

Breaking the Gridlock in Water Reforms through Water Markets: International Experience and Implementation Issues for India

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"Whiskey is for drinkin' and water is for fightin'."

Mark Twain

"Grace is given of God, but knowledge is bought in the market."

Arthur H. Clough 1819-1861

I. Introduction

In recent decades India has witnessed rapid growth in demand for water particularly in domestic and industrial sectors due to population growth, urbanisation, industrialisation and rising incomes. This growth in demand has not been matched by an increase in supply. The problem is compounded by pollution of water, which has reduced its suitability for various uses. At the same time, in traditionally water intensive sectors of the economy such as agriculture costs of irrigation have increased significantly.

Under these circumstances, it is more important than ever before to use water efficiently. It is also necessary to anticipate and address inter-sectoral conflicts over allocation and use of water.

The standard approach so far has been to advocate reform of water pricing across sectors to reflect the scarcity value of water. This advocacy is based on theoretical and empirical evidence on the need and desirability of such reforms including willing-to-pay studies. Nevertheless, major users of water particularly of irrigation water have resisted these reforms so far.

In this context, economic theory tells us that markets increase economic efficiency by allocating resources to their most valuable uses. In other words, if certain conditions are met, markets provide the correct incentives and lead to efficient resource use. Therefore, one way to change the incentives so that water users support the reallocation of water, and to achieving a more efficient allocation of water is through *water markets*. These allow water users to buy and sell water, thus changing the whole incentive structure and breaking the logjam of water pricing reforms—when water users can gain from reallocation they would be willing to sell water or pay a higher price for new supplies.

This paper explores the role of water markets particularly in the context of India's water supply and sanitation sector. The following section (II) elaborates on the concept of water markets and their rationale. We discuss here the deficiencies of the current systems of water allocation and how water markets could be an improvement over them. In particular, we draw out the advantages of water markets over administered efficiency pricing (i.e., pricing marginal units of water at their marginal cost). This is followed by a review of international experience with water markets (III). In this section we highlight the fact that water markets have existed in several countries with varying degrees of success and that they are hardly a novel idea. More important, informal water markets have been in existence in India and this experience is reviewed in section IV. This is followed by a discussion on the modalities of introducing formal water markets in India (V). After describing briefly how formal water markets could be an improvement over informal markets, we examine the legal and institutional problems in implementing formal water markets in India and identify measures required to establish such markets including enabling legislation. The final section (VI) concludes.

II. Water markets and their rationale

Apart from water markets there already exist numerous non-market mechanisms for allocating water in most countries. These usufructuary rights to water have evolved either explicitly through laws and regulations or implicitly through conventions. These water rights are generally based on one of three systems: first-come, first-served allocation (also known as *prior appropriation* rights), allocation based on proximity to flows (or *riparian* rights) and *public* allocation (Sampath 1992, Holden and Thobani 1996, Haddad 2000). Whereas queuing for water is the basic approach of the prior appropriation doctrine, the location of one's land determines water rights under the riparian doctrine. Under this approach whoever owns land along (above) the water has the right to ownership/reasonable use of the water. Finally, public allocation involves publicly administered distribution of water. "Under this system, public authorities decide how to allocate water using guidelines or laws establishing priorities and often specify the uses to which the water can be put." (Holden and Thobani op. cit. p. 2)

Most developing countries follow variants of the last approach where essentially the rights are allocated free—though there may be a charge for water use (typically based on the amount of irrigated area), the water rights themselves are obtained without charge.² The track record, however, of administered systems of water allocation has not been impressive—water is typically underpriced and wastefully used and the delivery is high cost and unreliable (see Holden and Thobani op. cit. for details).

While this is well known, the important point to note here is that none of these systems fulfil the conditions for well-defined property rights to water, which in turn are essential for water markets to exist. In this context, the question could well be asked, "why not use administered efficiency-based pricing of water as an intermediate policy between managed quantity allocation and water markets?"

There are three reasons why water markets could be preferred to administered efficiency pricing (i.e., pricing marginal units of water at their marginal cost)³:

First is the reduction in information costs since buyers and sellers of water generate the necessary information on the value of marginal product and opportunity costs of water. As is the case with all markets, different values are measured and compared by prices, and the way price signals coordinate dispersed information and preferences is one of the great advantages of water markets (over alternative systems of water allocation).

