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in

Dupuy B. (ed.).

Aspects économiques de la gestion de l'eau dans le bassin méditerranéen

Bari : CIHEAM

Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 31

1997

pages 125-135

Article available on line / Article disponible en ligne à l'adresse :

<http://om.ciheam.org/article.php?IDPDF=CI971536>

To cite this article / Pour citer cet article

Mergos G.J. **Sustainability, cost recovery and pricing for water in irrigation investment**. In : Dupuy B. (ed.). *Aspects économiques de la gestion de l'eau dans le bassin méditerranéen*. Bari : CIHEAM, 1997. p. 125-135 (Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 31)



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Sustainability, cost recovery and pricing for water in irrigation investment

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SUMMARY - Sustainable agricultural development is a desirable goal, but as a concept it cannot lead to practical project appraisal recommendations, unless it is properly defined and introduced in the project evaluation process as a set of selection rules. The critical link for ensuring sustainable development is to maintain ecological, operational and financial sustainability at the project level. Ecological sustainability is a well known concept, but financial sustainability needs some explanation. Financial sustainability is related to problems caused by the large recurrent cost burdens on government budgets and the need for frequent system rehabilitation of irrigation schemes. Since most countries face serious budgetary difficulties in financing their development plans, it is necessary to reconsider the basis on which irrigation projects operate and impose a principle of self-sustaining. Under such principle, the cost of operation and maintenance of irrigation projects (and perhaps the recovery of investment) should be internalized. In addition, a mechanism should be introduced for assessing institutional performance and for encouraging farmers' participation and responsibility. Pricing and cost recovery issues should, as a principle, be part of project economic work. The well known rule "price should equal short-run marginal cost" is far too simple to be practical and new types pricing policy are necessary. Equity and efficiency are generally the main issues. Hence, a presentation and discussion of alternative pricing rules as well as of price policy experience in irrigation investment becomes important. In addition, issues of water allocation methods and water rights are important for the establishment of an effective water management system. Finally, the relevance of water markets as a mechanism for the allocation of water is recently attracting considerable attention.

Key words: Sustainability, cost recovery, water pricing, water markets, water rights.

INTRODUCTION

Problems of water management in agriculture are gaining increased importance worldwide. The implications of a rapidly increasing population on food demand, the environment and water availability are severe. In ten years from now there will be not only 1 billion people more to feed, but also demand for extra food for the 500 million at present seriously undernourished. In addition more than 1 billion people, mainly poor, still have no access to clean water. It is estimated that food output has to increase by 40 percent over the next ten years in order to satisfy demand and this may come by increasing the productivity of cultivated land by irrigation and increasing output with application of new biological technology (FAO, 1993).

Within this context water availability becomes an important factor in global development and issues of sustainable development and water management attract prominent attention. Per capita availability of water is declining rapidly in many regions of the world and in particular in Middle East and Northern Africa because of a rapid population growth. Some of the countries in such regions move rapidly into a water scarcity and water crisis situation. For instance, per capita water availability in Middle East and Northern Africa has declined from 3480 cubic meters (c.m.) per capita in 1960 to 1450 c.m. per capita in 1990 and is expected to decline further to 680 c.m. per capita in 2015 due to the rapid population growth (Le Moigne, et al, 1994, p.4.). Such alarming trends imply that issues of water availability transcend sectorial considerations and have important effects on a country's economic and social development and on the general well being of the population.

Despite such trends in water availability, irrigation projects have in many countries been designed, evaluated and operated in a rather narrow sense, leaving aside issues of environment, maintenance, people's participation, and government financing. Disregard of such issues has resulted in many cases in dwindling irrigation resources, strained government finances, and irrational operation of the irrigation systems (O' Mara, 1990). The rationale for this behaviour is a concentration on irrigating more land to meet the rapidly increasing demand for agricultural products, and the subsequent choice for big, not always successful projects.

The formulation and implementation, then, of a strategy for water allocation and use is of paramount importance for achieving efficiency and equity in the use of water and in enhancing social and economic development. Governments need to review carefully their water related policies and strategies so that water is managed as a social and economic resource with emphasis on conservation. Water related policies may include government decisions about protection of ecosystems, water rights, water charges and water pricing, organizational and social issues.

