Becker and Easter, 1998).

The recent studies on irrigation water reform often will employ one or more of these approaches to model the political economy. However, as a framework for describing this issue, it is useful to understand the reasons for reform, the institutions undergoing reform,

support/opposition of the reform and compensation mechanisms, and possible international influences on the reform process (Dinar, 2000). Based on the review of different studies it can be generalized that reforms of any kind are likely to face the opposition and support of certain groups. The level of opposition or support is, in turn, determined by the change of power and benefits of each affected group compared with the status quo. Reforms may create new coalitions that were not in place, or were not even predicted before. The ability of a group to influence the implementation of a reform is a function of many factors, and is very complicated to generalize.

## 5. Markets and water management

Market forces and communities play critical role in water management. It was reported that in the 1980s cereal grain prices declined to 50 percent of their levels in the previous three decades (Barker and Molle, 2005). There are three reasons for this: (1) the extraordinary growth in production due to expansion of irrigated areas and adoption of *green revolution* technologies, (2) the decline in demand for cereal grains as incomes have risen, and (3) the continuing and increasing level of subsidies by the developed economies.

The downward drift of cereal grain prices is bringing greater pressure to bear for diversification. As many canal systems were designed and managed as supply driven systems, which was suitable when the major objective was producing cereal grains. There is a growing incentive to invest in pumps to improve flexibility and reliability in water deliveries or in short obtain water on demand. Diversification is a crucial aspect of agricultural change but it is constrained by a host of factors, ranging from soil and water suitability, skill acquisition, capital and labor constraints, risk in marketing, and, foremost, by the development of adequate markets. In most of the developing countries, policies have been designed to foster agricultural diversification, often seen as a panacea to low staple food prices, but they have been met with mixed success and it is doubtful that diversification can be boosted much beyond the level observed, which are mainly determined by the change in consumption patterns and by information technology that can put producers in more direct contact with export markets.

Water pricing and water markets have been an important focus for economists. In a market economy, prices should perform the task of allocating resources among competing uses. But when it comes to water, particularly water for irrigation, there are problems with this approach (Sampath, 1992; Perry *et al.*, 1997, Smith *et al.* 1997; Morris, 1996; Molle, 2001). The World Bank has recently undertaken a comprehensive study, “Guidelines for Pricing Irrigation Water Based on Efficiency, Implementation, and Equity Concerns.” As a part of that study, Johansson (2000) has conducted an exhaustive literature survey on pricing irrigation water. More concise treatment of the issues can be found in Tsur and Dinar (1997) and in Perry (2001). The authors emphasize the fact that water (particularly water used in irrigation) is a complicated natural resource, a complicated economic resource, and a complicated political resource.

Moreover, while water supplied is a proper measure of service in domestic and industrial uses, much of the water supplied to a group of producers may be “lost” as runoff or seepage only to be consumed by others through recycling and this is particularly difficult to measure. Water pricing methods are more likely to have effect on cropping pattern (even though this is little

observed in developing countries) than on water demand for a given crop (Tsur and Dinar, 1997). In fact, particularly with today's low commodity prices, the politically acceptable level of charging for water is well below the point at which farmers would respond by saving water (de Fraiture and Perry, 2002; Molle, 2002b). If the objective is allocation, rationing (i.e. assigning water to specific uses either within system or at basin level) represents an alternative mechanism for coping with water shortages where demand exceeds supply (Perry, 2001).

Cost recovery is often listed in the agreements of irrigation projects funded by the multilateral donor agencies and normally implies full or partial cost recovery of capital expenditures plus operation and maintenance costs. Yet most of the Asian farmers typically do not pay enough to cover even the annual operation and maintenance costs and governments increasingly find themselves unable to meet the costs for water related services. The result has been a steady deterioration of irrigation systems and the frequent request by governments for rehabilitation loans which multilateral lending agencies seem all to willing to provide.

The typical project feasibility study or project appraisal report shows that all benefits go to farmers under the assumption that commodity prices remain constant. For a single project this is correct. However, over the past several decades the multitude of irrigation projects completed throughout Asia have led to a sharp decline in cereal grain prices, with low income net consumers and not producers being the major beneficiaries. Furthermore, investment in irrigation has spill-over or multiplier effect, with non-farm benefits in terms of employment generation and higher incomes being even greater than direct benefits to producers (Mellor, 2001). Thus, the benefits of capital investments in public irrigation systems have gone largely to the non-farm sector and cost recovery for major capital investments should fall mainly on revenue sources other than farmers. Farmers should be required to pay operation and maintenance fees, but it is still too often the case that irrigation agencies need these fees to sustain their activities without farmers having any sort of control on them, or on the management of the water resources. Collecting fees is likely to be worthwhile only if it is a binding element of a real turnover of O&M responsibilities, in which users have control over water and over the fees collected, and pay for the local operators of the irrigation system and part of the maintenance (Small and Caruthers, 1991).