Second and perhaps more important, if the value of prevailing usufructuary water rights (formal or informal) has already been capitalised into the value of irrigated land, then imposition of administered pricing is (correctly) perceived by right holders as expropriation of those rights. In effect, this would result in a capital loss for irrigated farms. This could explain the strong resistance by these groups to establishing administered efficiency prices. Establishment of transferable water rights would formalise the existing situation (where

² The water rights themselves under any of these systems are defined volumetrically as a share of the stream or canal flow or of the water available in a reservoir/lake, or in terms of shifts or hours of availability at a certain intake.

³ This discussion is based on Holden and Thobani op. cit., and Rosegrant and Binswanger 1994.

irrigated land is more expensive), rather than being viewed as a usurpation of these rights.

Finally, the administrative solution presumes “far-seeing, incorruptible, influence-free”⁴ administrative bodies that are able to design and implement the ‘correct’ prices. In practice, this may often not be the case: these bodies could be captured by interest groups or they may be short-sighted and unable to estimate future demand, or they may be unable to set and collect appropriate water charges.

For water markets to work, property rights to water must be private, exclusive and transferable (Bauer 1997). In this context, secure ownership provides an incentive to invest in greater productivity of the resource, while freedom to exchange provides the flexibility to reallocate the rights according to changing demand and other conditions. The role of the state should be minimal in this setting and should be restricted to protecting property rights, enforcing contracts, and reducing transaction costs and barriers to exchange. In fact, it can be argued that much of the current inefficiency in the water sector in India is due to excessive state regulation and subsidies, which have distorted patterns of water use. As a corollary then, freer markets would help in “getting the prices right,” and in strengthening the incentives to conserve water as demand increases since any water saved could be sold. Another important rationale for water markets is the *relationship between markets and liberty*. In contrast to non-market allocation which gives the state leverage in non-economic spheres as well, private property creates a space for individuals where the state cannot trespass. “Private property [the necessary precursor to markets] has thus been viewed...as a bulwark against the dictatorial authority of governments.” (Cooter and Ulen 1996, p. 109)

In this context, by creating entitlements where none existed earlier, these markets can potentially be a *tool for empowerment*. Holders of water rights would be sought after (irrespective of their socio-economic status), by those who would like to buy these rights. Similarly, *environmentalists can also purchase water rights* in order to preserve a valued wetland or to increase a waterway’s flow. Without a market mechanism, environmental groups would have to depend on the state to achieve the same end (Haddad 2000). In fact, this is already happening in several states in western United States—the Oregon Water Trust, the Washington Water Trust, and Nevada’s Great Basin Land and Water are three recent groups that have used water markets to acquire water rights and convert them into instream flows. The Oregon Water Trust for instance has been able to increase flows on more than 25 different streams and rivers flowing into the Columbia River (Landry 1998). In sum, the private space created by market mechanisms can be used to achieve socially valued ends.

III. International experience with water markets

III.1 Western United States

Western United States (California in particular) is one of the earliest instances where water markets have been proposed to alleviate water shortages. According to the 1922 Colorado River Compact, allotments for use of the Colorado River are divided among seven western states and Mexico. California currently uses approximately 5.2 million acre-feet (maf)⁵ per

⁴ Holden and Thobani op. cit., p. 5.

⁵ An acre-foot is the amount of water necessary to cover an acre of land one foot deep, approximately 326,000 gallons.

year, more than its 4.4 million acre-feet allotment. Several groups such as the San Francisco-based Pacific Research Institute and Montana-based Political Economy Research Centre (PERC)⁶ have argued that water markets are the key to redressing this imbalance and to achieving a more efficient allocation of water.

Most of California's Colorado River allotment goes to the Imperial Irrigation District (IID, with 2.8 maf) and the Metropolitan Water District (MWD, with 500,000 acre-feet). The MWD has spent \$2 billion over the past decade to increase efficient water use in anticipation of rising demand. This has obviously resulted in a high price of water and MWD currently sells water for \$431 per acre-foot. On the other hand, agricultural water is extremely cheap -- IID sells water to farmers for \$14 per acre-feet. Thus, there are enormous potential gains from trade. Further, studies show that farmers are sensitive to changes in water price -- increasing the price of agricultural water by 10 percent decreases demand by 20 percent. In other words, the demand is price elastic. Thus, a marginal reduction in subsidies for agricultural water would reduce its use by this sector. It is not necessary (as some have argued) that agricultural output would decline as a consequence. Increasing the price of agricultural water would simply give agricultural communities an incentive to use water more efficiently, e.g., by using new technologies and planting high value crops such as nuts, fruits and vegetables that are less water intensive (Fowler 1999). Further, even if water markets reduced agricultural production, it would probably be on marginally productive lands and crops (where in the first instance cultivation took place because of cheap water). In this context, it has been estimated that agricultural water use could decline by as much as 15-20 percent through conservation without significant decreases in production (Wahl 1989). The Western Governors' Association Water Efficiency Working Group concluded (1987, p. 110) that water markets do not appear to "present the threat to traditional lifestyles or natural areas that is feared."

