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THEMATIC OVERVIEW

Module 027

Policy Highlights

Irrigation and Water Management

Policy Highlights

Irrigation and Water Management

by the

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based on *Agricultural Development Policy: Concepts and Experience* by Roger D. Norton

for the

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1 INTRODUCTION

Over 2.4 billion people worldwide depend on irrigation for food, employment and income. Since the early 1960s, over a million ha of new irrigated land have been created. By the late 1990s, irrigated agriculture in developing countries accounted for around 200 million ha or a fifth of total arable area, contributing to 40% of all crop production and nearly 60% of cereal production.

Over the next three decades, a further 40 million ha of irrigated land are expected to be developed, and water withdrawal increased by some 14%. Greater use of intensive irrigated agriculture would place enormous strains on available water resources. It could also lead to environmental degradation such as salinisation and waterlogging, and increasing conflicts between users.

In some regions, irrigated agriculture is fast approaching its full potential. FAO estimates that by 2030 East Asia and North Africa will be using three-quarters of their irrigable area. For South Asia (excluding India) this is expected to be closer to 90% of total irrigable area.

2 WATER: A SCARCE ECONOMIC RESOURCE

Supplies of freshwater that are economically available worldwide are estimated at 9,000 – 14,000 km3 per annum. Total annual water withdrawal for agriculture, industries and domestic use stands at some 3600 km^2 globally. Including surface water that must be left to follow its natural course to ensure effluent dilution and safeguard the aquatic ecosystem, the amount already subscribed for human and ecological needs is of the order of 6000 km^3, a significant proportion of resource availabilities.

With population growth and increasing demands, water supplies are tightening on an unprecedented scale, with scarcity already critical in some countries and regions. An FAO analysis indicated that some 36 countries out of 159 surveyed were already water stressed in 1998, with 20 countries in a critical condition.

Physical scarcity asides, harnessing and distribution of water involve real costs. Accessing the next unit of water becomes costlier (from having to dig deeper or convey further): so too should society need to pay more for this commodity. Because of competing demands on its use, the question of scarcity value and economic pricing takes on additional significance. But as yet, not all countries have taken adequate account of these factors in the planning of water systems or in allocation of supplies. Past policy failures at the macro and sectoral levels have led to gross inefficiencies in water resource use, including misuse, overuse and undue waste, with undesirable long term consequences for crop production, the environment, and food security (see Box 1).

Box 1 - Consequences of water overuse: Impact on the Aral Sea

Over a period of just three decades from the early 1960s, witdrawal for irrigated cotton production and construction of flood storage reservoirs havedrastically reduced annual inflow into the Aral Sea. This led to the decline in sea level by 16 metres, and reduction of lake volume by three-quarters.

Twenty of twenty four fish species, along with fish catches which totalled well over 40 000 tonnes a year in the 1950s, have disappeared; low river flows have concentrated salts and chemicals, making water hazardous to drink and harmful to human health; toxic dust-salt from dried up areas have deposited on surrounding farmland, killing crops. Thos e who remain in the area have lost their main livelihoods, while others who left have become environmental refugees.

Many countries are using more than their renewable water supply, hence are in effect mining the resource. Ground water mining is as much as 80% of total water withdrawal in some areas: clearly a non-sustainable activity.

More than a dozen countries have renewable water supplies at less than 1000 m3 per capita per year, a level at which water availability becomes a severe constraint on development and poses real hazards for the environment.

Countries are said to be water stressed when more than 20% of renewable water resources are abstracted for agriculture. Water availability becomes a critical issue when 40% or more of renewable water resources is used for irrigation – at around this level countries begin to have to make difficult choices between allocation to agricultural or urban sectors.

3 RECENT TRENDS IN IRRIGATION

It needs little reminding that irrigation worldwide has witnessed many instances of failed projects, inappropriate system design, ineffective management, low irrigation efficiencies, and systems deteriorating from insufficient cost recovery and poor operations and maintenance. But important lessons are being learned, and there is growing recognition of the need to tackle past weaknesses, both at planning and operation stages, in order to improve the efficiency, productivity and sustainability of water use. Though still limited, there are now success stories in improved system performance, as apparent from the experiences of countries as diverse as Mexico, Turkey, and Mali. Notable here is the shift from past emphasis on *supply augmentation* to *demand management* in irrigation and water use.

There is a growing body of evidence that adequate cost recovery for operations and maintenance can be achieved through participation of farmer-water users in planning and managing irrigation schemes. Full or close to full cost recovery for operations and maintenance is achieved in schemes in Mexico, Chile, Turkey, Tunisia, Mali and Ethiopia. The best results appear to be where water is delivered on demand (Chile, Mexico, Egypt) and users have a high degree of responsibility and control over maintenance issues like annual budgets, irrigation fees and procurement (Mali, Ethiopia).