## 6. Challenges Ahead

Irrigated agriculture has been a major factor of development during the past several centuries. However, as we face the future millennium, irrigation management will face substantial changes in regard to: (1) agricultural practices, (2) life in rural societies, (3) the economies of developing countries, and (4) the relationship of governments and private sectors. These major challenges will generate increased pressure for new policy goals for irrigation (Vermillion et al., 2005). In many respects, the earlier focus on physical capital, top-down governance, and "patronage with participation," will need to shift to the recognition that social capital is essential, polycentric governance systems are more responsive, and irrigation systems based on "partnership with empowerment" are more likely to meet future needs.

With the changing context, agricultural practices will also change around the world. For centuries, most irrigation water in developing countries, particularly in Asia, has been an input to the production of cereal grain. Prices for grains dropped by half in 1980s due to increased productivity after adoption of green revolution technologies, reduction in demand for rice due to the general increase in incomes, and subsidies given by developed country governments to their own agricultural sectors (Barker and Molle, 2005). It never allows that agricultural sectors of major Asian countries will again be devoted primarily to cereal production. Diversification of agricultural products will generate a demand for water at different times of the year. Coordination of water supply on irrigation canals will be more challenging and more farmers will rely on ground water which can be made available when their crops are in need of water.

In most of the developing countries rural society is shifting. Rural life in the past centered on the family. Having a large family in the past was the rational strategy to obtain sufficient farm labor to generate income for the family unit during the major part of life and to insure that someone will take care of those who are old and no longer able to farm. Thus, most members of the family saw their future in the rural area where they were born. Now parents are benefited most by educating children who can then leave the farm and obtain higher paying positions in industry. This leads many farm families to invest in fewer children many of whom migrate to urban areas instead of living their full life within a few miles of where they were born. Rural areas are thus no longer populated primarily by individuals who see themselves investing in rural life and its improvement.

The economies of all developing countries are globalizing. Physical distance is not the constraint as it once was. Farmers in one continent compete with farmers elsewhere. Large multi-national corporations have begun to enter productive fields where they never existed before. Instead of buying raw materials from family farms, they frequently buy up the family farms and engage in new forms of corporate farming. Given the changing trade patterns and the de-emphasis on subsistence crops, farmers find that investing in commercial crops is a more valuable strategy than growing all of their own food and selling a little surplus.

These changes in agriculture, rural society, and economy at large, will stimulate changes in governance systems and in relationship between governments and the private sector. A key to an effective transition is changing concept of government to that of governance. This requires recognizing that it is not just national governments that are crucial to building more efficient, responsive, equitable, and resilient societies. Top down, centralized policies have frequently failed in past. In future, governance systems will develop toward a polycentric structure, rather than a monocentric. Polycentric governance systems enable the creation of governance units that match decision-making units to hydraulic units. Polycentric governance systems are more complex but because there is no monopoly of political power, they can also respond to specific hydrological and environmental problems, generate more accurate and timely information, and provide effective conflict resolution at multiple scales. These systems will, however, face substantial pressures to achieve new policy goals for irrigation (Vermillion et al., 2005).

## 7. Making adjustments: Responding to Challenges Ahead

Significant advancements have been made over the past two decades in understanding what is involved in improving the management and governance of irrigation systems. Twenty First century brings new challenges. Population growth and urbanization place municipal, industrial, and environmental water needs in competition with water previously allocated for irrigation and increase pressures to use irrigation water more efficiently. While management responsibility is being transferred to local user groups, the question of land and water rights often remain unresolved. The transfer of irrigation system governance and management to water users' organizations has often overlooked the need to restructure government agencies, change how support services are provided and modify access to information necessary, to improve accountability. These challenges are not only limited to major irrigated paddy and horticulture producing areas, but are widespread even in the remote upland areas where still significant parts of population lives in different countries (Shivakoti, Lam and Pradhan, 2005).

The anticipated problems in these areas of transition can be illustrated by the situation in the Fang and Thai Yai districts of Chiang Mai Province of Northern Thailand, where there are still several traditional community managed irrigation systems. Some irrigation systems have received government assistance for repair and maintenance of the intake and main canals, others have been deprived of such assistance due their not having official land use entitlement certificates. While the traditional system of labor contribution for maintenance continues in the upstream Thai Yai irrigation system (which did not receive any external assistance) it has been replaced in the downstream Mae Sao system (which received external assistance) by staff hired by government to maintain the system. In the Mae Sao system, whereas collective action was mobilized for system maintenance in the past, after rehabilitation and assignment of government staff to the system, collective action has virtually disappeared at main and branch canal levels. The transitions that are taking place in these two communities capture the contemporary issues and challenges that need to be addressed by research and policy in future years (Shivakoti and Bastakoti, 2006).

We can summarize the three basic challenges facing irrigated agriculture in the future as follows:

1. How to respond effectively, equitably and efficiently to competition for water?
2. How to achieve real accountability and effective new partnerships between the public, community and private sectors?
3. How to enable necessary reforms to happen? and How to build on the social capital of water users organizations to promote new cooperative agri-business development and marketing opportunities for the rural poor?