Most countries, however, face budgetary difficulties and the competition for public funds is increasing. In addition, the costs of water investments are rising and Operation and Maintenance (O & M) costs strain government budgets. Economic efficiency becomes a key objective in most countries and opportunity costs will need to guide future water allocation decisions. In this sense pricing for water with the objective of cost recovery becomes a major issue. Furthermore, the role of water pricing and economic incentives for efficient water use is critical in guiding water use and allocation decisions and, hence, the design and selection of appropriate institutional mechanisms.

This paper discusses the issues of water pricing and cost recovery in irrigation projects. Its premise is that, given recent trends in water availability, irrigation projects should operate under the principle of self-sustaining. After a review of the concepts of sustainability and cost recovery, the paper concentrates on water pricing policies, and discusses issues of water markets, property rights and institutional mechanisms for water use and allocation. Finally, the paper concludes with some remarks and recommendations on the design and selection of appropriate institutional mechanisms for the allocation of water.

SUSTAINABILITY AND COST RECOVERY ISSUES

Sustainability

Under conditions of diminishing per capita availability of water in many regions of the world, sustainable agricultural development becomes an overriding objective. The concept of sustainability is

used by different people to mean different things (see, e.g. Conway 1987, Barbier et. al. 1990, O' Mara 1990, Mergos, 1991, etc.). Hence, although it is easy to accept sustainable agricultural development as a desirable goal, the danger is that the concept, unless properly defined, is too vague to lead to practical irrigation project recommendations.

Sustainability is usually approached as an ecosystem concept, where a set of elements, agricultural production units, interact with their surrounding natural environments. However, the concept is much wider, since, this approach refers only to the ecological concept of "resilience" of natural ecosystems. Sustainability, according to Conway (1987) is the ability of a system to withstand collapse and maintain productivity when subject to stress or shock. Cost Benefit Analysis Methods encounters severe problems in dealing with issues of sustainability (see Page, 1977, but also Morvaridi, 1994). Using standard Cost Benefit Analysis criteria it may be economically efficient, under certain conditions, to allow for the exhaustion of a resource that is important for sustainability. This is the reason that some economists have argued in the past that justification of the conservation of such a resource requires an additional criterion in project appraisal taking into account "intergenerational equity". Following such an approach, the concept of sustainability is made operational in project appraisal by setting a constraint to the depletion or degradation of the particular resource that is important for sustainability (see, e.g. Barbier et. al. 1990, p. 188).

Besides the intertemporal nature of the challenge of sustainable development to standard Cost Benefit Analysis methods, there is also a an "intergroup" externality, which means that activities of one group of people have some unintended impact, either positive or negative on some other group separated from them in space. A clear example illustrating this property in water resource management is the setting up of a dam or the management of water upstream, that affects the welfare of people downstream. Although one may tend to consider this case as an income distribution problem, it is also possible that the change in the flow of water may destroy the natural resource stock downstream that is not accounted in conventional cost benefit analysis.

The concept of externality brings us to the collective nature of the problem of sustainability. Both neoclassical economists and sustainable develop-

ment advocates perceive that externalities arise from institutional failure, because property rights do not provide incentives to protect the resource. It is, therefore, necessary to consider solutions to problems of sustainability of institutional or of collective character. The first refers to the creation of mechanisms that provide incentives for change in individual behaviour towards the objective of sustainability and the second to the creation of a group whose members act in the common interest of the membership as a whole, perhaps at some cost to individuals members.

A serious criticism advanced against the sustainable development concept is that it lacks an adequate framework to make the concept operational. Without such a framework, it is claimed, it is impossible to provide policy advice for reallocation of investment resources and for guidance on policy action.

Development activities are structured in the form of projects and mobilized resources are allocated among alternative project proposals. Project evaluation methodology is used to select individual development project to be included in the development plan. Since the standard criteria for project selection ignore sustainability in favour of efficiency, it is important to find new rules that guide project selection and allocation of resources among, the rule of the " alternative projects taking into account sustainability. However opportunity cost" need to be maintained (Batie, 1989, p. 1096). Hence, the critical link for ensuring sustainable development is to maintain sustainability at the project level. It follows that the project selection and implementation process should be redefined to be consistent with the concepts of efficiency and sustainability.

