IMPACT OF VALUE ASSESSMENT ON COMPETITION FOR WATER

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ABSTRACT

Irrigation systems have long been evaluated and managed solely to produce irrigated crops, but many irrigation systems also provide water for other uses. The quantities of water consumed in these uses are small, but these uses have high value in terms of social benefits. Recognising these multiple uses of water from irrigation systems is critical for development of better water allocation policy. In this paper we have justified a low water price in the agriculture sector with high non-agriculture water benefits. Water supply reliability, water quality, infrastructure cost, social and environmental values of water, etc have widened the gap between the price of irrigation water and its true (real) value. The importance of these factors in the agriculture sector must be taken into account when making water allocation decisions. The current affordable food prices also tell us that the true value of agricultural water is much higher than the charges made for irrigation water in most parts of the world. The indirect benefits of irrigation water are many times more than the indirect benefits of town water. These benefits must be included as basic parameters in thinking about future water allocation decisions.

Keywords: True value of water, non-agriculture values, irrigation efficiency, water allocation decision

INTRODUCTION

Irrigated agriculture is the biggest consumer of the world's fresh water resources. On a global level, irrigation comprises 72 percent of the average diversions, with industrial and domestic sector accounting for 19 percent and 9 percent, respectively, (Seckler et al. [1]). Also, this sector is the most inefficient fresh water user with average water use efficiency not more than 35 percent (Bakker et al. [2]; Bakker & Matsuno [3]). This inefficiency in water use and the low economic value of irrigation water, water being transferred out of agriculture to meet the growing demand in other areas, often without the agreement of, or compensation to farmers for their irrigated land and water rights.

There is a failure to recognise that irrigation systems supply water not only for the main fields, but also for domestic uses, home gardens, trees, permanent vegetation, and livestock (Bakker et al. [2]; Bakker & Matsuno [3]; Meinzen-Dick & Hoek [4]; Meinzen-Dick & Bakker [5]). Other productive uses include fishing, harvesting of aquatic plants and animals, and in brick making. In addition, irrigation systems support the ecology of the region and wildlife habitats. Transfer of water from agriculture affects rural households, rural economy, and the environment in a number of ways. Therefore, it would be misleading to equate irrigation only with the crop production, just as it is misleading to equate municipal consumption with domestic water use, since much municipal water goes for productive enterprises, and even gardens and lawns. The typical example of non-crop production benefits occurs with irrigation schemes that provide water for domestic use and livestock, which can result in higher incomes and improved health for the rural poor. In areas of North-west India where groundwater is saline, irrigation canals not only provide water for domestic and livestock uses, but water from these canals recharge the groundwater table, thus enabling the pumping of water using handpumps and shallow tubewells. In the absence of this fresh water, use of saline groundwater by animals is reported to result in about a 50 percent reduction in the output of milk (Bhatia & Raheja [6]). In many arid regions of Haryana, the Indian Punjab and the Pakistani Punjab, returns from livestock accounts for a significant proportion of the income of poor households, particularly in the dry season. In addition to livestock, irrigation canals provide water for wildlife, flora and fauna and provide in-stream benefits. These indirect benefits have to be included while estimating 'the value in use' of water that is diverted for agricultural purposes. Ignoring these benefits could result in a serious underestimation of societal benefits available from the volume of water that is diverted for irrigation.

Renwick [7] estimates the contribution of irrigation water in fish production in Kirindi Oya Irrigation System, Sri Lanka. He found that this "secondary" use of irrigation water for fisheries provides an additional 18 percent to the value of water for paddy irrigation alone. Palanisami and Meinzen-Dick's [8] study of tanks in Tamil Nadu compares performance on a number of measures, and finds that including all major productive uses of tanks (excluding domestic uses and livestock) increases the total value of output by 13 percent over consideration of irrigation alone. However, a much more dramatic difference is seen when revenue from all uses is compared to revenue from irrigation alone: total revenue is more than triple the income from irrigation alone.

These non-agricultural values of irrigation water are just indicative of the total value of irrigation water. Studies at other sites may reveal more or less change in the total value of water uses in irrigation systems. To ensure efficient, equitable and sustainable water use, irrigation and water resources policies need to take into account all uses and users of water within the irrigation system. Economic valuation of the different uses of water can provide input in decision-making. Better informed water allocation decisions can be made when the full range of uses and returns obtained from irrigation water are taken into account. If only overt economic considerations and financial values were used to determine water allocation, the poor of the world could be very much worse off (Perry et al [9]).

