

Water markets as drought mitigation and water demand management tools

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Abstract

This paper argues that water markets have a significant ability to assist irrigation communities in mitigating drought and managing demand for water. Such markets should not be introduced in isolation, but need to be seen as part of a holistic water management framework which ensures that the social, environmental, cultural, and economic benefits from water are maximized, while the wider community is protected from the potential negative externalities associated with private usage and dealings in water. Water belongs to the community as a whole, yet while individuals are being granted the privilege of putting part of this water to beneficial use, they have to accept the obligation to use the resource efficiently not only for their private profit, but also for the benefit of the wider community within which they operate. In many developing countries most beneficial outcomes can only be achieved if institutions are in place to facilitate efficient collaboration between funding agencies, development aid organizations and other NGOs, federal and state governments, research organizations and private industry.

Key words

Water markets, water trading, drought mitigation, water demand management.

INTRODUCTION

This paper discusses how water markets can play a significant role in solving three vital problems facing many developing countries: i) how to mitigate the impact of drought; ii) how to manage and balance demands from urban and rural users; and iii) how to reallocate water to indigenous or previously disadvantaged groups.

Many agricultural areas in developing countries that depend on irrigation for production experience a high level of rainfall variability and frequent cycles of drought. The impacts of such drought conditions are often exacerbated by the lack of storage capacity. The absence of adequate funding, combined with environmental opposition from the international community, makes it unlikely that storage facilities will be significantly increased. Further, such drought conditions are likely to worsen in the future as the global warming process begins to take effect; this is predicted to result in reduced rainfall, a rise in temperature and consequently an increase in evaporation (Ayers 2003). It has been estimated that droughts, which currently have a 5% frequency, may increase to a 50% frequency by 2050, and that water therefore will increasingly become a limiting factor in social and economic development (Pelser and Redelingshuys 2002).

The rapid urbanization process in most developing countries has resulted in escalating demand for water for consumption and sanitation in the growing cities. In most countries such increased demand can only be met by a similar reduction in supply for the traditional rural uses. Increased urban demand will therefore result in a need to reallocate scarce water resources from rural to urban uses. Such reallocation will lead to a reduction in economic activity and social hardship within rural areas and an increased dependence on food imports. In order to minimize these impacts it is important that water demand and the reallocation process should be managed and guided by appropriate water policies. These should ideally encourage a reallocation from low value and inefficient users to higher value and more efficient rural users, so as to compensate for the impact of the inevitable transfer of water to urban areas, as well as provide financial compensation to those rural users who give up their access to water.

In many countries there is the additional complication of reallocating water from existing users to indigenous and previously disadvantaged groups following many years of colonial or apartheid policies that gave preferential treatment to certain sectors of the community.

Water markets have significant potential to assist in facilitating all the three processes discussed in the preceding paragraphs, and have increasingly been promoted by international organizations and national governments since the early 1990s as part of a new water management paradigm, which also places importance on full cost recovery prices and a devolution of water management to local communities (World Bank 1993; Sitarz 1993). However, water markets are only in operation in very few countries and in most instances only in limited capacities (Bjornlund and McKay 2002). In many countries and cultures concerns exist over the whole concept of treating water as an economic good that can be dealt with like any other commodity, while in other countries the social, institutional and economic capacities are inadequate to implement formal water markets (Applegreen and Klohn 1999).

The second section of this paper elaborates on water management within the context of developing countries, while the third section explores how the poor and previously disadvantaged could prosper from increased access to land and water resources. The fourth section discusses how water markets can be used to manage drought and water demand while reducing poverty and sustaining communities. Finally the fifth section outlines elements of a water management framework which would enable water markets to achieve the benefits outlined in section four while protecting wider environmental, social, community and economic interests.

WATER MANAGEMENT IN THE CONTEXT OF DEVELOPING COUNTRIES

Water management in developing countries, and countries facing redistribution from previously privileged groups to previously disadvantaged groups, is associated with added complexities. It has to explicitly and decisively deal with past inequitable power relationships between rich and poor, white and black, Muslims and Hindus, Israelis and Palestinians, and between different tribes, etc.