### *7.1 Responding to Competition*

Population increases, economic diversification and environmental degradation are rapidly increasing competition for increasingly scarce farmland and water. The foremost issue of concern in responding to competition for water between agriculture and other sectors is the pressure to transfer water and irrigated land away from agriculture to municipal and industrial uses. This is further aggravated by aquifer depletion, degradation of water quality and water reclamation. While reclaiming water, the issues of trans-basin and trans-boundary water transfers have been one important agenda. Re-allocation is a complicated and politically-charged issue that is related to questions of water, land and infrastructure rights and the planning, information and administrative requirements for using these resources. Recently, many countries have placed priority on integrated watershed management in their development planning and have called for design of mechanisms to link downstream and catchment stakeholders in watershed and basin management. In order to facilitate cooperation between downstream and catchment stakeholders, it is important to regulate use of groundwater. Furthermore, the role of innovation in information and communication has become important, as is evidenced by the recent experience of the *Gramin* (Rural) Bank of Bangladesh with enabling the poor in remote areas to respond to market opportunities by providing them with cellular telephones.

### *7.2 Accountability and new partnerships*

Another issue relates to shifts in the roles, responsibilities and accountability of the public, community and private sectors. Responsibilities in irrigation management, agricultural extension, financing irrigation and provision of support services will need to be redefined in the future and new partnerships must emerge for managing the irrigation systems. There will be a need to transfer authority for irrigation system management to water users' organizations. This will require changes in government roles from that of manager to regulator and facilitator in providing support services. Consequently, much effort will be needed for building new capacities in the public, private and community sectors. A new emphasis on co-management of the irrigation sector, polycentric (or distributed) governance by multiple parties and more integrated management of water resources within river basins will be required in order to cope with the future. New accountability mechanisms will be needed, such as service agreements, management audits, asset management plans, enhanced information bases and 'polluter 'pays' arrangements will be needed. Ultimately, there will be a need to redesign government subsidies through alternate steps such as matching investments, transparent and agreed allocation criteria and incremental infrastructure improvement.

### *7.3 Reform, synergy and economic productivity*

Once the principles of co-management and polycentric governance are applied in managing irrigation, new opportunities for up-scaling will arise through scheme-level WUO federations, basin or state-level networks of WUO's and prospects for WUO's to finance and supervise their own agricultural/agri-business development extension and initiatives (Uraivan et al., 2005). This calls for new information/communication systems for market identification and networking, which will open up new avenues for demand-oriented irrigation services to promote crop diversification and commercialization. More attention should be given to how to expand the economic niche of farmers beyond cultivation to include agri-business activities, such as input production and supply, crop processing, production of manufactured agricultural/horticultural products. These problems can be solved through joint monitoring and regulation of irrigation operation, which calls for diverse methods of data collection, storage and processing information for easy public access and sharing of information.

## 8. Future policies, strategies and roles

### *8.1 Irrigated agriculture and productivity of water*

The key policy imperative for irrigated agriculture in the coming decades will be to increase the productivity of water used for agriculture. As water becomes more of a limiting factor of production than land, in many places, crop yield per unit of water will become more important that yield per unit of land. Incentives for farmers to increase water productivity for agriculture would be strengthened by future requirements for water users to pay for water services. But whether or not users pay for water, scarcity and competition alone will create pressures to increase "water productivity." And water productivity will be defined more broadly than the agronomic sense. It will be increasingly important to rural people and governments to promote the labor and income productivity of water (Vermillion et al., 2005).

With the continued advancement of commercialization, global economic integration, farm fragmentation and labor mobility in rural areas, farm families will be pressured to increase income and stabilize employment year round with diversified livelihood strategies that are less reliant on previous levels of access to land or water. In addition to diversifying production into commercial crops from cereals which have more commercial value, many farmers may want to expand their economic niche beyond mere individualized cultivation. There may be increasing incentives for local groups of farmers to cooperate in contract farming for production of commercial crops and development of agri-business enterprises, such as production and distribution of agricultural inputs, crop storage, value-added processing and marketing.

The social capital creates potential synergy to develop cooperative agri-business ventures. Local social capital will also become a point of leverage and political influence as local farming communities face the aggressive outside world of big capital and corporate interests, with the need to defend their interests and property rights. As information disseminates more freely and the rural poor gain more ability to articulate their interests, it is likely in the future that governments will feel rising pressure to alleviate rural poverty, at least for the sake of political stability. As agriculture declines in more rapidly developing countries, it is likely that governments will feel pressures to reintroduce subsidies for irrigated agriculture in order to ensure food security without too great a dependence on imports. If so, it will be important that governments do not simply reapply the same kind of subsidies of the past that create unsustainable and inefficient dependency of society on the government (such as full financing for irrigation system rehabilitation). Rather, new subsidies should be designed so as to stimulate local investment (subsidies that have eligibility and cost sharing requirements) and be targeted at pockets of poverty that are ignored or ill-served by private sector investment.

The sustainability of irrigated agriculture will require major improvements in the protection of water quality and vital ecosystems The unregulated exploitation of groundwater, growing pollution of rivers, water-logging and salinity are macro problems caused by people at the micro level (Shah, 2003). A large part of water “mismanagement” is actually a utilization problem, caused by individuals or groups that are widely dispersed. State-level or basin-level regulations have been and will be largely ineffective in protecting land and water resources unless the users are integrated into a representative process of making and enforcing rules and agreements at the various hydraulic levels (Moench, 2003).