In fact, with a growing population and urbanisation, water is undoubtedly California's most precious resource. In this context, numerous trends indicate that a significant reallocation of water from agricultural to urban regions is likely to occur in western states in the coming decades, and a reallocation of as much as 15 percent of current agricultural usage is plausible (Haddad 2000). If cities in California were to get 15 percent of what agriculture in California currently uses, urban water availability would rise by more than half. This would be more than enough to meet new urban demands well into this century. It is also increasingly clear that markets will play an important role in this reallocation.⁷ All of this has important implications and parallels to the Indian situation as discussed below. Also of interest is that transfers have already been taking place in California. Under an agreement the Metropolitan Water District (MWD) in southern California is already acquiring 106,000 acre-feet of water per year for 35 years from the Imperial Irrigation District (IID). The water comes entirely from increases in water-use efficiency brought about through techniques such as lining irrigation canals or replacing them with pipes to reduce waste. By paying for these improvements, MWD was able to acquire the conserved water without reducing the number of acres irrigated within IID (Reisner and Bates 1990).

⁶ <http://www.pacificresearch.org/issues/enviro> and <http://www.perc.org/brfwatermar.htm>

⁷ "Water reallocation and marketing, for better or worse, are part of our future in the West, and we must prepare to face the challenge." Shupe, Weatherford, and Checchio as quoted in Haddad (op. cit.) p. 19.

As is the case for India (see section IV below), irrigators in California have been trading water among themselves for years, both formally and informally and trading even occurs in some districts supplied with federal water. Members of the Westlands Water District (WWD), for example, negotiated roughly 4,500 transfers during 1990-91 alone. In March 1996, WWD introduced an electronic bulletin board system that enables farmers to buy and sell annual entitlements to federal water using a personal computer and a modem (Anderson and Snyder 1997).

Perhaps the most established market for federal water operates in the Northern Colorado Water Conservancy District near Fort Collins, Colorado. Annual water entitlements within the district are freely transferable. About 30 percent of the water delivered to the district each year passes through the rental market, with rents ranging from \$5-7 per acre-foot (Wahl op. cit.).

There are also numerous examples of water trading between agricultural and urban users in western United States in the states of Utah, Arizona, Colorado and Nevada. For instance, groundwater in Arizona was made freely transferable by law in 1980. Following this the cities of Phoenix, Tucson, Mesa and Scottsdale acquired more than 50,000 acres of farmland in order to retire the fields and to utilise the water. A study by researchers at the University of Arizona found that during the late 1970s and during the 1980s there were about 6,000 transaction in Utah, 1,455 in New Mexico, and 1,500 in Colorado (Steinhart 1990). With respect to legislation, the leading proposal for water markets in California is embodied in the *Model Water Transfer Act for California*. It provides a detailed framework for institutional reform of this sector. The Model Act endorses voluntary water transfers because they provide flexibility in resource allocation and because they promote reallocation based on the principle of economic efficiency. At the same time it also acknowledges the importance of protecting other parties who might be adversely affected by water transfers. One of the major aims of the Model Act is to streamline the cumbersome administrative process of review and approval of long-term (market-like) water transfers. At present this process severely limits the number of transfers that can take place. Among other key provisions the Model Act proposes to strengthen ownership rights to water. The objective is to assure the rights owners that if they decide to part with water rights temporarily, their doing so will not be viewed as an indication that they do not really need the water and therefore should eventually give it up.

III.2 Australia

Water markets have not been confined to the United States alone. Led by South Australia in 1983 and followed by New South Wales in 1989 and Victoria in 1991, Australian states have started allowing transfers of water entitlements through markets. Transferable rights were a response to increasing scarcity of water. As in the case of India, informal markets had already evolved before the state enacted legislation during the 1980s that codified water trading. Prior to this, farmers transferred water entitlements through 'dual ownership' whereby they purchased two landholdings and transferred water from one to the other. The fact that they chose to do this despite the high transaction costs associated with such transfers indicates the gains from water trading.

In this context, it has been estimated that water transfers along the Murray-Darling River Basin stretching over 2,500 kilometres led to a significant increase in farm incomes. In

1988-89 this increase in income was \$5.6 million through 280 transfers of 85,000 megalitres of water. In 1990-91 the increase was \$10 million comprising 437 transfers of about 120,000 megalitres. It is further noted that if "benefits of this scale can be obtained by a system of water transfers circumscribed by regional barriers, the benefits that would flow from the redefinition of water property rights to allow the free transfer of water between regions ... would be greater still." (Sturges and Wright 1993, p. 23-24).