What is also clear is that irrigation system enhancement needs to be supported by policies and institutions that would provide the correct price signals for investment decisions and adequate incentives for agricultural producers. For instance, expanded production of high value irrigated crops in Chile was linked to incentives from the opening up of the country's economy in the early 1980s. For Mexico, access to urban markets from trade liberalisation, including the emerging NAFTA negotiations, provided a stimulus for efficient agricultural production and development of new markets.

4 KEY POLICY CONCERNS

Whilst the concern of decision makers in irrigation and water management may be primarily on resource use efficiency, taking a holistic view of water as a natural and scarce economic resource is also predicated. Without factoring in the range of stakeholder and environmental interests, any efficiency gains may be transient and prove administratively unworkable in the long term. The overarching objectives of irrigation and water management policies are:

- Improving *efficiency* of water use. This consists not only of technical efficiency in conveyance and application of water (minimal losses in canals and fields), but also financial efficiency (net returns to farmers) and economic efficiency (value to society as a whole, taking into account externalities and alternative uses of water.
- Promoting more *equitable access* to irrigation. There are intra-system as well as intra-sector dimensions here: in distributing water more equitably between top and bottom enders within a scheme; and facilitating small holders, women and marginal groups in undertaking irrigated agriculture efficiently and remuneratively.
- Ensuring *sustainability* of irrigation schemes and water management systems. Both environmental and institutional dimensions of sustainability need to be built into irrigation policies: firstly to help maintain water and soil quality without adversely affecting ecosystem and downstream of irrigation schemes, and secondly in ensuring structures, organisations and processes have the capacity to function effectively over the long term.

Increased efficiency in water use need not incur tradeoffs in equity or poverty reduction. Distributing water to rural families on the basis of where they live rather than the land they own can be an effective way of increasing employment and incomes for land poor people. The fadama schemes in river valley areas of Nigeria that allowed irrigation on 1 – 2 ha. using small pumps were able to achieve high rates of participation within the project areas, with over 50,000 pumps operating nationwide and a strong local service industry developed to maintain them, thus increasing employment and ensuring sustainability.

A principal operational concern is to improve irrigation management in the broadest sense, from watersheds to the field level, and from performance of public agencies to the roles of user groups and other community level associations. The above policy objectives pose important policy challenges at two levels: the *irrigation sector* as well as the wider, *strategic level* of water resource management and system development. Strategic and sector specific policy issues are further examined.

5 STRATEGIC POLICY ISSUES

Taking a holistic view of water resources equates with adopting a strategic approach in policy formulation. This is essentially a macro perspective, which seeks to resolve questions of the future scope of irrigation in the light of other water needs and externalities. Strategic issues which merit attention in irrigation and water use policy include the following.

5.1 The macro and agricultural policy framework

Having the appropriate macro and sectoral policy mix is one pre-condition to achieving efficiency and productivity goals in irrigation. Trade and exchange rate policies and agricultural pricing and incentives, for instance, determine whether and which crops are profitable, and if farmers have the ability to contribute to costs of investment and/or operations and maintenance. They also influence the mix between export and domestically consumed crops and with this the total demand for irrigation water. It would be not very meaningful to pursue irrigation and water use policies without a prior and full consideration of these critical macro and sectoral policy components.

Embedded in irrigation and water use policies are pricing, resource and access policy components of the wider agricultural policy framework. Macro policy instruments, particularly on trade, exchange rate and fiscal expenditures also can have an over-riding influence on irrigation and water use efficiency and productivity.

5.2 Intersectoral resource linkages

Besides its use for agriculture, water resources of a country (sometimes shared between countries) serve a range of functions. Policy decisions must be based a clear understanding of: a) their sources and availabilities; and b) the full range of stakeholder interests. The former include surface and ground water, from both conventional and unconventional sources such as desalinised and treated wastewater. Included in the latter are resource users and uses, which may be at local, catchment or water basin levels, and include upstream and downstream interests.

There may be a need in some situations to undertake a comprehensive national or regional water resource assessment, including an examination of water balances, and covering existing and future demand and supplies. Like other major natural resources, analysis of trade-offs between alternative uses, and of potential conflicts between the main stakeholders is also often necessary.

5.3 Investment and technological options

Water and irrigation investment, and related fiscal policies, must be guided at the outset by strategic assessment of broad technical approaches and alternatives. Such assessment should be based on sound economic principles, involving comparative analysis of costs and benefits for options such as investing in: *a)* single or multi-purpose systems; *b)* new irrigation and/ or drainage schemes; *c)* rehabilitation of existing ones, or *d)* upgrading and improving the design of existing systems.