### *8.2 Irrigation system management and institutional integration*

As it seems it is crucial to increase the productivity of water, means irrigation systems needs to be managed more intensively than in the past, so as to be more responsive to variable water demands for diversified commercial crop production under conditions of increasing constraints on water supply. Generally, commercial crops are more sensitive to the timeliness and reliability of water delivery than are cereal crops. In order to increase water productivity from the farm to irrigation system to basin levels, it will be necessary to manage both surface and ground water conjunctively. This will require realignment of organizational boundaries and jurisdictions to manage water from multiple sources in an integrated way, both to use water more efficiently and to mitigate salinization and water-logging through better water delivery and drainage.

The trend toward multiple uses of water in irrigation systems calls for increasing needs to formally incorporate non-agriculture users of water into water users' organizations and into planning and management of water delivery and drainage. Government policies and laws will need to enable WUO's to include all water users as members, not only farmers. However, regulations must reflect distinctions in priorities and water use rights between different uses. It is becomingly increasingly important for governments, with the participation of civil society, to modernize water rights and acknowledge the status of water user organizations as autonomous, legal entities, so that they have the local capacity to develop and enforce rules, mobilize resources and settle disputes. WUO's will need to be empowered legally to perform their expanding roles of governance in irrigation systems (Vermillion et al., 2005).

In the future, because of lack of funds from most developing country governments, it is likely that water users will increasingly have to bear the cost of routine operations and maintenance of irrigation systems. But this will only be possible if the economic productivity of water used for irrigated agriculture increases from what it is today for cereal crops. In general, planning and water allocation will have to take into account economic valuation of water for different users. Economic valuation will be needed in order to promote efficiency in water use, to provide revenue to support private sector investment, to encourage allocation of water to highest value uses, to discourage generation of externalities (such as pollution), to provide incentives for compliance with government policy and to provide revenue to cover the costs of environmental conservation and protection against natural disasters. Too often policy makers and development agencies under-value the use of water for irrigation because they fail to account for its often high-value multiple uses, including for sanitation, fish production, livestock and rural industry.

However, economic valuation is not the same thing as assignment of charges. For planning and allocation, it may be necessary to give water an economic value. But water services may be charged on the basis of both their economic and social values and they may be paid for by both user payments and targeted subsidies, where needed. The pay-for-service principle is not the same thing as volumetric pricing. Payments may be based on achievement of agreed service standards (such as timeliness or reliability), not necessarily on the basis of water volume delivered. Social policy valuation and charging must also be applied to ensure that the poor or disadvantaged have access to water for their basic consumptive and productive needs.

As governments gradually reduce their role in direct management of irrigation systems and shift their emphasis to capacity building, technical and financial support, dispute resolution and regulation, they will need to promote development of private sector organizations capable of providing irrigation services to WUO's. Governments and civil society organizations will be needed to provide mediating and social auditing functions, to help ensure accountability between WUO leaders, WUO members and other stakeholders. Government/civil society partnership must become more adept at designing incentives to promote optimal joint investment in irrigation development and maintenance (Svendsen & Huppert 2000). Accountability can be further strengthened if WUO's have a clear right to choose who will provide irrigation services in their system (including alternatives to government agencies) and if there are multiple service providers from among which WUO's can choose.

The argument that management for main canals or large irrigation systems can not be transferred to WUO's because they lack the technical skills, fails to appreciate the difference between the roles of irrigation system governance versus provision of irrigation services. As long as water users can collectively define what irrigation services they need and can agree on the terms and conditions of how they will be provided, they are more or less capable of playing the role of governance. Formal agreements must represent credible commitments, backed up by the support of government and "social auditors". Social auditors may be committees that examine to what extent parties to service agreements have fulfilled their obligations under the agreements. They may be constituted by government, professional, community-based and civil society representatives. In the future, we will see much more of private sector provision of irrigation and other water services, formal service agreements and heightened government regulation. Perhaps the most important challenge will be how to ensure accountability of stakeholders to agreements and regulations.

Generally it is perceived that public irrigation systems are usually in an inefficient and unsustainable cycle of being built with external financing, inadequately maintained for lack of funds and incentives, and prematurely rehabilitated with more external loan funds. In the future, it is likely that the supply of loan funds available for irrigation infrastructure will continue to decrease and governments and society will need to find more efficient and effective ways to ensure the sustainability of irrigation infrastructure. It is likely that this will require introduction of incentives for WUO's to invest in routine maintenance and share the cost of rehabilitation. Governments may find it more efficient and easier to encourage farmers to share the cost of irrigation rehabilitation if it is done incrementally, in smaller, annual activities, rather than as occasional major investments.

New approaches to rehabilitation and upgrading might involve demand-driven allocation of government subsidies, based on cost sharing and other criteria aimed at strengthening local investment and self reliance and improving the productivity of government subsidies. In the future, it will become less and less feasible for irrigation assistance projects to focus almost entirely on physical works. Increasingly, the emphasis must be placed on building the capacity of WUO's to maintain systems and private sector organizations to provide maintenance and repair services. All this implies a future reversal from the concept of farmer participation in government initiatives to government assistance to farmer initiatives.