It has been argued above that the broad goal of sustainable development can be achieved if projects are selected according to a set of criteria that assure sustainability. Implementation of sustainable projects will lead to sustainable development (ODA, 1985). This approach modifies the standard project selection process so that attention is paid to the impact of the selected projects on broad development concerns such as the environment or the conditions of the poorest sections of the society. Similarly, project viability is of critical importance for sustainability because it implies that the invested resources produce the intended benefit and, hence, contribute to the broad goals of sustainable development.

Project sustainability has been defined as the capacity of the project to maintain an acceptable level of benefit flows through its economic life (OED, 1985). Project benefits may include such benefits as increased output, favourable sector conditions, use of technology transferred, and operation of institutions built by the project.

In an effort to quantify the concept, project sustainability has been defined to reflect the percentage of project-initiated goods and services that is still delivered and maintained five years past the termination of donor resources, the continuation of local action stipulated by the project, and the generation of successor services and initiatives as a result of project-built local capacity. However, project sustainability is a relative concept which should be assessed using a set of indicators that differ across different sectors. We elaborate on such a set of indicators for irrigation investment next.

The projected growth in demand for food, expected as a result of population and income growth, should be met with increased food production. Although investment in irrigation has not always been successful and realised benefits are sometimes much lower than intended benefits (Mergos, 1987), irrigation investment plays a pivotal role in expanding production capacity and increasing agricultural output. However, investment in irrigation should be considered not only from an efficiency, but also from a sustainability point of view. Irrigation projects should be examined for (a) ecological sustainability; (b) operational sustainability; and (c) financial sustainability. We briefly discuss these aspects next.

Ecological sustainability relates to the interaction of irrigation schemes with the resource base. A large irrigation scheme, even if it is efficient, may have undesirable effects on the ecosystem. Large dams and river diversions are examples of irrigation projects with possible adverse effects on the ecosystems. The important point in this discussion is that such effects are not localized and by breaking the ecological chain in one point, adverse effects can spread over the entire ecosystem affecting populations living far away (even in different parts of the globe) from the irrigation project. Hence, a possible adverse impact of an irrigation scheme on the resource base is the degradation of the physical resource base, that is finite in extent, and which can lead to serious discontinuities in benefit streams

and can cut short productive lifetimes of other major investment elsewhere.

Operational sustainability is confined to the operation of the irrigation project itself. A major role in the operational sustainability of an irrigation scheme play the technical solution and the design of the scheme. Salinity and water logging are considered as major problems in the context of irrigation system sustainability and constitute a serious threat to the productive capacity and long-term sustainability of a large number of irrigation schemes, which if not dealt in time may lead to a complete collapse of the schemes. In certain situations it is necessary to install extensive surface drainage systems in previously irrigated areas in order to deal with the problem.

Another problem of poor design that leads to operational problems, shorter productive lifetimes, and much lower benefit streams is when the operation of the system is implemented in a technically different than it has been designed way. If the scheme is poorly designed, water supply may not be dependable. Under such circumstances, farmers are eager to find alternative ways to secure water, usually to the detriment of their fellow farmers, sometime creating chaos and complete collapse of the irrigation system.

Besides technical factors, economic, political, and institutional factors constitute the most intractable constraints for the operational sustainability of irrigation projects. Projects operate, and usually should be seen, as interventions in an economic, social, and institutional environment. Unless they are in agreement with this environment, irrigation projects are doomed to fail. Major difficulties in implementing remedial or preventive actions relate to the delayed onset of the undesirable effects, the collective nature of many of the solution, the restricted constituencies supporting remedial programmes, and the high costs related to the changes in the technical design (either to control water logging and salinity or other operational problems).

The most promising approach in solving these problems and leading to sustainable irrigation projects, is to create farm-level incentives that point to the desirable direction. If the design of the project rewards those who follow undesirable practices, it is a matter of time for the project to collapse. If, on the other hand, there are farm-level incentives for

desirable practices, sustainability of the project is secured. However, there has been little research up to now on the design of such incentives, especially those that are of institutional and collective nature.

Financial sustainability relates to problems caused by the large recurrent cost burdens on government and the need for frequent system rehabilitation of irrigation schemes. It is natural to consider this issue as affecting not only the viability and productivity of existing systems but also the economic rationale for the development of new irrigated land as well.

