POLICY ISSUES IN MANAGING IRRIGATION AND DRAINAGE

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ABSTRACT

Water for irrigation and drainage has multiple characteristics that have often caused market failures, government failures and environmental deterioration. For improving the management of irrigation and drainage, five major policy issues are raised in this Bulletin. They are (i) a comprehensive cross-sector framework for managing water resources; (ii) demand management for irrigated agriculture; (iii) participatory irrigation management; (iv) control of agricultural water quality; and (v) poverty alleviation in irrigation management. Each of these policy issues contains a set of further issues related to policy and implementation concerns. Turning these policy issues into action needs more research and training. Research can help formulate appropriate policies, while training can raise public awareness and upgrade the implementation capacity of these policies.

INTRODUCTION

F. Kennedy, the former president of the USA once said: "Anyone who solves the problem of water deserves not one Nobel Prize but two — one for science and the other for peace". This is a simple expression of the complexity and difficulty of managing water resources.

Agriculture accounts for two-thirds of the world's use of fresh water. Some 40% of the world's food crops are produced by irrigated agriculture. The performance of irrigation and drainage is critical to the food supply, farmers' incomes and the environment.

This Bulletin aims to highlight major policy issues in the management of agriculturally used water resources, mainly irrigation and drainage. Before the discussion of individual policy issues, the Bulletin will link the relationship that exists between the characteristics of irrigation water; goals and problem areas of the management; and policy issues in managing irrigation and drainage.

Characteristics of Water for Irrigation and Drainage

Water for irrigation and drainage has multiple characteristics. It is an economic good and also a social good (Perry, Rock and Seckler 1997). An economic good is a common material which can be traded as a factor of agricultural production, such as fertilizer. A social good is something that may have a benefit (or cost) to society beyond that which accrues to the individuals consuming it, such as low-cost housing. Irrigation water is another example, as it has social implications that involve a large number of mostly poor farmers. Irrigation water can also be a private good and sometimes a public good. A private good, such as an apple, can be individually and exclusively consumed. A public good, such as national defense, has no excludability (i.e. it is difficult to exclude others from consuming it) and zero subtractability (i.e. many people may simultaneously consume it without decreasing each consumer's benefits). In the case of a large irrigation and drainage system, it would be very costly to exclude others from using it.

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Furthermore, because of limited sources of water and limited sites for building structures such as dams and canals, irrigation-drainage is often a natural monopoly. Also, irrigation and drainage systems, particularly modern ones, have economies of scale. They are large in size and complicated in structure. This characteristic also limits market function. In addition, the effects of irrigation and drainage activities are highly interdependent with other uses of water and land resources, and have considerable and lasting impact on the environment.

Goals of Water Management

The ultimate goals for managing water resources in general, and irrigation-drainage water in particular, are efficiency, equity, and sustainability.

When the goal of efficiency is achieved, each drop of water has been properly allocated and used. This implies that the marginal returns of water for each user (rich or poor) for various purposes (rice or corn etc.) should be the same, and equal to the marginal cost (and price) of water. In such cases, the economic benefits of society from water can be maximized. Of course this is an economic ideal which could only be achieved if both the water supply system and market conditions are perfect. In a practical sense, efficient water use means a proper allocation without waste of water.

The goal of equity, on the other hand, refers to a fair distribution to users. For irrigation and drainage, some users may have more advantages than others. Such a difference can be found between canal head users and tail enders, and also between influential farmers and poor farmers. In many cases, equity is more important than efficiency in irrigated agriculture. This is because irrigation efficiency is a difficult concept. Poor irrigation efficiency in the upper stream of the river basin may be beneficial to those down stream. However, unfair distribution to users in a system tends to be undesirable both economically and socially.

The goal of sustainability expects that current users maintain the quantity and quality of water resources for the use of future generations. It is extremely important that current water users keep a productive and healthy environment for generations to come. Poor water management in irrigation and drainage may have many negative effects on agricultural productivity, health and the environment. These effects include sedimentation, toxic discharges, water-logging, salinity, and even desertification.

PROBLEMS IN WATER MANAGEMENT

Because of the above-mentioned characteristics, it is very difficult to manage irrigation and drainage so as to achieve efficiency, equity, and sustainability. From past experience in many countries, there are three principal problems in management. These are market failure, government failure and environmental deterioration (Serageldin 1995).

Market failure refers to the inability of market mechanisms or the invisible hand of capitalism to allocate water properly to different users in various sectors, or manage it efficiently without government intervention. Water sale and pricing are useful, but their function is limited. Water moves through a complicated hydrological cycle of rainfall, absorption, runoff, and evapotranspiration. This makes various uses of surface water and groundwater highly interdependent.