In the future, it will probably become increasingly unacceptable for lenders and governments to promote "cost recovery" from "beneficiaries" after investment decisions have already been made by lenders and governments. It will become essential to involve stakeholders in decision making and cost sharing, before investments are made which involve international lending agencies and national governments. In future, it will be important to improve efficiency, productivity and sustainability of investments in irrigated agriculture and irrigation systems. This will require governments to perform more regulatory functions and for the private sector to be accountable both to water user clients and to government policy. The governments should also have clear and consistent sector policies and principles for investment. Development agencies should do their part to ensure better consistency and coordination between themselves. In the future, governments would be wise to hold annual meetings with all foreign development assistance agencies to coordinate such investments and activities.

Given the rising competition for water, the need to protect water supplies for agriculture from unacceptable levels of pollution and the need to protect water use rights, it will be necessary for WUO's to be linked directly to river basin councils that have as their mandate the governance of the river basin, including water allocation, resource development and environmental protection. It is also likely that WUO's will be increasingly required to monitor their own water use and other aspects of irrigation system performance and report these to river basin councils, because of the interest that the broader set of water users in the basin will have in the water productivity of each type of user and because such information may help protect the interests of WUO's vis-à-vis their neighboring water users in the basin (Vermillion et al., 2005).

### *8.3 Reform and governance*

In order to bridge the growing gap between existing institutions and the changing demands for more integrated and responsive water management, over the next two decades both basic reform and incremental innovation will be needed in the governance framework (policies, laws, organizations, rules and agreements) for irrigated agriculture, especially in less developed countries that have high rates of population growth, economic diversification and increase in water demand. There will be pressures to either consolidate fragmented, sectoral agencies or to create new coordinating bodies. In many cases, there will be pressures to realign jurisdictions based on administrative boundaries to jurisdictions based on hydraulic boundaries, such as irrigation systems, sub-basins and basins. It will become increasingly important to create governing and consultative councils (to formulate development and management plans, new projects, regulate water use, set fees, and settle disputes) at irrigation system and higher levels that represent constituent water users and other stakeholders (Vermillion et al., 2005).

Policy makers and development agencies in the past often showed the tendency to transplant technical models from one country to very different contexts. They, sometimes eager for quick fixes, transplant reform models into very different contexts. Examples include irrigation management transfer attempts by governments to recover costs of irrigation O&M through collection of irrigation service fees to be paid to the government, volumetric pricing, water markets, and river basin management organizations (Shah et al., 2001). Participatory councils at the irrigation system, basin, and national levels, that review international experience and filter and reinvent ideas in local contexts, could help prevent indiscriminant transplantation of models. New policy initiatives should be considered less as imperatives and more as testable hypotheses.

There has also been a tendency for policy makers and development agencies to sponsor adoption of comprehensive policy and legal frameworks for irrigated agriculture that are sometimes overly elaborate and pre-empt a more incremental process of participatory dialogue and making of rules and agreements. The result is lack of public awareness about, or commitment to, such frameworks. Development professionals and stakeholders need to learn to appreciate where to stop elaborating the formal framework and where to start facilitating an incremental, evolving process of making agreements and solving local problems. A lot of institution building goes on informally and incrementally at operational levels (Bruns and Meinzen-Dick 2000). It is time for development professionals to better understand the limitations of comprehensive, technocratic planning for complex irrigation systems and river basins with multiple users and sources of water.

The automatic response of technocrats to environmental complexity is to call for more and more sophisticated information and management systems. Perhaps a more realistic response would be to recognize the limitations of comprehensive, integrated planning and augment these efforts with an equally important process of participatory decision-making among diverse groups with contending interests. There is so much water management and use activity at irrigation system and sub-basin levels that integrated water management at the system or basin levels may not capture much of the total picture (Moench, et al 2003). It is time for governments to moderate the top-down centralistic administrative approach and work on building new partnerships with civil society that are based on a more incremental and polycentric process of analysis, dialogue, and building consensus and agreements at multiple hydraulic levels.

Under the new partnership, public consultation and other communication forums are promoted so that the government can be responsive to priorities identified by stakeholders. Water resources management should be ordered through governing and consultative councils that embody a new partnership between water users, the government and third parties, where transparency, negotiation and agreements are made among all parties concerned. A greater reliance on negotiated rules and agreements between partners will require a much heightened emphasis on adopting effective incentives and mechanisms to ensure accountability (Wolff and Huppert 2000). And accountability between government and stakeholders would be promoted through supportive incentives, service plans and agreements, management audits, asset management plans and more effective financial incentives.

Actually, such changes are already needed in many parts of the world. Why have they not occurred to the extent needed? What will help make them come about in the future? As was pointed out by Sengupta (2005), there are many powerful organizations and vested interests that are against change. What is to be done? There is no simple answer to this. To achieve breakthroughs in basic reform, it will normally take an energetic combination of different efforts, being supported by multiple proponents. In addition, the reform process can be better facilitated in the future by including more careful and realistic assessments of the political economic interests of different stakeholders regarding reform options, with an aim toward identifying opportunities to create win-win situations among them.