In most countries recurrent costs for the operation of irrigation projects do not come from irrigation revenues, which are inadequate in any case, but from the general budget of the state. Also, in most cases, water is paid for by its users on an administratively-determined basis that has no direct relationship to the quantity of water used. In such circumstances cost recovery is low and financial incentives do not operate to encourage good water management practices, creating problems of sustainability for existing projects and disincentives for the development of new projects.

At present, when most countries face serious budgetary difficulties, it is necessary to reconsider the basis on which irrigation projects operate and impose a principle of self-sustaining. Under such principle, irrigation project operation and maintenance should be internalized, raising revenues for cost recovery, assessing institutional performance, and encouraging farmers' participation and responsibility. Since continued growth in government outlays for O & M of irrigation projects would probably be dwindling and resources for expansion of irrigated land may be difficult to find, the operation of irrigation projects should be restructured for financial sustainability without inflows from the general government budget.

Cost recovery

Imposing a principle of self-sustaining on irrigation projects leads, as explained above, to sustainable agricultural development. Of particular importance is the internalizing of irrigation project operation and maintenance, raising revenues for cost recovery, and encouraging financial sustainability without inflows from the general government budget.

The principle of cost recovery has become of particular importance under conditions of rising cost of investment in irrigation and other water resources projects and under increasing competition for funding from government budgets. Hence, there will be an increasing reliance on cost recovery as a source of funds to sustain projects. In addition, however, securing funding for financing new investment in irrigation and for operation of existing projects, new institutional solutions are necessary to improve project efficiency in the use of water by encouraging conservation and efficient use.

Cost recovery mechanisms can play a very useful role in this respect. For instance, Operation and Management of irrigation projects can become more efficient by setting up mechanisms that encourage farmers' participation and in this way willingness to pay of farmers is increased, the quality of services is improved, and irrigation projects become self-sustained. The best way to achieve self-sustaining of projects is to turn over Operation and Management to water users in the form of a financially independent entity. World Bank experience in Philippines shows that cost recovery increased to 75% of O & M costs by encouraging users' participation and ownership of irrigation facilities. Increased efficiency is achieved in water conservation and use because water users can better monitor water use and exercise social pressure for collecting water fees among users. But also, by turning over cost recovery mechanisms to users' associations, the cost of monitoring and enforcing water fee collection is decreased.

Implementation of cost recovery policies is a complicated issue. Governments that follow a low price policy for agricultural products, taxing farmers indirectly by maintaining prices below world market levels, cannot and, perhaps, should not expect farmers to pay full cost for irrigation facilities. When, on the other hand, prices of agricultural products are maintained above world market levels and there are implicit transfers of income from consumers and the budget to farmers, full cost for irrigation facilities should be charged. In addition, when project operation aims to satisfy other country objectives, e.g. to achieve national food security and irrigation is not profitable to farmers, then some form of subsidy from the general government budget should be logically expected. Similar complications

arise in multi-purpose projects where joint costs should be allocated according to the different purposes (e.g. irrigation and generation of electricity). However, farmers may be able sometimes to use pressure to shift operation and management costs to the general government budget and keep their water charges low.

Finally, it should be noted that in the years to come the needs for financing of irrigation investment will probably exceed available resources in government budgets and hence, additional sources of capital may be required (World Bank, 1993). For this reason there will be a need to identify bankable projects so that commercial capital financing irrigation investment. Under such circumstances can be used for there is need to rely more on financial mechanisms that establish the appropriate conditions of financial independence of project operation from government budgets, to rely on water users associations for monitoring cost recovery operations, and to encourage collective initiatives. Assuming the existence of reasonably developed capital markets, meeting the above conditions will allow private capital to be used for financing operation of existing irrigation projects as well as new irrigation investment.

WATER PRICING POLICIES

Policy objectives

Pricing and cost recovery issues should, as a principle, be part of project economic work. However, a number of issues arise when one is confronted with the actual implementation of pricing policies. However, as it has been discussed earlier, cost recovery and charging for water is not an end in itself, but serves the objectives of efficiency and equity within the national economy.