External factors such as pollution, waterlogging, and over-use of groundwater are often major causes of market failure. High transaction costs are another cause. Measuring and delivering water, and monitoring the quantity and quality, to serve the market's purposes can be very expensive. The third major cause of market failure is the lack of secure and effective property rights over water for each user. This is particularly the case in irrigation and drainage in developing countries. Stealing of water by users is common. Moreover, on the supply side, the characteristic of a natural monopoly of irrigation and drainage is a fourth major cause of market failure.

Government failures refer to weaknesses of government authorities in managing water resources in general, and irrigation and drainage in particular. Given water's special characteristics, there are good reasons for governments to intervene, and even to directly manage various water uses by means of irrigation departments and water supply authorities. In many cases, however, governments may not have done this job well (World Bank 1993, pp.27-31).

Fragmented management is often the main cause of government failures. Many governments create separate departments or agencies to manage different types of water use. In some governments, irrigation, the municipal water supply and water used to supply electric power, or as a means of transportation are each handled by different departments or agencies. Each is responsible for its own operations, and independent of the others.

This leads to uncoordinated and fragmented decision-making; excessive and unproductive

investment; and undesirable environment effects. Problems are likely to be more severe when a water source involves various levels of government, such as central, provincial and local governments.

Overextended government agencies are another major cause of government failure. There is often a heavy dependency on a centralized agency to plan, develop, operate, and maintain irrigation systems. The agency is often too large, bureaucratic and inefficient. It hires too many members of staff, wasting precious funds on their salaries. Hence the cost of water supplies, particularly the operation and maintenance costs, are often too high, while the service provided is generally poor. As a result, the users, who are mostly small-scale farmers, are often unwilling to pay. Furthermore, there is little user participation. This creates a vicious cycle, in which high costs plus poor service lead to users' unwillingness to pay, causing inadequate funds for operating and maintaining the system, leading to a further decline in the level of service.

ENVIRONMENTAL DETERIORATION

Many developing countries pay too little attention to water quality and pollution control. The discharge of untreated industrial wastes, the runoff of agricultural chemicals, and poor use of land for agriculture and forestry, all cause widespread degradation of land and water resources. In India, for example, a country that depends on irrigated agriculture, more than 4 million hectares of once-productive land have been abandoned because of water-logging and salinization. At present, about 10 to 15% of the world's irrigated land is affected by waterlogging. This is a common and difficult problem in agricultural water management.

MAJOR POLICY ISSUES

Policy issues here refer to various non-technical issues in managing irrigation and drainage. There is a long list of such issues. The following are among the most important.

- The need for a comprehensive multi-sectoral framework for managing water resources as a whole;
- The need for demand-driven management of irrigation for agriculture;
- The need for participatory irrigation management;
- The need to control water quality for irrigated agriculture; *and*
- The need for poverty alleviation in irrigation management.

COMPREHENSIVE CROSS-SECTOR FRAMEWORK FOR MANAGING WATER RESOURCES

Current trends in the growth of population, urbanization, industrialization, and income have generated increasing demand for more water quantity and better water quality. As water is a limited resource, conflicts between various water users from different sectors and locations are increasing, and becoming more complicated. It is almost impossible to optimize water management for the agricultural sector or any other sector on its own, without considering the needs of other sectors. The UN conference on environment and development in 1992 in Rio de Janeiro emphasized the need for a holistic approach to fresh water, and the integration of different sectors in water management, within the framework of national policy (UNDP 1992).

The World Bank states:

"Water resources should be managed in the context of a national water strategy that is based on an assessment of the country's water resources.... The strategy would spell out priorities on water services; establish policies on water rights; water pricing and cost recovery, public investment, and the role of private sector in water development; and institute measures for environment protection and restoration..... In essence, this compre-hensive approach breaks down very complex problems in a river-basin into more manageable elements to achieve coherent cross-sectoral water manage-ment." (World Bank 1993 p. 41).

The World Bank approach views water as a single resource with many uses. The Asian Development Bank also emphasizes an integrated and cross-sectoral approach at a national level to avoid the consequences of uncoordinated and *ad* hoc development of water resources (Asian Development Bank 1995).

The cross-sectoral framework is a general map in managing a nation's water resources, in which a broad range of national policy issues will be involved. These include self-sufficiency in food, property rights and ownership, urbanization and regional development.

Demand Management for Irrigation and Drainage

To improve the management of existing

irrigation and drainage systems, there is not much to do on the supply side except rehabilitation and modernization of these systems. These hardware investments can be very costly, and their impact is relatively short-term unless measures are taken to improve the demand side.

Demand management is user-oriented. It involves mainly software activities, including regulation, education, pricing, incentives, user participation and re-allocation of water rights. These activities influence water users directly or indirectly to adopt efficient water-use practices.