Basic reform will be needed occasionally for restructuring and establishing new decision-making processes and ground rules. Incremental innovation will be needed more regularly, for the process of intra and inter-organizational learning about how to make irrigation system management and irrigated agriculture more productive, effective, equitable, efficient and sustainable in the face of constant change.

**References**


Bardhan, P. 1993. “Analytics of the Institutions of Informal Cooperation in Rural Development,” World Development, 24(4): 633-639.

Barker, R., and F. Molle. 2005. Perspectives on Asian Irrigation. In Shivakoti et al. (Eds), Asian Irrigation in Transition: Responding to Challenges. India, New Delhi: Sage Publications India.

Barrett, S. 1994. “Conflict and Cooperation in Managing International Water Resources,” World Bank, Policy Research Working Paper #1303.

Becker, N. and K.W. Easter. 1998. “Conflict and Cooperation in Utilizing a Common Property Resource,” *Natural Resource Modeling*, 11(3): 173-198.

Brisco, J. 1999. “The Changing Face of Water Infrastructure Financing in Developing Countries” *Water Resources Development* 15(3): 301-308.

Bromley, D. W. 1989. Institutional Change and Economic Efficiency. *Journal of Economic Issues*, 3(3):735-759.

Bruns, B. R. and R. S. Meinzen-Dick. 2000. Negotiating Water Rights. New Delhi: Vistaar Publications and International Food Policy Research Institute.

Bruns, B., and S. D. Amato. 1992. How to Turn Over Irrigation Systems to Farmers? Questions and Decisions in Indonesia. Irrigation Management Network Paper no. 10. London: ODI.

Coward, E. W. 1980. Irrigation and Agricultural Development in Asia: Perspectives from the Social Sciences. Ithaca, NY: Cornell University Press.

Cummings, R., A. Dinar, and D. Olson, 1996. *New Evaluation Procedures for a New Generation of Water-Related Projects*. World Bank Technical Paper No. 349, World Bank, Washington, D.C., USA.

De Fraiture, C. and C. Perry. 2002. *Why is irrigation water demand inelastic at low price ranges?* Paper to be presented at the workshop “Irrigation water policies: macro and micro considerations”, Agadir, Morocco, 15-17 June 2002.

de Gorter, H. and Y. Tsur, 1991, "Explaining Policy Bias in Agriculture: the Calculus of Support Maximizing Politicians," *American Journal of Agricultural Economics*, 73, 1244-1254.

Dinar, A. (ed.) 2000. *The Political Economy of Water Pricing Reforms*, Oxford University Press.

Easter, K. W. 2000. Asia’s irrigation management in transition: A paradigm shift faces high transaction costs. *Review of Agricultural Economics*, 22 (2): 370-388.

Eggertsson, T. 1997. The Old Theory of Economic Policy and the New Institutionalism. *World Development*, 25(8):1187-1203.

Finkelshtein, I. and Y. Kislev. 1997. Prices Versus Quantities: The Political Perspective. *Journal of Political Economy*, 105: 83-100.

Geijer, J.C. M. A., M. Svendsen, and D. L. Vermillion. 1996. Transferring irrigation management responsibility in Asia: Results of a Workshop. FAO/IMMI/ Expert Consultation on Irrigation Management Transfer in Asia, Bangkok and Chiang Mai, 25-29 September 1995.Short Report Series on Locally managed Irrigation. Report No. 13. Colombo: IIMI.

Groenfeldt D., and M. Svendsen. (Eds.) 2000. *Case studies in participatory irrigation management*.. USA, Washington, DC: World Bank Institute.

Groenfeldt, D. 2000. Introduction: A Global Consensus on Participatory Irrigation Management. In D. Groenfeldt and M. Svendsen (eds). Case Studies in Participatory Irrigation Management. USA, Washington, D.C.: World Bank Institute.

Haggard, S., J-D Lafay, and C. Morrisson. 1995. The Political Feasibility of Adjustment in Developing Countries. Political Feasibility of Adjustment. C. Morrisson (Ed.), Development Centre of the Organization for Economic Co-operation and Development, Paris, France.

Itty, P. 2000. "The role and future of agriculture for poverty alleviation." Reflections from the XXIV International Conference of Agricultural Economists, held in Berlin.

Johansson, R. J. 2000. *Pricing irrigation water: A literature survey*. Working paper 2449. Washington, D.C.: The World Bank.

Johnson, S.H., D.L. Vermillion and J.A. Sagardoy (eds). 1995. Irrigation management transfer. Selected papers from the International Conference on Irrigation Management Transfer, 1994 Sep 20–24; Wuhan, China. Rome: IIM/FAO.

Joshi, N., E. Ostrom, G. Shivakoti, and W. F. Lam. 2000. Institutional Opportunities and Constraints in the Performance of Farmer Managed Irrigation Systems in Nepal. *Asia-Pacific Journal of Rural Development*, 10 (2).