COMPETITION BETWEEN TOWN AND AGRICULTURE FOR WATER

There is competition among all water users where fresh water resources are scarce. The reasons for this competition are obvious. The development of industries, which can afford to pay high prices, is the main cause of water transfer from agriculture to cities. Growing more and more grain crops to meet increasing global population food requirements has reduced the environment's share of water in many rivers. The flow in many rivers in the world is not reaching its natural terminus (ocean/lakes). If projected global population increase is realised then fertile lands will become barren because of non-availability of fresh water. Many nations will face food shortages in the next few decades. But, this would not happen if the true value of water was understood. Understanding the true value of water is not enough, but this understanding must then influence water allocation decisions. The neglect of the true value of water will result in misallocation of scarce resources. In this paper, we have arbitrarily created a water competition between town and agriculture by considering these true values in the agriculture sector. The main reason of such an analysis is to demonstrate the misconception that the agriculture sector is a low value water user.

1. Release of Water from a Multipurpose Reservoir

Suppose we have a reservoir which can supply 5200 ML/day. The current town water share from this reservoir is assumed 200 ML/day for 0.7 million population with daily per capita water demand of approximately 300 litres. The total annual revenue collection from town water consumers is 73 million dollars at a charge rate of $1/KL (or $1000/ML). The bulk of the water (i.e. 5000 ML/day) is allocated to the agriculture sector to grow crops for meeting the food requirement of the nation. Agriculture is paying just $100/ML (10 times less than town). Total annual revenue collection from 5000 ML of daily water supply to agriculture is 182.5 million dollars. Town people think that the existing daily per capita town water supply is not enough to meet their actual water demand. They want to double their daily water demand and are willing to pay $1/KL for extra water. It is also assumed here that there is no other water resource available to meet their demand except the transference of water from agriculture. The town water authority is putting pressure on the water management authority for reallocation of water supply from the multipurpose reservoir. Water policy-makers are seriously considering the request of the town water authority. The situation developed here does not look favourable to the agriculture sector. The options for agriculture sector are (1). To pay more per unit of fresh water, or/and (2) to justify that this sector is earning more (or equal to) from a ML of water as compared to town water to retain its existing water share from the reservoir. In this paper we analyse the benefits in the agriculture sector from a single unit of water to defend the existing agriculture water share. It will be demonstrated that the agriculture sector is probably producing equal (or greater) benefits as the town from a single unit of water.

NON-AGRICULTURE VALUES OF IRRIGATION WATER

The limited literature and data availability on the subject of assessing the true value of water give us the impression that non-agricultural water values of irrigation water are often overlooked and, therefore, are rarely taken into account in water management decisions. In this paper we have attempted to account for all these non-agricultural water values, and have shown that the value of irrigation water for non-agriculture purposes will be of a significant magnitude when compared with the total value of agricultural water use.

1. Factors Responsible for Low Price of Irrigation Water

Irrigation water application to the fields under subsidised supply-based irrigation systems is the main cause of the low price of irrigation water. Over- and under-irrigation is the major problem created in supply-based irrigation systems and it results in low returns from each unit of water. If an irrigation system is demand-based then the value of a single unit of water will be more than for an equivalent supply-based irrigation system. Timely, demand-based irrigation helps to improve water usage efficiency and crop quality. Delivery of water only as needed can also reduce runoff and leaching problems associated with over-watering. The responsibility of switching from supply-based systems to a demand base should probably fall on water authority shoulders more than farmers. Another factor which causes lower values of water in agriculture is reliability in water supply. There is usually no compensation to farmers, if they do not receive delivery on the day they require it. When the reliability of water supply is low, ultimately it will result in low returns from a unit of water. In town water supply the reliability factor is usually high and that is one reason why the price of water in town is higher as compared to agriculture water. Also, infrastructure and O&M cost is another reason for the high price of town water because town water must be treated and meet human drinking standards. Also, the maintenance of drainage systems in cities for disposing of waste safely also contributes to the high price of town water. In the case of the agriculture sector this cost is a fraction of town water disposal. This part of the higher price of town water does not contribute direct benefits but is a necessary cost of town water use. Other reasons for higher town water prices are the high number of a staff needed to maintain the system, and billing. In agriculture there is much less billing and water meter checking. Therefore, the cost of supplying water in agriculture should be less as compared to the town water price.

In many parts of the world lining watercourses is the responsibility of the water authority and not of farmers. A substantial portion of farmers' water share is lost between the head of the delivery channel and the farm. Roughly 20 to 30 percent of the allocated water never reaches the farm. Farmers are paying for this quantity of water to which they have no access. This "loss" of water has social and economic value to other farmers who may be able to access the "lost" water free of charge. Since the control of such water loss is beyond the farmers' control why do they pay for that water "loss"? If the social value of this loss is adjusted then the overall value of irrigation water will increase. In the case of town water supply, the consumers only pay for the quantity of water they consume. So, the consideration of this factor is also important in making water allocation decisions to the agriculture sector.