Today, demand management has become the main way of managing water resources, particularly for irrigation and drainage, which involve a large number of small-scale farmers. It is difficult to improve the management of irrigation and drainage without cooperation and participation by these farmers.

Many further policy issues regarding demand management can be raised. These include the pricing of water; providing incentives for farmers to save water in the dry season and to drain water in the wet season; educating farmers in better management of water; and re-allocating water among sectors to adjust the long-term demand for water from various users.

Which measures should be taken depends on the country or region. The basic principle of demand management is to focus on the user. How to maximize users' participation in the full range of water management activities is the key in improving irrigation and drainage performance.

PARTICIPATORY IRRIGATION MANAGEMENT

Since 1994, the World Bank Institute (WBI) has carried out a program of Participatory Irrigation Management (PIM). It has been very successful. PIM refers to the involvement of irrigation users in all aspects and at all levels of irrigation management. This includes planning, design, construction, maintenance, and financing for the main irrigation system and all subsystems. 'Involvement' is flexible, ranging from information sharing, consultation, and joint assessment to shared decision-making, collaboration, and empowerment.

The rationale of PIM is mainly derived from market and government failures in managing irrigation and drainage, and the need for demand management. The World Bank employs a new word, "**userism**", to express the essence of PIM. It is indeed management of the users, by the users and for the users (Sun 1996).

It is believed that PIM, or user management, can save financial and social costs compared to government management. Also, irrigation users have a stronger incentive to manage water more productively, and can respond more quickly to management problems in the system. In recent years, there have been many successful examples of PIM (Groenfeldt and Sun 1997).

The Mexico Experience

In the 1980s, the Mexico government suffered a serious financial crisis, resulting in a reduced budget for the maintenance of national irrigation systems. This created a vicious cycle in the irrigation sector — rapidly deteriorating systems, leading to farmers' unwillingness to pay for water, causing a shortage of funds which made systems deteriorate further.

In 1990, an irrigation district of about 80,000 ha was transferred to the users. While the government manages head works and the main canal system, the users' irrigation association manages the remaining secondary and tertiary canal system. By 1995, more than two-thirds of the nation's 3.2 million ha network had been transferred to 316 irrigation associations. Each association has a legal contract with the district water board. Management of the board remains in the government's hands for a specific share of the total water supply. The contract, covering twenty years, specifies the proportion of irrigation fees that will go to the association and to the district water board.

The so-called Mexico Model has saved the country from its crisis of irrigation management. In general, farmers were very pleased with the performance of the users' associations, and were willing to pay even higher water fees (without government subsidy).

The case of Turkey

Following Mexico's lead, Turkey adopted a similar policy of irrigation transfer in 1993. More than half the national systems administered by the government in Turkey were transferred to local users' associations within the first three years.

The results were encouraging. Farmers were paying roughly the same amount of water fees. However, a much smaller part of the fees were used for personnel. Irrigation services significantly improved. It was not possible to have irrigation during weekends and nights before the transfer, but this became possible when users managed the system.

The story in Albania

In 1997, Albania suffered from serious political and social instability, which almost reached the level of a civil war. Most public infrastructure and facilities, such as powerhouses and pumping stations, were severely damaged. However, those irrigation systems which were managed by users were spared. Men, women and even children, the brave group of users, defended their irrigation facilities by force from rebel damage. Albanians called this "The power of PIM".

The case of Andhra Pradesh, India

Following the example of Mexico and Turkey, the Legislative Assembly of the State of Andhra Pradesh approved an Act called 'Farmers' Management of Irrigation Systems' in 1997. According to this Act, the management of about 5 million ha was to be brought under the control of millions of farmers, mainly smallholders. Over 10,000 Water Users' Associations (WUAs) and 174 Distributory Committees were created. They were given the responsibility of planning and implementing the maintenance and improvement of irrigation systems and water distribution. The role of the irrigation department changed from a "doer" to a "facilitator". During its first year of operations, the area where the Act was put into practice reached 200,000 ha. Agricultural productivity in this area increased (INPIM 1999).

Participatory Irrigation Management (PIM) is not new and has been practiced in various forms in different countries for years. Japan's Land Improvement District and Taiwan's Irrigation Associations have existed for many decades. Countries such as China, Vietnam, Pakistan, Egypt, Morocco, Nepal and Jordan are in the process of finding their own way to implement PIM reforms. The International Network on Participatory Irrigation Management (INPIM), an international non-government organization, was established in Washington D.C., with funding from the World Bank and some bilateral donors, to promote PIM reforms world-wide (INPIM 1997).