Krueger, A.O., M. Schiff, and A. Valdés (Eds.). 1991. *The Political Economy of Agricultural Pricing Policy*, A World Bank Comparative Study, Johns Hopkins University Press, Baltimore.

Lam, D.W. F. 1999. "Institutional Design of Public Agencies and Co-production: A Study of Irrigation Associations in Taiwan" in M.D. McGinnis (ed.) *Polycentric Governance and Development: Readings from the Workshop in Political Theory and Policy Analysis.* Ann Arbor: The University of Michigan Press.

Lam, D.W.F. 1998. *Governing Irrigation Systems in Nepal: Institutions, Infrastructure, and Collective Action.* Oakland, CA: ICS Press.

Lam, W. F. 1996. Institutional design of public agencies and coproduction: A study of irrigation associations in Taiwan. *World Development*, 24(6):1039 – 1054.

Lam, W. F., M. Lee, and E. Ostrom. 1997. The institutional analysis and development framework: Application to irrigation policy in Nepal. Presented at Workshop on Political Theory and Policy Analysis, Bloomington, Indiana.

McCann, R.J. and D. Zilberman. 2000. "Governance Rules and Management in California's Agricultural Water Districts," In A. Dinar (ed.) *The Political Economy of Water Pricing Reforms*, Oxford University Press.

McCully, P. 1996. Silenced rivers: The ecology and politics of large dams. London, UK:

Mellor, J. W. 2001. *Irrigation agriculture and poverty reduction – General relationships and specific needs.* Meeting of the OECD Poverty Targets: An approach paper for USAID. In Barker et al., (Eds.). 2001. *Water- saving irrigation for rice:* Proceedings of an International Workshop held in Wuhan, China, 23-25 March 2002. Colombo, Sri Lanka: International Water Management Institute.

Moench, M., A. Dixit, S. Janakarajan, M.S. Rathore and S. Mudrakartha. 2003. The Fluid Mosaic: Water Governance in the Context of Variability, Uncertainty and Change, A Synthesis Paper. Kathmandu, Nepal: Nepal Water Conservation Foundation and Boulder, Colorado, USA: Institute for Social and Environmental Transition.

Molle, F. 2001. *Water pricing in Thailand: Theory and practice*. Research Report No.7, DORAS Project. Bangkok: Kasetsart University.

Molle, F. 2002a. *Development trajectories of river basins: a preliminary conceptual framework.* IWMI Research Paper.

Molle, F. 2002b. *To price or not to price? Thailand and the stigmata of "free water*". Paper to be presented at the workshop "Irrigation water policies: macro and micro considerations", Agadir, Morocco, 15-17 June 2002.

Mollinga, P. P. 2001. Water and politics: levels, rational choice and South Indian canal irrigation. *Futures*, 33 (2001):733–752.

Morris, J. 1996. Water Policy: economic theory and political reality, in Howsam, P. and R. C. Carter (eds.): *Water Policy: allocation and management in practice*, pp. 228-234

Murray-Rust, H. and M. Svendsen. 2001. Performance of locally managed irrigation in Turkey: Gediz case study. *Irrigation and Drainage Systems* 15: 373-388.

Ostrom, E. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action.* New York: Cambridge University Press.

Ostrom, E. 1992. *Crafting Institutions for Self-Governing Irrigation Systems.* San Francisco: ICS Press.

Ostrom, E. 2005. Understanding Institutional Diversity. Princeton, New Jersey: Princeton University Press.

Ostrom, E., D.W. F. Lam and M.S. Lee 1994. "The Performance of self-governing irrigation systems in Nepal." *Human Systems Management* 13, no. 3: 197-207.

Perry, C. J. 2001. *Water at any price? Issues and options in charging for irrigation water.* Irrigation and Drainage 50:1-7. UK: John Wiley & Sons Ltd.

Perry, C. J.; M. Rock, and D. Seckler. 1997. *Water as an economic good: a solution, or a problem?* Research Report 14, IWMI, Colombo, 17 p.

Pradhan, U. 1988. "Local resource mobilization and government intervention in hill irrigation systems in Nepal." Working paper prepared for the Water Management Synthesis Project. Ithaca, NY: Cornell University.

Samad, M. 2001. *Impact of irrigation management transfer on the performance of irrigation systems: A review of selected Asian experiences.* Paper presented at the ACIAR Water Policy Workshop, 8-9 June 2001, Bangkok, Thailand.

Samad, M., and D. Vermillion. 1999. An assessment of the impact of participatory irrigation management in Sri Lanka. *Water Resources Development*, 15(1/2):219-240.

Sampath, R. K. 1992. Issues in irrigation pricing in developing countries. *World Development*, Vol. 20, No. 7, pp. 967-977.

Seckler, D, U. Amarasinghe, D. Molden, R. de Silva & R. Barker. 1998. *World water demand and supply, 1990 to 2025: Scenarios and issues*. Research Report 19. Colombo, Sri Lanka: International Water Management Institute.

Sengupta, N. 2005. Institutions against change. In Shivakoti et al. (Eds), Asian Irrigation in Transition: Responding to Challenges. India, New Delhi: Sage Publications India.