Here the issue of poverty reduction plays an important role. It has been widely acknowledged that it is the rural and urban poor that suffer the most from water scarcity (Barker and Koppen 1999), and that a major dimension of poverty is unequal access to productive assets such as water (Adaman and Mandra 2003). In irrigation regions, water is an essential productive asset and only by giving a more equitable access to this productive asset can poverty be reduced. The importance of equitable access to productive assets is highlighted by the fact that without this access the poor have less economic flexibility and as a consequence they have to accept low paid jobs and tend to suffer from poor health and low levels of education and training. This tends to further consolidate these people in the poverty trap, and it also prevents the community from building the social capacity necessary to implement public participation in natural resource management and planning so necessary to ensure sustainable resource use. This represents a kind of chicken and egg situation in that only by involving the previously disadvantaged in the decision-making processes with respect to the allocation and management of natural resources can we effectively prevent the previously privileged from corrupting these processes.

Proponents of a neoclassical approach would suggest that it is requisite to solve allocation issues by introducing well defined property rights to natural resources and then leave it to the unregulated market to solve the allocation problems as it has been attempted in Chile (Bauer, 1998). Due to the complex nature of water, and most other environmental and natural resources, and the prevalent third party impacts of their use, this unregulated market approach will always result in economically inefficient outcomes and will inevitably favor and benefit the previously privileged class. The other traditional approach has often been called the command-and-control approach (Easter 1999). Under this approach a central government sets regulations and rules to protect against third party impacts and to protect the environment. This centralized approach has been shown to be prone to failures, inefficiency and environmental damage (Easter 1999; Postel 1999).

To close the loop it also has to be acknowledged that drought has a major impact on the viability of communities depending on water as a productive asset. The poor and previously disadvantaged

are most at risk during periods of drought since they have the least economic capacity and are least well endowed with water resources relative to need. It is therefore essential that the institutional framework provides flexibility to enable the poor to maximize the economic benefits from their land and water resources so that they can maintain an income during periods of drought. This will allow them to continue to improve their education and training, build their asset base, work their way out of the poverty trap, and thereby build the social capacity of their communities and participate in the necessary institutional processes.

HOW CAN THE POOR AND PREVIOUSLY DISADVANTAGED PROSPER

Often it is not enough to give the poor and previously disadvantaged land and water assets and then expect them to prosper. They might not have the necessary: (i) capital to start the production; (ii) skill to grow the products; or (iii) know how to market these products. They might also find it difficult to get access to the input to produce these products and get the products to the market. The most profitable and marketable products often need processing, cooling, and packaging facilities and need to be transported to local, national and international markets. To justify such infrastructure economies of scale is often a necessity and detailed knowledge is frequently required to end up with a product of a quality acceptable in the market. To overcome these problems and assist emerging small farmers to get established institutions might be needed which promote collaboration between national governments, international funding agencies, private capital, research organizations, and development aid organizations (Bjornlund and McKay 2003). Within such a framework:

- national government could provide land and some infrastructure and finance;
- funding agencies could provide finance for infrastructure and provide assistance to small farmers to get established;
- international research organizations could provide targeted research to provide technologies which are adapted to physical conditions and social capacities of developing countries and accordingly prevent a technical dependence between developed and developing countries;
- development aid organizations could assist in providing educational and health services to ensure that the new small farmers and their children have good education, vocational skills and health to enable them to break out of the poverty trap and to build the social capacity of their communities; and,
- private industry could provide capital to develop large scale agriculture, which would then constitute the critical mass to justify processing, packaging and transport infrastructure, and which would facilitate import of agricultural inputs at competitive prices and export of final products. These developments would also provide additional work for the small farmers especially in the establishment period. Such large projects could also constitute model farms and be under an obligation to provide training for the small farmers in the use of new technology and growing methods, they could also process the produce of the small farmers through their infrastructure at reasonable prices. In return for providing these services the national government could provide the developer with access to land and water and the new small farmer group would provide a stable, healthy, well educated, reliable and productive workforce, as well as additional produce to justify the necessary infrastructure.