Efficiency and equity are the two fundamental economic objectives that should be satisfied, when governments design their economic policies. These two conflicting objectives lead to quite different water pricing policy criteria, hence, the appropriate mix of the two reflects, in general, the particular choices of governments. On the other hand, water price determination is influenced by a number of other case specific natural factors (physical, hydrological, climate, soils etc.) as well as social and institutional factors. In addition, the need for adminis-

trative efficiency and the cost of monitoring and enforcing water pricing policies, also, affect governments' choices.

Despite general acceptance that charging for water is justified on efficiency grounds, and in many cases on social grounds as well, there are opponents to cost recovery practices. Their objections are based on the following arguments: (i) there are direct and indirect benefits from the operation of irrigation projects and, hence, it would be difficult to charge for water according to benefits accrued; (ii) there are great difficulties in monitoring and enforcing cost recovery system and hence, it may under certain circumstances be preferable not to charge for water at all; (iii) cost recovery system do not account for the need to help poor parts of the agricultural population; (iv) irrigation facilities are often under-utilized, hence, charging for water makes farmers less motivated to irrigate. Overall, however such arguments against using cost recovery mechanisms do not stand scrutiny either on efficiency or on equity grounds and in addition they do not ensure water conservation. The only valid argument against charging for water in the cost of enforcing and monitoring pricing policies.

WATER PRICING METHODS

Marginal cost pricing is the most efficient method of pricing not only in irrigation but in every economic system. Nevertheless, the actual implementation of water changes can rarely be related to marginal cost concepts especially in the real world where administered prices prevail. In particular such a pricing system encounters enormous difficulties in determining the true marginal cost, and the complexity of measurement difficulties and tariff structures makes its use for farmers impractical if used with administered prices.

Average cost pricing policies intend to cover all costs and thus such a system satisfies the requirements for financial mobility. In addition, average cost pricing despite a number of advantages compared with marginal cost pricing, it is not consistent with the principle of efficiency.

Benefit pricing has the objective of charging not only for operation and maintenance costs but also for part of the benefits obtained from irrigation. This system however, is very difficult to implement

since it is completely unrelated to the volume of water used.

There are, in addition, various systems of charging for part of the operation and maintenance costs of the projects while governments finance the rest and investment costs. The objective is to provide income assistance to farmers and improve equity since farmers are in general poorer compared to the non-farm population. However, this system has many drawbacks since it does not encourage efficiency in water use and leads to large financial deficits of water management organisations.

There are several approaches in assessing water changes with two main lines of thought. The first considers water charges as a fee to be used for the cost of operation and maintenance of the water facilities and perhaps, for the improvement and expansion of services. The second, considers that fees should be charged on the basis of the concept of value of water. The various methods used for pricing the water around the world follow these two general approaches.

Area-based pricing of water is the most common and perhaps the simpler to operate. Water in this approach is priced per hectare or other unit of area irrigated with minimal or no control at all on the amount of water supplied. Major advantages of this approach are its minimal requirements for monitoring and control of water supplies and its reliance on information that is easily accessible and verifiable (hectares of land cultivated and irrigated). Hence, in terms of cost effectiveness this approach has quite a number of advantages compared with other more sophisticated methods of price assessment. The method relies, also, on some form of group behaviour and social pressure to prevent wastage of water, especially in periods of water shortages. Hence the efficiency of this method depends to a large extent on the ability of the group to follow water control schedules and practices.

A slightly different method of pricing is followed when water prices depend on the number of shares that a farmer holds for irrigation in the command area. The number of shares, however, is usually associated with the amount of irrigable land. Hence, there are no major differences between the efficiency and equity impact. There are, however, in the method also significant effects on efficiency from group behaviour and institutional arrange-

ments for water control schedules and practices. If control methods are efficient then this method, as the previous one, can lead to efficient and equitable outcomes of water distribution. In contrast, if there are no good control practices, then the achieved water distribution is neither efficient nor equitable, and in addition significant water wastage will occur. Hence, the efficiency of the outcome of this method of pricing depends to a large extent on the institutional arrangements made for control of water use and availability and, hence, on group cohesion and group behaviour of the farmers who participate.