III.3 Chile

With its 1981 Water Code Chile established secure, transferable water rights⁸. With these rights, individuals can buy or lease water quite easily. The aim of the Code was to strengthen private property, increase private autonomy in water use and favour free markets in water. As a corollary, the Code sharply curtailed the state's role in water management and irrigation.

Water rights in Chile are now completely separate from land ownership and can be freely bought, sold, mortgaged, and transferred like any other piece of real estate. The National Water Directorate (Dirección General de Agua, or DGA) is the state water rights agency. It grants requests for new rights free of charge whenever the water is physically or legally available. If the water is not enough for all applicants, the DGA is required to hold a public auction and sell the new rights to the highest bidder (Bauer 1997). Rights-holders do not pay taxes or fees either for acquiring the rights or for keeping them over time.

Once constituted, water rights are governed by private or civil law rather than public or administrative law. They are subject to the general system of real estate title registration, and are protected as private property under the Constitution. In principle, all water rights are supposed to be measured in volume per unit time (e.g., litres per second), but in practice many are expressed as shares of canals. Holders of water rights can freely change the locations and types of uses of water rights without approval from the DGA. In sum, "the Code does not mandate or establish a market in water rights, but tries to set up the legal preconditions for such a market to emerge spontaneously." (Bauer op. cit., p. 641) In practice, sales and transfers of water rights separate from land are not common in Chile. Further, only about 20 percent of water needs are met through water markets. Most of the water rights transactions that occur are between irrigators within the agricultural sector. Inter-sectoral sales are less common but have occurred when cities such as Santiago (as well as some smaller cities in the north) have expanded into rural areas.

There are a number of factors that have limited trading in Chile. Some of these are unique to that country such as its topography that makes it difficult and expensive to move water from one basin to another, or from downstream to upstream areas within the same basin. Further, unlike the case of California discussed above, the existing water infrastructure is too rigid or otherwise inadequate to move large amounts of water.

Among economic factors that have limited trading, many owners of water rights have held on to them in anticipation that their value will increase in the near future. So far the prices have not been bid up "partly because in fact water is not yet as scarce in most of Chile as

⁸ The Constitution of Chile, passed in 1980 reiterates this principle by stating, "The rights to private individuals, or enterprises, over water, recognized or established by law, grant their holders the property over them." (Chapter III, Article 24)

popular myth would have it. Those who need water and have the means to pay for it have cheaper alternatives than buying existing rights, or they simply buy land with associated water rights." (Bauer op. cit., p. 649)

In sum, the Chilean experience with water markets is one of mixed success and is "something for other countries to learn from rather than to copy." (Bauer op. cit., p. 651) Two key lessons emerge from the Chilean experience for India. First, water users strongly favour the increased legal security that private property rights provide. Not only have stronger property rights increased the autonomy of local canal associations, they have also encouraged investment in agricultural water use, particularly by those growing high value export crops like fruits. The second lesson is that the original decision to privatise water rights without legal obligations to use was perhaps incorrect, as it weakened the market incentives.

IV. Water markets in India

Before we review the Indian experience with water markets, it is important to distinguish between formal and informal markets. In formal markets, water rights are clearly and universally assigned, with legal validity for freely negotiated sale of these rights. In case of informal markets, there is neither clear assignment of rights nor legal sanction to trade. Thus, in formal water markets enforcement of trades occurs by recourse to legal and institutional measures, whereas in the case of informal markets (which simply arise from spontaneous response of water users to changes in demand-supply situations), such recourse is not possible (Easter et al. 1998). Also, formal markets are often defined with respect to water rights, while informal markets operate for volume of water.

IV.1 Extent of water markets in India

Water markets that exist in India are informal and are generally limited to localised water trading between adjacent farmers and the practice is quite common especially for groundwater. Although found in many parts of India, the occurrence of groundwater markets is not uniform. While water markets are widespread in Gujarat, Punjab, Uttar Pradesh, Tamil Nadu, Andhra Pradesh and West Bengal, they are most developed in Gujarat. The extent of area irrigated through water markets, which is often considered to be a surrogate for the magnitude of water trading, varies across regions as well as over time depending on a number of factors such as rainfall, groundwater supply, cropping patterns, and the cost and availability of electricity (Saleth 1994). In water scarce pockets of Gujarat, Tamil Nadu and Andhra Pradesh, a substantial area is irrigated through groundwater markets.