Within such a framework new small farmer developments are likely to prosper where many previous projects have failed. Analyses of experiences with small farmer management systems in Zimbabwe suggest that such a framework would significantly improve small farmer earnings (Makombe and Sampath 2003). In the absence of such a framework many previously disadvantaged groups given access to land and water resources might struggle to cope with the transition. When visiting a small farmer irrigation scheme on tribal land around Malelane in South Africa in July 2003 it was apparent that many new black farmers were struggling to get established, and some indeed failed, while others were unwilling or incapable to follow the necessary agricultural practices. However, there was no means of disciplining growers who did not follow the agricultural program or did not pay their loans. For such a system to work there needs to be communal processes in place which can ensure that individuals follow the right programs, or that there are the

means to replace members not willing to follow those processes, so that other small farmers could be given a chance.

In some circumstances it might be a good idea to provide transitional arrangements when previously disadvantaged groups are given access to land and water resources, so as to ensure long-term sustainable developments. Recently the blood Indians in Alberta Canada were given a relatively large water entitlement for their reservation of about 30,000 ML and some financial assistance to develop center pivot irrigation systems (site visit by author in September 2003). To immediately benefit from the access to this resource the land, water and irrigation systems have been leased to surrounding white farmers with the lease money going to the local tribe. Furthermore, it was the local blood Indians who were trained to install and run the irrigation system. They are now doing all the work involved with running and maintaining the systems and crews of blood Indians are working as contractors in Canada and part of the US setting up center pivot irrigation systems. In the next round of lease negotiations it is being considered to insert clauses in the lease contracts that the white farmers have to hire and train a certain number of blood Indians in the farming aspects. This way the previously disadvantaged group is building up an asset base while also building up the farming capacity to one day run the whole enterprise.

HOW CAN WATER MARKETS HELP

There are basically two different markets. The first is the market in which the long-term underlying entitlement to get access to water is traded; this is often called permanent or formal markets and has been introduced in countries such as Australia (Bjornlund and McKay 1998), United States (Colby and Bush 1987), and Chile (Bauer 1998). More recently they have been introduced into Spain (Olaizola 2001), South Africa (Nieuwoudt 2002) and Canada (Klein et al. 2003). The uptake of this market in both developed and developing countries has been very slow due to the complexity and costs of operating such systems and the rigid nature of many existing delivery systems as well as the lack of water meters (Bjornlund and McKay 2002).

In the second market only the right to use a certain volume of water over a limited period of time is traded but no change of ownership takes place to the underlying long-term entitlement to access water. This market has been more widely adopted in many developing countries such as India and Pakistan (Saleth 1998, Meinzen-Dick 1998). For a discussion of the potential use of markets for permanent and temporary water in Australia see Bjornlund (2002, 2003a,b,c)

Water markets to manage drought

During prolonged periods of drought water becomes scarce and irrigators cannot get access to the water they need. If water cannot move from one irrigator to another then they will all have to make do with what they have. This will not produce the optimal outcome since:

- in many instances each farmer will have too little water to efficiently grow a crop. A better economic outcome for all could be achieved if water was pooled to grow a larger area;
- irrigators face very different financial consequences of not irrigating sufficiently. Some will simply lose all or part of that year's crop, which is bad enough, but still they will not suffer long-term consequences. Others, such as horticultural growers with permanent plantings or dairy farmers with milking herds and milking equipment, will suffer far bigger losses, often with long-term implications for yields and potential loss of plantings and animals. The growers with much to lose should be willing to buy the water from those suffering smaller losses and both should be better off. Those buying water under this scenario might not make a lot of money from the water but it will prevent significant losses, and those selling water will receive more money than they could have earned from using the little water that they have access to;
- some farmers grow low value crops, which are only marginally profitable during years of good water supply, while other farmers grow much more valuable crops. During periods of drought the growers of high value crops should be willing to pay a good price to the growers of low value crops and thereby leave both better off; and,

- some farmers have better and more productive soils than others. During periods of scarcity it should be more beneficial for all if production could be concentrated on the better soils while production was reduced or ceased on the poorer soils.