A less widely used approach is volumetric pricing. This approach is prevalent in charging for water for household use, however, despite its attractiveness, it has many disadvantages in its implementation in irrigation systems. Volumetric pricing is considered as a method that promotes efficiency and equity and encourages conservation of water. Hence, it is argued, this method has many desirable characteristics for use in the operation of irrigation projects. Although, no one would disagree with the premise that such pricing approach would lead to higher efficiency in the use and conservation of water and perhaps to equitable distribution of water as well, its implementation in actual field conditions especially in most parts of the world is impractical and cost inefficient. There is no way that a system of volumetric pricing can be applied, e.g. in surface irrigation systems where water is diverted from canals to the farmers' fields. This explains to a large extent this method's minimal use around the world and the prevalence of area based pricing methods.

Water Markets

Seeking the satisfaction of the objectives of higher efficiency and conservation in water systems, the use of the market model for water distribution and pricing has recently gained a significant attraction. Water markets were always existing around the world, but their extent was limited. Recently there is an increasing attention on the use of the market model for water pricing and this section aims to briefly review concepts and experiences.

The ways that water is allocated and priced depends to a large extent on numerous factors such as culture, tradition, availability of water, and institutional arrangements that have evolved over centuries of its use. In some cases water is considered a

private good (e.g., by digging a well in one's field) while in others is considered as a public good with regulated distribution (e.g., water diverted from a river with a dam). However, if water is to be priced by markets the most important prerequisite is the existence and respect of clear water property rights and this is the most difficult part of using the market model for water pricing.

Water has several characteristics that affect the way that it is handled by markets and governments and limit the ability of countries to rely on markets for pricing of water. The most important prerequisite for an efficient market operation, is the establishment of property rights. However, there are quite a number of difficulties in establishing water rights that also vary from country to country depending on customs, tradition, legislation, but also on natural conditions. For instance in Israel there are no private rights on water, while in other countries the existence of property rights depends on the circumstances. Again, complications arise for example when tubewells are used and ground water availability is limited. Under such circumstances although there are property rights on water from a tubewell in one's field, the lowering of the watertable when everybody uses a tubewell prevents the establishment of clear and identifiable property rights for water.

Another important characteristic that makes the operation of water markets difficult is the existence of inadequate information concerning water supply and water demand with substantial variability over time. Under such circumstances, even when property rights exist, there are difficulties in managing water allocation and pricing water even using a market. For instance, market efficiency depends on some kind of price expectations for products and inputs. Such expectations for both water supply and water demand are difficult to establish and, hence, a significant variability in the price of water should be expected, which in turn affects the efficiency of agricultural production.

Irrigation systems require a large investment upfront with very long periods of pay off, a characteristic that discourages private investment and makes the use of public funds in the development of irrigation facilities a necessity. But then, when public investment has been used for such facilities it is not easy how can property rights be established for the operation of water markets. The problems multiply

and the case becomes extremely complicated in cases of multipurpose projects. For instance, how one can allocate costs and hence, establish property rights from the construction of a dam for electricity generation, irrigation, and recreation is clearly a public good since increasing use of the facilities. Using water for recreation clearly increases economic welfare. On the other hand, no simple rule exists for projects with joint energy generation and agricultural use of water.

A third important characteristic that affects the operation of water markets is the existence of externalities in water use in its interactions with other activities within the ecosystem. The complexity of the ecosystem, the variability of water supplies, the intricacies of the hydrological cycle make it difficult for those transacting with water to consider all aspects. Hence, the established market prices for water are, perhaps, not efficient, given the fact that markets cannot take into account all such interactions.

Finally, it should be recognised that market systems have their shortcomings as well. Unregulated market systems for water cannot, in principle, take into account desirable objectives, e.g., the conservation of the environment, social goals, food security, income distribution, international effects, etc.

Having reviewed the characteristics of water that affect the operation of markets, the next question is "What are the prerequisites for the successful operation of water markets"? Four are the most important conditions (see Le Moigne et. al., 1994, p. 97) for establishing successful water marketing. First, the existence of clear and tradable water rights. This is not an easy task, since, the title must be on record in such a manner that there is no possibility to dispute over the ownership of the right. The property right on water must be defined in readily understood and measurable units so that everybody involved in the transaction knows exactly what is being traded. Second, clear quantification of water transferred should be established. It can take the form of volumetric quantification, cubic meters, rate of flow, etc. Third, certain institutional arrangements must exist for the efficient administration of the water market. This requires record keeping and administration that is efficient and reliable, hence, a water market cannot function unless an efficient administrative system is in place to ensure that abuses of the system do not take place. Fi-

nally, for the efficient operation of a water market the necessary infrastructure should exist for the mobility of the commodity being traded.