Shah, T., B. van Koppen, D. Merry, M. de Lange, and M. Samad. 2002. Institutional alternatives in African smallholder irrigation: Lessons from international experience with irrigation management transfer. Research Report 60. Colombo, Sri Lanka: International Water Management Institute.

Shah, T., I. Makin, R. Sakthivadivel. 2001. Limits to Leapfrogging: Issues in Transposing Successful River Basin Management Institutions in the Developing World. Draft research paper. Colombo, Sri Lanka: International Water Management Institute.

Shivakoti, G. 1992. "Variations in Intervention, Variations in Results: Assisting FMIS in Nepal." Irrigation Management Network Paper no. 11. London, England: Overseas Development Institute.

Shivakoti, G. and E. Ostrom (ed). 2002. *Improving Irrigation Governance and Management in Nepal*. Oakland: California, ICS Press.

Shivakoti, G. P. and R. C. Bastakoti. 2006. The robustness of Montane irrigation systems of Thailand in a dynamic human-water resources interface. *Journal of Institutional Economic*s. 2 (2):1-26.

Shivakoti, G. P., D. L. Vermillion, W. F. Lam, E. Ostrom, U. Pradhan, and R. Yoder (Eds). 2005. Asian Irrigation in Transition: Responding to Challenges. India, New Delhi: Sage Publications India.

Shivakoti, G. P., W. F. Lam, U. Pradhan. 2005. Asian Irrigation Problems and Prospects. In Shivakoti et al. (Eds), Asian Irrigation in Transition: Responding to Challenges. India, New Delhi: Sage Publications India.

Small, L. E. and Ian Carruthers 1991. *Farmer-financed irrigation: the economic of reform*. Cambridge University Press, p. 233.

Smith, L. E.D.; Franks, T. and Jay Melvyn. 1997. Water – An economic good? : Theory and practice. *ICID Journal*, Vol. 46 No. 2, p. 1-13.

Sturzenegger, A. C. 1991. Argentina. In: Krueger, A. O., M. Schiff, and A. Valdes (Eds.), The Political Economy of Agricultural Pricing Policy, Volume 1, Latin America, Johns Hopkins, Baltimore, Pg. 15-51.

Svendsen, M. and W. Huppert. 2000. Incentive Creation for Irrigation System Maintenance and Water Delivery: The Case of Recent Reforms in Andhra Pradesh. Eschborn, Germany: Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH.

Svendsen, M., and G. Nott. 2000. Irrigation Management Transfer in Turkey: Process and Outcomes. In D. Groenfeldt and M. Svendsen (eds). Case Studies in Participatory Irrigation Management. USA, Washington, D.C.: World Bank Institute.

Tang, S. Y. 1992. Institutions and Collective Action: Self-Governance in Irrigation. San Francisco: ICS Press.

Tsur, Y. and A. Dinar. 1997. *The relative efficiency and implementation costs of alternative methods of pricing irrigation water.* The World Bank Economic Review, Vol. 11, No. 2: 243-62.

Uphoff, N. 1986. Improving International Irrigation Management with Farmer Participation: Getting the Process Right. Boulder, Colorado: Westview Press.

Uraivan, T.K.Y, P. C. Bruns, And B. R. Bruns. 2005. The emergence of Polycentric Water Governance in Northern Thailand. In Shivakoti et al. (Eds), Asian Irrigation in Transition: Responding to Challenges. India, New Delhi: Sage Publications India.

Vermillion, D. L. 1997. Impacts of management transfer: A review of the evidence. Research Report 11. Colombo, Sri Lanka: International Irrigation Management Institute.

Vermillion, D. L., E. Ostrom, and R. Yoder. 2005. The Future of Irrigated Agriculture in Asia: What the Twenty-First Century Will Require pf Policies, Institutions, and Governance. In Shivakoti et al. (Eds), Asian Irrigation in Transition: Responding to Challenges. India, New Delhi: Sage Publications India.

Wade R. 1982. The system of administrative and political corruption: canal irrigation in South India. *Journal of Development Studies*, 18(3):287–328.

Wambia, J. M. 2000. "The Political Economy of Water Resources Institutional Reform in Pakistan," In A. Dinar (ed.) *The Political Economy of Water Pricing Reforms*, Oxford University Press.

Wijayratna, C. M., and D. L. Vermillion. 1994. Irrigation Management Turnover in the Philippines: Strategy of the National Irrigation Administration. Research Report No.4. Colombo: International Irrigation Management Institute.

Wolff, B. and W. Huppert. 2000. Governance by Contractual Rules: Improving Service Relations in Irrigation. Eschborn, Germany: Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH.

World Bank, *Kingdom of Morocco Water Sector Review*, #14750-MOR, Middle East and North Africa Region, Maghreb and Iran Department, Natural Resources and Environmental Division, Washington, D.C., June 1995.

World Bank, *Pakistan, Staff Appraisal Report National Drainage Program Project*, #15310-PAK, Rural Development Sector Management Unit, South Asia Region, Washington, DC, September 25, 1997.