The value of water in the agriculture sector is controlled not only by the crop production but also by other factors. The crop market is the main factor that may increase or decrease the value of a unit of irrigation water. So, the value of irrigation water is not just the product of the crop yield but also of the selling price in the market. The market is not in the control of farmers. If farmers wish to grow a high-value crop, for example, carrots, then the price of carrots will fall in market as supply increases. Therefore, farmers can not always grow high-value crops because of these market limitations. On the other hand, town water value is not usually controlled by such markets. So, this factor can contribute to the low value of water in agriculture. The last but very crucial factor that must be considered in water allocation decisions is the effects of return flows of irrigation water. This flow may generate secondary benefits of irrigation supplies. But, in the case of towns the secondary benefits are zero or negative because there is no return flow or return flow is highly contaminated and needs expensive treatment. This factor also increases the value of water in agriculture and results in a lower price of irrigation water to the farmers.

The above discussion has revealed many indirect benefits of irrigation water. Town water does not produce comparable indirect benefits. These discussed factors of agriculture have tended not to be considered in previous water policies and water allocation decisions. The agriculture sector has always been criticised as being a low-efficiency water user. This would perhaps not be true if some reforms were introduced in agriculture such as, application of advanced irrigation methods and demand-based irrigation systems.

REFORMS TO INCREASE IRRIGATION WATER-USE EFFICIENCY

When irrigation water is applied to fields by surface irrigation (flooding and furrow methods), the productivity per unit of water is relatively low. Water-use efficiency of furrow irrigation is just 50% (Juneidt [10]). Half of the water applied to the field does not give any benefit to crops. On the other hand, the range of water-use efficiency for sprinkler and drip irrigation methods is 70-80% and 80-95%, respectively (Juneidt [10]; Irrigation Methods [11]). The capital cost of recently developed drip irrigation systems is about $25,000/km^2 ($250/hectare) (Drip Irrigation [12]). This amount is much lower than the older drip irrigation methods. Drip irrigation is now affordable to many farmers. However, drip irrigation methods have some limitations. For example, grain crops can not be grown by using drip irrigation techniques. This method is mainly useful for horticulture with water-use efficiency almost double that of furrow irrigation (Methods of Irrigation [13]).

Land grading will also result in high efficiency of irrigation water-use. More than 10 percent of water can be saved by precise land leveling. Controlling water losses in the field can also make more irrigation water available. Good knowledge of crop marketing will also result in assignment of higher values to water in agriculture. Knowledge of when and where to sell crops will increase the value of a single unit of water in agriculture. On-farm water management is another factor which can lead to an increase in the value of a unit of water (Bazza [14]). Bazza [14] explains the low value of a unit of irrigation water in Yemen by pointing out the factors such as low crop yields, low post harvest treatment, unregulated marketing and the lack of competitiveness for exports.

DISCUSSIONS AND CONCLUSIONS

In this paper we have discussed the true value of irrigation water to assist decision-makers allocate water between agriculture and other water uses. Water managers generally only consider the economic value of water as one of many factors in water allocation decisions. Competition among water sectors for scarce fresh water resources is increasing day by day. It is argued many times in the literature that the agriculture sector is the most inefficient water user. In future, if the economic value remains the base of water allocation decisions, then it is feared that the agriculture sector will lose much of its existing water share. If that happens then food prices will rise in the international market and the poor will not be able to afford to purchase food.

But, reality is different. The agriculture sector will not lose its water share even if there is intense competition for the scarce resource. Literature reveals that water is not moving from low-value agriculture use to high-value uses at the rates which could be expected. This slow rate of water movement tells us something different than our expectations. The reason behind this slow pace of water movement from agriculture to other uses, for example, towns, is due to its true value in agriculture. We have pointed out many of these values of irrigation water, which contribute to the true value of irrigation water. The price of water in agriculture does not reflect the true value of water. But, the price of town water shows true value of highly managed and treated town water. Water supply reliability, water quality, zero indirect benefits, and zero return flow factors narrow the gap between the price and the true value of town water. The considerable impacts of these factors in agriculture sector widen the gap between price and true value of agriculture water. There is a desperate need of research to find out the real impact or contribution of these factors in contributing to the true value of irrigation water. It is concluded that accounting for the non-agricultural benefits of irrigation water will result in retaining the existing water share of the agriculture sector. The extra demand for water by town populations needs to be met by exploring other water resources and recycling and not by transferring agricultural water to town.

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