When visiting the Delicias irrigation districts in the state of Chihuahua, Mexico in July 1999 the author saw a good example of a community approach to solving these issues. It was a drought year and a limited supply of water was available. All irrigators within Modulo 7 of the district met and discussed what to do. It was decided that all the water available should be used on the most productive soil and to produce the highest value crops. The meeting also agreed on the price that should be paid to those giving up using their water. In this way all irrigators within the Modulo suffered least as a result of the drought.

In Australia there is clear evidence that markets have the most important impact during periods of droughts. Within the largest irrigation district in Australia, the Goulburn–Murray Irrigation District (GMID), two to five percent of total water use is generated through trade in years of normal supply while during a six year period of low supply this increased to 18% of and topped at 24% during the year with the lowest supply in a 100 years (Bjornlund 2004a).

During these periods of drought there is also clear evidence that water is moving from low value users to high value users, that is from broad acre cropping to horticulture and dairy farming. During the worst drought year of 2002/03 prices within the GMID reached A\$500 per ML on the temporary market as horticultural growers and dairy farmers bought water to protect their long term investment in plantings, herd and infrastructure (Bjornlund 2004a, 2003b,c). Considering that many low value farmers (who are also the poorer farmers) are using their water on crops with a gross margin at around A\$50–A\$100 per ML, by selling their water at A\$500 per ML these farmers are significantly offsetting the financial impact of reduced access to water. On the other hand the horticultural growers and the dairy farmers were able to stay in business.

Analyses of trading and water entitlement registers within the GMID also show that farmers are using both the temporary and permanent markets to manage the risk associated with drought and water scarcity relative to their production and risk averseness (Bjornlund 2003c, 2004a). Some irrigators have: (i) bought water on the permanent market to ensure that they have water enough for their crops during all years, which is done mostly by high value irrigators with permanent plantings, as well as dairy farmers. During years with normal and high supply they sell part of their water; (ii) bought water on the permanent market to have enough during most years and then buy water on the temporary market during periods of very low supply. The reason for this behavior is mainly the lack of funds to buy enough water; or (iii) sold water on the permanent market and then buy water on the temporary market during periods of high supply when the relationship between water prices and commodity prices for their low value crops makes it profitable.

There is strong evidence that irrigators over time will get used to water markets and use them in an elaborate way to manage the risks associated with water scarcity and drought, and to benefit from fluctuating water and commodity prices as well as supply and demand for water (Bjornlund 2003a,b, 2004a). During focus groups with irrigators in New South Wales in Australia it was strongly expressed that ‘in most seasons the temporary market is a great help, but last season (2002/03 the worst drought year) it saved us’ (Bjornlund 2004b).

Water markets as a demand management instrument

Many developing countries in semi arid regions such as southern Africa are experiencing increased water scarcity, which is especially due to escalating urban demand. The costs of increasing supply by constructing additional reservoirs and canals for inter-basin transfers are sharply increasing both in economic and environmental (and therefore political) terms. Other ways of augmenting supply such as water barging, iceberg tugging, desalination, wastewater reuse and atmospheric moisture harvesting are considered economically unviable under present technologies (Smakhtin et al. 2001). Desalination and reuse of wastewater show the greatest promise with costs approaching levels close to feasibility for many urban uses. Virtual water trading has further potential to reduce demand for water in water scarce regions (Hoekstrad 2003; Smakhtin et al. 2001). However, there are still

significant problems associated with individual countries relying on virtual water for basic food production. Firstly, the country must be able to afford to buy food products rather than using scarce water resources to grow it. Secondly, countries relying on virtual water imports will leave themselves vulnerable to fluctuations in price and supply of such food products. Virtual water trading as a way of significantly reducing demand for water for basic food production will require an international or at least regional strategy protecting importing nations.