Several micro studies illustrate the degree of variation in use of water trading in India. In terms of area irrigated through groundwater markets, estimates vary from 80 percent for Northern Gujarat (Shah 1993) to 60 percent in Allahabad district in Uttar Pradesh (Shankar, in his 16-village sample study in 1992) to 30 percent in the Vaigai basin, Tamil Nadu (Janakarajan 1994). Some studies report no water trading in their study area (Shah 1993). There is no systematic estimate at the national level of the magnitude of water trading. The area irrigated through water markets has been projected to be about 50 percent of the total gross irrigated area with private lift irrigation systems (Shah 1993). Other estimates, using a methodology based on pumpset rental data, put the figure at 6 million hectares or 15

percent of the total area under groundwater irrigation (Saleth 1999)⁹. Assuming a net addition to output of \$230/ha/year (based on the difference between the average irrigated and rainfed yields as reported by Government of India), the total value of output due to water sales is estimated to be \$1.38 billion per year.

IV.2 Nature and characteristics of informal water markets in India

A review of the functioning of informal water markets in India can improve our understanding of the market and provide useful insights, which could form the basis for designing formal markets.

Localised and fragmented: As stated earlier, water markets in India are mainly limited to the irrigation sector—that is, one irrigator selling water to another irrigator. Water trading in India is localised, fragmented and are over short distances and periods. Unlike in Chile, Western USA and Australia, the institutions, legislation and regulatory framework do not exist in India for more formal transactions. In some rare cases, however, water purchases for non-irrigation uses have been reported. For example, brick-kilns purchasing water was reported by Shankar (1992); and urban domestic users purchasing water in Tamil Nadu was observed by Palanisami (1994) and Janakarajan (1994).

Mainly driven by surplus supply: The emergence of groundwater markets typically depends on rainfall, groundwater supply, availability and cost of energy, cropping pattern etc. Most water sales do not involve any reduction in irrigation by sellers (Saleth 1999). Most of the sellers are large farmers owning deep wells and large capacity pumpsets and the buyers are usually small farmers without wells or pumpsets, though there are non-poor farmers who rely on groundwater markets due to farm fragmentation or inadequacy of water in own wells. By providing access to use of groundwater and irrigation assets to resource poor farmers, groundwater markets have promoted equity.

Monopoly power: The existing informal markets are small and unbalanced and are typically characterised by a weak bargaining position for buyers. Buyers often do not have a choice because of low density of wells, compounded by uneven topography and potential for seepage losses (Shah 1993), which gives sellers a degree of monopoly power. Further, there is evidence of buyers being tied down to sellers from contiguous plots, as sellers can and do refuse conveyance of water through their plots to other possible suppliers (Janakarajan 1993, 1994). Monopoly power helps sellers not only in raising prices but also in compromising the quality of service they offer.

Influenced by social factors: Social factors and agrarian relations sometimes determine the development of water markets. For example, in Bihar it has been found that it was the water buyers' position in the social network, particularly their social proximity to sellers--rather than their ability to pay--that determines their access to water (Wood 1995). Moreover, there were several cases of price discrimination with prices being lowered for favoured clients. In Paldi village in Gujarat, there is evidence of many water transactions being "bundled into existing landlord-tenant relations" (Dubash 2000). Thus, out of 20 wells sampled, eleven sold water--five separately and six to tenants.

⁹ It is assumed that pumpset rentals inherently involve water sales for all fixed pumpsets permanently fitted to wells or connected to electric power lines.

Widely varying terms of payment: Terms of water payment vary widely and differ by crop and by season. Payments can be made through cash transaction or non-cash contracts. Cash payments are made on the basis of time, volume or area irrigated. Hourly price ranges between Rs3 in West Godavari district of Andhra Pradesh to Rs 45 in Mehasana district of Gujarat (Shah 1993). Non-cash contracts, which typically take the form of sharecropping (i.e., seller collects a water rent in the form of a share of the buyer's output), are not uncommon¹⁰. They have been found to be incentive compatible (Aggarwal 1999). These contracts work as 'double-sided' incentive, providing the seller an incentive to ensure that water supply is timely and reliable and the buyer an incentive not to shirk in the application of labour. Sometimes the market displays a feudal character. In Tamil Nadu, there are cases where water buyers have to offer labour services such as operating the pump and irrigating the well owners' fields for a paltry sum or none at all (Janakarajan 1993, 1994).