The possibility of doing nothing if original designs are seriously flawed, or too costly to improve (thus treated as a sunk cost), should be an option to be considered.

Another strategic consideration is making technological choices that are consistent with the conditions of the country or region. Investment alternatives include, for instance, large and small-scale systems, modern and traditional schemes, full or supplemental irrigation, and for conjunctive use of surface and ground water. Strategic choices based on affordability, management capacity, fiscal, and other considerations of a social and environmental nature may need to be made prior to detailed investment planning. Multi-criteria decision making tools provide an important basis for such analysis.

6 SECTOR DEVELOPMENT POLICY ISSUES

Towards enhancing irrigation sector performance, particularly water use efficiency and productivity, two imperatives for the irrigation sub-sector in particular, and the agricultural sector in general, are:

Creating an appropriate enabling environment, including legal provisions, the regulatory framework, user rights, and regimes of economic incentives and disincentives, with security of land tenure a priority objective; and

Strengthening of government and private institutions involved in water management and supporting services, and fostering greater participation of water users and communities in decision making at various stages of irrigation planning and operation.

These seek to address issues of irrigation water allocation; the pricing of and engendering a market for water; making institutional choices; and capacity development within the sector. Policy instruments being used vary between country and regional contexts, but generally fall under the following main categories:

- Managing irrigation water demand
- Pricing irrigation water
- Creating markets for water rights
- Local management and water users associations

Their implications for sectoral policy are briefly reviewed below.

7 MANAGING IRRIGATION WATER DEMAND

This is central to the earlier question of scarcity values of water. Policy goals are to see that water is allocated equitably and sustainably to its most productive and socially desirable uses. The main systems of demand management in use today include:

- Administrative (public sector) allocation
- User-based (collective action) allocation
- Market allocation of water rights
- Joint allocation by users and government agencies (mainly in countries such as France)
- Individual allocational decisions, such as by owners of wells and other infrastructure.

Different allocation systems often overlap. Public allocation may be used for allocation between sectors and within large-scale irrigation schemes; user-based mechanisms may be used on tertiary distribution units; and market allocation of groundwater may be used conjunctively to supplement surface irrigation schemes.

Mechanisms which relied on regulations and sanctions for compliance had often proved unworkable. Enforcement is difficult except where there are only a few points to monitor, such as main canals of large schemes. But they may be justified in situations where the state is the only institution with jurisdiction over all sectors of water use, and could take the needed strategic actions to reconcile stakeholder interests, whilst promoting positive externalities (such as catchment protection) and minimising negative externalities (e.g. from agricultural run-off, urban sewage, and industrial effluent).

By and large, the trend is moving towards market-based and user-run allocation, along with transferring system management (or parts of it) to users and local communities. Which mechanism should be adopted depends on the context and circumstances of water use. No single mechanism is optimal or even appropriate for all situations. Because economic opportunities for productive use, as well as social and equity preference criteria could change over time, flexibility and responsiveness must be built into any mechanisms that are adopted.

8 PRICING IRRIGATION WATER

Water pricing policies vary, but often leave prices at levels which cover only a fraction of the supply cost. This limits revenues available for improving and expanding the system, encourages waste and overuse, and provides little incentive for farmers to allocate water to the highest value crops. Experience shows that farmers often will pay more for water supplies that are reliable in quantity and timeliness.

Pricing policy reform is usually aimed at raising irrigation prices to permit: *a)* cost recovery of operations and maintenance (O&M); *b)* generating revenues for system rehabilitation and expansion; and *c)* make irrigation more productive i.e. giving a higher value of output per unit of water used in the fields. Cost recovery of investment costs of irrigation systems are also being attempted in some countries.

It is expected that the upper price limit for water will be at a level corresponding to full recovery of O&M cost plus partial recovery of investment costs. However full economic pricing is not likely to be feasible except through operation of water rights markets (see below).

Whilst many kinds of irrigation pricing are being practiced, area pricing (based on unit areas irrigated) is most common, followed by volumetric pricing. Variations include two-part tariffs, comprising an annual charge for recovery of investment cost plus a volumetric fee. Prices may also be established through the market, such as for transferable water rights.

Area pricing does not promote water conservation or encourage shifts to higher value crops. Volumetric pricing overcomes these problems, but its metering requirements often had been a deterrent to its adoption. However, as water scarcity grows, volumetric pricing systems are expected to be increasingly the norm.

Irrigation systems in Morocco, Tunisia and elsewhere have shown that volumetric charges are feasible to implement on the basis of simple engineering designs. Such pricing is facilitated by selling water in bulk to user associations and allowing them to distribute this among their members.