Demand management is therefore seen as an important way of reducing demand for water in the short to medium term to give time to develop technical and political solutions to increase supply within economic, social and political constraints of both nations and the international community. Water markets combined with water pricing policies have significant potential as demand management instruments. If water becomes tradable separately from land then it gets a commercial value; if irrigators use less water they can sell what they do not use. This will encourage irrigators to use more efficient irrigation methods and adopt less water consuming farming practices. The saved water can then be sold to other irrigators to increase agricultural output or be sold to cities to meet increased urban demand. The incentive to use water more efficiently will be emphasized if the price of water is increased to reflect its full cost (for a balanced discussion of water pricing in the context of demand management see Savenije and Zaag 2002). Higher prices will encourage irrigators to use water more efficiently. Higher prices will also encourage or force irrigators not capable of using water more efficiently and profitably to sell their water to farmers who have the financial and technical ability to make the necessary adjustments. Irrigators who might be forced to sell their water and stop irrigating can then sell their water on the market and thereby get some compensation to help them establish an alternative life. To increase small farmers' ability to survive this process it is essential that they operate within a supported framework as discussed in the preceding section. Experiences from Australia show clear evidence that trading moves water from less efficient and lower value producers to more efficient and higher value users (Bjornlund 2003, 2004a; Bjornlund and McKay 2002).

THE NECESSARY WATER MANAGEMENT AND PLANNING FRAMEWORK

To overcome the problems discussed with the neoclassical and command-and-control approaches, while providing irrigators with the flexibility necessary to achieve the drought mitigation, demand management, and poverty alleviation benefits of markets discussed in the preceding section, a third approach is needed. When considering such an approach it is essential to acknowledge that communities in developed and developing countries have significant concerns with the operation of markets for water due to the potential social, cultural and environmental impacts. It is therefore necessary that the operations of water markets be constrained within a planning and property rights framework, which protects these interests (Bjornlund 2004c; Bjornlund and McKay 2003). Such constraints will only be accepted by local communities and therefore adopted, monitored and enforced, if they are defined within locally developed water management plans. This requires devolution of water management issues to the lowest appropriate level in the community and is only possible if the community is empowered to take part in the decision-making processes in a meaningful way and an institutional framework exists within which such decisions can be made. To do that the community needs to be given the necessary information and needs to have the social capacity to process this information into sensible decisions. This need for capacity building is widely acknowledged by international organizations promoting Integrated Water Resources Management in developing countries (Lamoree and Harlin 2002).

Once such a framework is in place it can be left to markets to move water freely around while overcoming the problems that Savenije and Zaag (2002) pointed out was associated with introducing markets within more complex and complicated systems in a multi-sectoral and multi-interest environment. To maximize the discussed benefits of water markets Australian experiences suggest that mechanisms need to be in place ensuring efficiently working markets so that irrigators can instantly adjust their access to water (Bjornlund 2003b) and that demand for more flexible and sophisticated market instruments such as those proposed by Bjornlund (2004c) starts to emerge.

However, within many developing countries the social and institutional capacity is not in place to allow for such developments. A far better approach is to get started with simple seasonal water transactions, which can take place within established social structures where trust within social networks is critical (Greif 1997). Experiences from India and Pakistan suggest that such simple markets can significantly enhance poorer farmers' access to water and thereby facilitate a more socially equitable outcome of irrigated farming (Meinzen-Dick 1998; Saleth 1998; Shah 1993). More complicated water market frameworks can then emerge as social and institutional capacities develop – the key issue here is the adoption of an adaptive management approach.

CONCLUSION

This paper has showed how water markets can significantly assist many developing countries in solving three vital problems: i) how to mitigate the impact of drought; ii) how to manage and balance demands from urban and rural users; and, iii) how to reallocate water to indigenous or previously disadvantaged groups. Experiences from countries such as Australia have indicated that beneficial outcomes can be maximized by the introduction of more complex property rights structures and market processes. However, in developing countries it is important to allow such markets to evolve using an adaptive water management approach so that more complex markets can emerge as institutional and social capacities grows. Experiences from Pakistan and India suggest that significant benefits can be achieved by less complex market transactions, which can take place within social and institutional constraints of local communities. The important issue is that processes are set in place to ensure more socially equitable outcomes of irrigated farming so that poverty can be reduced and the social and institutional capacity of communities can be built which will facilitate the emergence of more complex institutions and water markets to further the process. In many developing countries this process would be significantly enhanced if institutions were in place to facilitate efficient collaboration between funding agencies, development aid organizations and other NGOs, federal and state governments, research organizations and private industry.

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