Groundwater overexploitation: There is some evidence of decline in groundwater table caused by competitive water withdrawal due to intense water marketing activities (Moench 1992). Under the current legal system, there is 'open access' to groundwater and the access to groundwater is governed by *de facto* water rights system (see below). As long as this is the case, overexploitation of groundwater cannot be avoided, since water price tends to reflect pumping costs and other related factors, and do not fully capture the scarcity value of groundwater. The problem is compounded by electricity and diesel subsidy¹¹. In addition to reducing ecological sustainability, one important side effect of this phenomenon is that poor farmers who do not have the resources to deepen their wells are driven out of farming. The regulatory response, which has been in the form of well spacing and depth norms, has largely failed. Besides, since these norms can take effect only when a farmer applies for a concessional loan or well permit and electric connection, they mostly restrict resource-poor farmers, thereby raising questions about fairness.

V. Introducing formal water markets in India

In India, there has been no explicit policy statement in favour of water markets¹². At the same time, though there is no legal basis for informal markets to exist and function, the state has followed a policy of non-interference *vis-à-vis* such markets. As we saw in an earlier section, regulations--albeit ineffective--have aimed at ecological sustainability. Under such a policy and regulatory regime, informal markets have grown and served a useful purpose. Why do we then need formal markets? Some of the major benefits that a formal market is expected to yield are:

- This would allow water transfers to take place on a large scale and also between sectors, thus allowing a reallocation of water to higher productive use. For instance, as discussed earlier, farmers instead of producing low-value, water intensive crops might sell water to a neighbouring city if it fetches them a higher price. At the same time, the possibility of large-scale inter-sectoral transfers could postpone or make unnecessary construction of

¹⁰ For example, in some parts of Gujarat water is provided to tenants by the land and well owners, where the buyer receives one-quarter of the crop, while the seller receives three-quarters. Of the three-quarters that water sellers receive, half is on account of land and one quarter is on account of water.

¹¹ "Suggestions to replace the electricity and diesel subsidies with an adjustment in terms of trade through higher purchasing power, while having other problems, would work to attenuate (but possibly not remove) the overexploitation of groundwater in water-constrained systems." (Morris 2000)

¹² The National Commission on Agriculture recognizes only rental market for LIS and not water markets.

costly hydraulic infrastructure. La Serena City, for example, was able to meet its water needs by purchasing water rights from farmers and this was attained at much less cost as compared to building a dam.

- Secondly, the nature of informal markets is such that trading cannot be regulated. In contrast, since property rights are well defined in formal markets, trading can be regulated. Regulation can lead to better resolution of the negative side effects of trading such as aquifer depletion or monopoly creation or equity issues, more effectively.
- Thirdly, formal markets, based on an explicit water right system, can help potential investors and water companies gain secure long-term access to water, which is one of the important prerequisites to attract private investment into the water sector.
- Fourthly, legally well-defined and registered property rights reduce transaction costs involved in water trading. These costs include monitoring and enforcement costs, conveyance costs, and costs of designing contracts. Low transaction costs would encourage trade and thereby expand the scope of the market.
- Fifthly, in a formal water market regime small farmers and the poor will gain water rights, which would empower them, and can serve as additional collateral.
- Finally, informal markets generate neither any fiscal revenue for the government nor funds and incentives for investment in infrastructure.

Clearly, formal markets that retain and extend the potential gains of informal markets and counteract many of their negative features, are preferable. Before introducing formal water markets with tradable property rights, however, some legal and institutional issues would have to be resolved. These are discussed below.

V.1 Legal and institutional measures:

Manage surface water on a river basin basis

Indian law treats all surface water as state property. Under the Indian Constitution, while the central government is responsible for regulation and development of inter-state rivers and river valleys, state governments are responsible for water supplies, irrigation and canals, drainage and embankments, water storage etc. Under the *de facto* interpretation of these responsibilities, the power of the states has emerged as pre-eminent and water has come to be perceived as a state subject. This has serious ramifications for inter-state water development and allocation. The fragmentation of basins by state boundaries and lack of cooperation between them is a critical issue. In the absence of legal clarity on what individual states' shares are, each state has argued for as large a share as possible. It is therefore important to introduce necessary legal arrangements to facilitate the management of surface water on a river basin basis, before formal water markets can be introduced.

Clarify legal position on individual usufructuary rights for surface water

There is also a lack of clarity on individual usufructuary rights for surface water, as the legislation has failed to devise a system for providing secure, defensible and enforceable surface water rights. Although courts have upheld the riparian rights--individuals abutting upon a (natural) stream can use water without disturbing a similar benefit to other riparians--as natural rights, individualised rights of abstraction and use of such water can only be established through time-consuming litigation (World Bank 1999). Furthermore, states' sovereign rights over surface water have in the past been challenged in courts by riparian

landowners, who claimed that their rights had been infringed upon by the government in pursuit of its irrigation projects¹³. Unless surface water rights are better clarified and in favour of individuals, conflict and litigation will grow in the future and formal water markets will not be possible.