Impact of PIM reforms

The impact of transferring irrigation management from government agencies to users' associations may be viewed from three perspectives: that of the farmers, that of the government, and that of the irrigation department. The government is likely to be a winner, as subsidies for irrigation can be reduced. Farmers are also probable winners, as they can enjoy a sense of ownership with improved services. The irrigation department, however, may be a loser. Its budget, staff, and authority are likely to be significantly cut, and its role changed.

IPIM is desirable and is likely to be the general direction most countries take in irrigation management (Vermillion and Johnson 1995). However, there are many policy issues in the planning, implementation and evaluation of PIM reforms, and different countries are likely to decide these differently.

WATER QUALITY MANAGEMENT AND WATERSHED PROTECTION

Water quality management is as important as the management of water quantity, and is even more difficult. This is because water quality management involves many external factors that can easily be neglected. Irrigated agriculture, in many instances, may have a negative impact on water quality and the environment. These negative effects include soil erosion, fertilizers, pesticides, herbicides, salinity, waterlogging, and flood runoff.

Fertilizers add excess nutrients in the forms of nitrogen and phosphorous to streams and lakes. Pesticides and herbicides can contain toxic chemicals which may be lethal to wildlife. Water-logging and salinity will reduce land productivity, and also contribute sediment nutrients and chemicals to runoff. Runoff from animal husbandry can add greatly to non-point pollution. Because there are many water users, most irrigation systems are large. It is difficult for governments to control water quality effectively. Both regulatory and market approaches are needed (Grigg 1996).

In the **regulatory approach**, the government sets regulations (quality standards) that dischargers must meet. This is basically a command-and-control format. The advantage of this approach is its simplicity and fairness, rather like setting a speed limit on the roads that applies to all vehicles. However, there are disadvantages. First, it requires expensive research and a long time to set quality standards. Second, high administrative costs are involved in enforcing the standards. Third, standards are often too rigid for individuals to meet, and sometimes discourage free enterprise. These disadvantages leave room for a market-oriented approach.

The **market-oriented approach** offers the promise of economic efficiency and user innovation.

It may also be administratively simpler than the regulatory approach. One way to implement a market-oriented approach is to use the concept of the total maximum daily load (TMDL), to evaluate the total waste that a stream can assimilate while still maintaining its standard of quality. Once the TMDL is determined, then point and non-point sources can be allocated. This should make it possible to develop innovations such as pollution trading. This kind of self-regulation can help increase economic efficiency.

In addition, a watershed management strategy should protect the ecology of the watershed and control water quality. Many policy issues, however, should also be addressed. These include the land tenure system, the agricultural extension network, and incentive policies for credit, taxes and subsidies. Secure land tenure will encourage farmers to invest in land and water for the long term. An effective agricultural extension network can teach farmers new technologies and practices, while incentives can induce farmers to do more to protect the watershed and reduce agricultural pollution.

POVERTY ALLEVIATION AND IRRIGATION MANAGEMENT

Poverty alleviation is a major goal of national development in most countries. What irrigation management can do to help poverty alleviation is an important policy issue. Among others, the following approaches may be considered.

Treat the poor equally as irrigation clients. In many cases, resource-poor, small-scale farmers are disadvantaged water users. They may be located at the tail end part of the system, or have little connection with water management officials. As a result, they often suffer from frequent water shortages, which make them even poorer. To break this vicious cycle of poverty, the government and water management authorities must adopt a service-oriented management approach, and treat the poor as equal clients of the system. This should be the minimum that irrigation management does to alleviate poverty and achieve equity in water management.

Let the poor be favorably represented. Generally the poor are a silent group with little influence in irrigation management issues. Recently, there is an encouraging trend in Mexico of letting the poor be represented on the Board of Directors of the newly established water users' associations. The Directors of the Board are elected separately from two groups of users—small farmers or tenants, and farmers with large land holdings. Directors from each group alternate as chairperson and other key positions on the Board. This helps protect the interests of the poor. The same approach can be used to solve conflicts between different social groups in water management.

Reduce the cost of water for the poor. There are various ways of reducing the cost of water paid by the poor. These include subsidies from the government, lower water fees for the poor, providing more jobs for the poor, or allocating favorable water rights to small users in dry seasons.

CONCLUSION

I have described five related policy issues in managing irrigation and drainage. They are:

- The need for a comprehensive, multi-sectoral framework in managing a nation's water resources;
- Demand management for irrigated agriculture;
- Participatory management for irrigated agriculture;
- The need to control the quality of water used for agriculture, *and*
- The need to alleviate poverty in irrigation districts.

Turning these policy issues into action plans needs more research and training. Policy research can formulate appropriate policies for specific issues in a specific place, while training can raise public awareness and upgrade the capacity to implement these policies.

I sincerely hope someone will be able to solve the problems of water, and receive two Nobel Prizes — one for science and the other for peace — in the foreseeable future.

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