Despite the caveats expressed above, when the prerequisites of property rights and sufficient infrastructure for water quantification and market administration exist, such a water market system is the most efficient method of allocating and pricing water. Nevertheless, the actual implementation of such a water market system may prove to be an extremely difficult task. First, in many countries before water markets can be established, significant changes should occur in the way water has been viewed over centuries of tradition and custom. Second, laws must be modified to create private ownership of water. Third, extreme care should be taken in the establishment of the initial allocation system (market operation is greatly affected by initial endowments). Fourth, third-party implications must be detailed and considered.

Concluding, this section about water markets one can agree that this system ensures efficiency and conservation in the use of water and with some government regulation can achieve equity as well. There are however, many other considerations that make the widespread use of water markets difficult, if not impossible. Water markets existed around the world for centuries, but their extent was quite restricted and localized. Although the market model can be effectively used in more cases than presently is used, one can express strong doubts for its general applicability at present across countries, cultures and social organisations for water allocation and pricing.

CONCLUSIONS

Water availability per capita in many parts of the world diminishes with alarming rates and emphasis is needed on the formulation of policies and strategies that ultimately will lead to effective measures of managing water as a social and economic resource with emphasis on conservation. This paper focused, within this context, on issues of sustainability, cost recovery and pricing for water.

The premise of the paper is that cost recovery in irrigation projects is not an end by itself. Cost recovery and charging for water is becoming an instrument for achieving sustainability of irrigation projects and hence sustainable development because of the increasing scarcity of water and the serious budget-

ary difficulties that countries face in funding their development programmes. The major development objective is sustainability in the sense that sustainable development is a desirable goal. Although there is wide support for such a goal, no clear mechanisms exist for making it operational in irrigation project appraisal. In pursuing the objective of sustainable development, attention should be placed on project sustainability. Financial sustainability at project level is a concept that considers problems caused by the large recurrent cost burdens on government and the need for frequent system rehabilitation of irrigation schemes. It is natural to consider this issue as affecting not only the viability and productivity of existing systems, but also the economic rationale for the development of new irrigated land and the capacity of governments to match with adequate resources other development goals.

The paper starts with an analysis of the concept of sustainability and in particular of the concept of financial sustainability at the project level. It continues with a discussion of cost recovery mechanisms and of the difficulties encountered in administering cost recovery. Water pricing policies are then analyzed in some detail starting with policy objectives, then continuing with a review of water pricing methods used at present around the world and continuing with an examination of water markets.

The major development policy objectives are efficiency and equity with particular attention, in the context of this paper, to water conservation. Despite general acceptance of charging for water on grounds of efficiency and equity, there are opponents of cost recovery practices as well. However, their arguments do not stand scrutiny except perhaps of those related to the difficulties and costs of monitoring and enforcing the collection systems.

The methods that are used around the world for water fee or water charge assessment vary widely. Area-based pricing is the most common. Although volumetric water pricing is considered as the most efficient method of charging for water, its implementation in actual field conditions is difficult and in many cases inappropriate and cost-ineffective.

Recently the method of using market concepts for the allocation and pricing of water has gained considerable support. Although water markets existed for centuries around the world, their extent was limited and their use was localised. There are some

important prerequisites that should be met if water markets are to function properly. These are: (a) the establishment of property rights; (b) the capacity for quantification of water traded; and (c) administrative and infrastructure capacity to support the operation of such markets. Markets, as it is well known, are complex institutional arrangements with substantial requirements in terms of investment, effort, and organisational structure. Their development

requires considerable planning and resources and they do not always lead to efficient and cost effective resource allocation solutions. In this sense, water markets are difficult institutions to create and the effectiveness of their wide application across countries, cultures and social organisations may be questioned. However, under specific conditions, the use of the market model, is perhaps, the most efficient way of allocating and pricing water.

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