Separate rights to groundwater from rights to land

Under the law of riparianism applicable in India, ownership of groundwater accrues to the owner of the land above. By virtue of these laws, groundwater is 'attached like chattel' to land property and cannot be transferred separately from the land to which it is attached (Singh 1992). This has constrained the potential for inter-sectoral allocation. For example, a municipality is not authorised to have access to groundwater from the neighbouring farms without purchasing those farms. To establish an active water market, rights to water use must be authorised separate from land.

Establish limits for withdrawal of groundwater

Under the current laws, there are no quantitative limits on groundwater withdrawal by individual users. This provision together with the provision of tying land rights with water rights has serious equity implications, because it allows larger farmers with higher pumping capacity and deeper tube wells to have a disproportionate claim over water than others. Further, sellers can get a payment from the very group whose water rights get infringed by the seller's activities (Saleth 1994). Besides, withdrawal limits will promote efficient water use. Furthermore, in a theoretical sense, an efficient operation of a market is critically dependent on the prior existence of an effective legal institution of property rights establishing the initial resource endowments of individuals. There is therefore a need to specify water withdrawal limits by individuals in volumetric terms¹⁴. Although establishing individual withdrawal limits can promote equity and efficiency, ecological sustainability requires collective withdrawal limits keeping in view annual recharge.

Broaden the market

It is not enough to give users the option to buy and sell water. Institutional and organisational changes are necessary to broaden the market and make it more competitive. For example, canal infrastructure need to be improved to make sure that trading can take place over a larger area--for example, by joining different systems. Similarly, management may have to be improved so that buy and sell orders are easily executed. Improved control structures are also necessary which would allow managers to easily increase the flow in one canal and decrease it in another.

Create conflict-resolving institutional arrangements

Further, institutional arrangements are needed for resolving conflicts over water rights. Toward this end, committees of water users comprising elected representatives of the community can be created. The role of such groups would depend on how clearly water rights are specified and how well they are established and distributed to users. If water rights are unclear, and the distribution contentious, conflicts would be difficult and complicated. In such cases, courts rather than committees of users will be the conflict resolving institution.

¹³ Both the Madras High Court in 1936 and the Bombay High Court in 1979 have established that the Government's sovereign rights do not amount to absolute rights.

¹⁴ In addition to legislative efforts, quantification of ground water rights in an operational context requires technological changes.

V.2 Operational measures

In addition to creating an enabling legal and institutional framework, a number of issues have to be addressed to ensure smooth implementation of water trade regime. The transition can take several years partly because water allocation often evokes emotional response and partly because of opposition from those who stand to gain from the status quo. One way of designing and implementing tradable water rights is to follow the steps adopted by countries that have successfully established formal water markets. In doing so, we have to avoid their mistakes and make necessary changes to suit our specific needs. So far, only two countries have tradable water rights at the national level-Chile and Mexico. As discussed earlier, parts of western United States such as the states of Colorado and California and the province of Alberta in Canada, have also adopted these regimes. Since water markets have been quite successful in Chile, we draw on the Chilean experience.

Conduct an information campaign

A draft version of the law may be prepared and given wide publicity. This has to be accompanied by a campaign highlighting the fact that benefits of water trade can lead to mutual gains. This would help overcome the opposition by vested interests and remove apprehensions that the incognizant public may have about its efficacy. It should be made clear that the concerns of the farmers and other user groups would be accommodated.

Initial allocation of rights

The initial allocation of water rights should be made to the existing users without any charge based on their historic uses. Since existing users will be assigned formal trading rights, the regime will be politically more acceptable. If however, the government were to snatch all the illegally obtained rights, and correct all its past mistakes, there are good chances that the proposed legislation will never be approved.

But how does one identify the actual users? Using 'block titling' method, public authorities can allocate rights in blocks to local institutions such as water user associations, based on historical use. These associations, which would represent all users, could verify the claims for rights. Adequate watch by the regulatory bodies at central and state levels will minimise chances of expropriation by the rich and powerful. Proper information campaign can reduce chances of rights not being claimed for. The rights should be registered with a public registry. To ensure fiscal autonomy for the registry, there should be nominal registration charge to meet its operational costs. These water rights may be defined either in volumetric terms (i.e. in actual litres/second, hrs, years etc.) or as a share of the total flow, whatever that flow may be. Although defining water rights is technically difficult, it is actually being undertaken in Chile as noted earlier and in other countries. Hence, ground-level implementation expertise can be obtained from their experience.