9 CREATING WATER RIGHTS MARKETS

Informal water rights markets have existed for a long time in places like Brazil, Mexico, Yemen, and in South Asia. With water scarcity, water rights tended to become more formally defined, and institutional structures governing their transfer more complex. Chile, Mexico and Peru have been leaders in creating such markets.

Water rights markets foster greater productivity and help move the price of water closer to its true economic value. They could also impact positively on poverty reduction. The requirements for their successful functioning are however fairly demanding, hence they may not be a practical option in many circumstances.

Requirements include: *a)* the existence of legally recognised water rights, separate from land titles; *b)* institutional structures that allow re-allocation of water; *c)* regulations for protection of the public interest and third parties, including rules for treatment of return flows; *d)* institutions for contract enforcement and conflict resolution; *e)* existence of well informed water users associations; and *f)* rules for apportioning shortages and surpluses of water.

A basic rule is that prices are negotiated freely between buyers and sellers. But above all, a strong political commitment to develop such a market is required. This will likely require a high level of advocacy, supported by competent analysis of economic gains and trade-offs between different uses of water, intra and inter-sectorally.

Secure and tradable water rights can reduce poverty through allowing redeployment of scarce resources for more productive purposes, leading to increased output and employment. Empowering user groups to have a say on the issuance or transfer of water rights also help protect the poor. Secure and tradable water rights increase the value of rights, which are often the most precious assets of poor farmers. In Mexico, many small farmers were able to take advantage of their ability to sell their water rights while still remaining on their land.

10 LOCAL MANAGEMENT AND WATER USERS ASSOCIATONS

A sense of ownership helps bestow responsibility, hence increases the prospects of system sustainability. The arguments for broadening participation and decentralising irrigation planning and management stem from practicality and efficiency as well as equity concerns. Various institutional forms for transferring responsibilities are being developed in response to these concerns. Of these, the establishment of water users associations (WUAs) is the most widespread and have become basic tools of irrigation management in many countries.

Amongst the main benefits of WUAs are: improved water delivery; increased efficiency in O&M; greater flexibility in adjusting cropping patterns to market signals; and reduced government outlays for O&M. They can also be an effective vehicle for conflict management.

The scope and responsibility of WUAs in water, financial, and infrastructure management vary enormously amongst countries. These range from small WUAs covering a few ha to large corporate WUAs that have contractual relationships with national irrigation agencies and significant management responsibilities. Examples of the latter are to be found in Mexico, Chile, Colombia and Turkey.

Whatever their size and scale, functioning and viability of WUAs depend critically on clear legal and contractual provisions for demarcation of rights and responsibilities vis-a-vis national irrigation agencies. Clarifying future financial responsibilities for system rehabilitation is also particularly important in this regard.

Past experience shows that WUAs work best when they build upon existing patterns of social organisation and cooperation. But there are also indications that a 'big bang' approach in WUA development has greater impact than a gradualist one, with the latter often going little beyond the piloting stage. Reasons forwarded are that rapid implementation, with adequate top policy support, minimises resistance from vested interests, and provides a more efficient route to user participation. It is also evident that the greater the devolution of responsibility the more successful its transfer to farmers.

In Mexico, irrigation system management at the district level has been transferred to legally constituted WUAs through a concession. Here, WUAs have complete authority in making relevant water and financial management decisions, including hiring and firing of staff. Management of over 3 million ha has been transferred to some 350 WUAs ... from a World Bank review of experience based on selected 'new style' projects (Dec 1998).

WUA development requires careful planning and follow-through. Involvement of WUAs from the very beginning of system conception and design is essential. The teaming up of community organisers and engineers to integrate social and engineering activities into one process; allowing enough time for farmers to mobilise and organise themselves well before construction; and building up their organisational skills are other prerequisites. Defining membership to include all stakeholders, including tenant farmers and women, is also essential on both social equity and productivity grounds.

The importance of gender mainstreaming in the organisation and operational aspects of WUAs, especially the potential contribution to agricultural productivity and household food security[2] had generally not received much emphasis, and require much greater attention than hitherto. The effectiveness of WUAs in improving agricultural productivity also depends on availability of and access to other agricultural support services, such as rural financial services and technology development support[3].

[2] See Module EASYPol Module 030: ***Policy Highlights Gender in Agricultural Development Policies.***

[3] Policy ramifications of these are further discussed in EASYPol Module 028 and 029 respectively: ***Policy Highlights: Strengthening Rural Financial Systems***, ***Policy Highlights: Agricultural Technology Research and Extension Systems***.

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