Assignment of new rights

The newly discovered water rights and rights that are not used by others could be assigned through auction conducted in an open and transparent manner. If there are no competing claims, the petitioner may be given rights over it by charging a minimum reservation price. The government should preserve the water rights, if they are needed for environmental purposes.

Protecting rights of third party

It has to be ensured that trades do not infringe on the water rights of third parties. This is particularly important where reuse of return flows are substantial. One way is to specify that all water rights have both a consumptive and non-consumptive portion. While consumptive portion can be sold without restriction, non-consumptive part can be sold only if it does not deprive other water users. Thus if farmers were to sell their rights to a water company whose return flows do not return to the same aquifer or river, they could sell only the purely consumptive part of their right. However, for transfers within the same water basin, owners can sell their entire water rights.

Calculation of the consumptive portion on a case-by-case basis is difficult. However, it may be suitable to calculate average that specify the volume of water consumed by certain crop or activity. These published volumes are all that the owners would be free to sell to those whose return flows do not return to the same aquifer or river. It is applicable for both surface water and ground water. This practice reduces the need for each seller to justify the consumptive portion of water.

Protection against monopoly through taxes and regulations

Since there are likely to be large number of consumptive users in India who will demand high prices to give up their rights, there is little chance of monopoly being developed. However, there are two cases under which monopoly might emerge. One is when the new non-consumptive rights are assigned. This happened in Chile where big companies started acquiring rights over rivers essentially to preempt future competition, although there was no use of the water at the time. They did not have to pay anything for these rights, since in Chile, new rights are granted without charge if there are no competitors. To minimise chances of monopoly arising on this count, there is a need to impose taxes on holdings of water rights (analogous to land taxes) without use rather than to require the holders to exercise the rights within a prescribed period. The second case under which monopolies could develop is when large volumes of new water rights (consumptive or non-consumptive) are awarded to private entities while privatising large hydraulic projects. To protect against this, appropriate regulatory framework should be developed.

Protection against pollution and depletion

There is no need to change water quality standards while establishing tradable water rights. If quality standard or enforcement is to be improved, it can be done independently of the law establishing water rights. Experience shows that laws that threaten forfeiture of rights for water polluting activities are difficult to enforce. A more effective and more credible alternative is to impose escalating fines.

Water markets can actually create incentives to excess pumping of water for sales, making groundwater aquifer more prone to depletion. A mechanism can be introduced within the framework of formal markets if law provides for registration of ground water rights. For example, associations of ground water users can be formed who, with public assistance, collectively monitor the water table and each other's use. For example, if aquifers do not recharge adequately, the association could reduce the extraction limits of its users proportionately.

VI. Conclusion

Water markets have been in operation in many parts of the world including India. Although informal water markets have been in existence for decades, formal markets with clearly assigned, private and transferable water rights are of relatively recent origin. In Chile, Western USA and Australia, where there are developed formal water markets, there have been significant gains from water trading, particularly from trades between agricultural and urban users as water gets reallocated to more productive uses. In many instances, water trading has alleviated water shortages. International experience also shows that formal and developed water markets strengthen the incentives for conservation and more efficient use of water. For example, farmers have responded by switching to water-saving technologies and high-value, less water intensive crops. The Indian experience with water markets has been positive, although there have been only limited gains as markets have remained informal, localised and primitive. Thus, while these markets have led to some efficiency gains and have expanded the scope for many resource poor farmers to access irrigation, inter-sectoral water transfers have not taken place so far.

The current challenge in India is therefore to establish formal water markets, which will expand the scope of trading and make inter-sectoral water transfers possible. Further, since formal water markets have a legal basis, effective regulation can be designed to address the issue of ecological sustainability. These markets will be of significant relevance to the urban sector, which has been suffering from acute shortages of water, but has not been able to access informal markets. While it is true that in urban areas tariff rationalisation and reforms at the distribution end can improve efficiency in water supply and use, nevertheless, additional measures will be required in view of fast growing urban population. Formal water markets can provide low cost solutions to augmentation of water supply relatively quickly. In this context, it is estimated that if 5 percent of the water being used for irrigation is transferred to the urban sector, the latter's water requirements can be met for the next fifty years.

With respect to further steps, it is desirable that a beginning be made by selective piloting of water markets in a few specific locations. This is important to gain hand-on experience with the functioning of formal water markets in India. This suggestion is consistent with the views of the Government of India and the World Bank (World Bank 1999, pp 56-57).

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