

The Economic Aspects of Water at Mandya City

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ABSTRACT: Water is a natural resource on Earth, but one can see the transit of this natural resource into an essential good, irrespective of its availability and sovereignty. Today, we have reached such a stance where we have to pay for this natural resource. But, people still believe in the ideology that water should be free of cost and no such tariff should be fixed. However, some of them have come out of this ideology and are compensating the charges associated with the service. The present study projects the scenario of economic aspects associated with Water at Mandya City, which includes the cost of production per kiloliter of water, the cost associated with the treatment, the tariffs, returns of the service and the need for revival of present Water Supply System.

KEYWORDS: Cost Production, Market Failure, Benefit Transfer, Elasticity Cost Turbidity.

I. INTRODUCTION

Economics is just not about financial comings and goings within markets but it is also about the un-priced or non-market services that the natural environment provides us with equal concern (Hanley et al., 2013). People often confuse economics only with financial and commercial aspects, but on broader perspective economics can be equated with water. Water is one of the primary drivers of public health, therefore it is gaining more concern, with the increase in demand; the chance of water being scarce is also increasing, triggered by urbanization. Though levied, still urbanization affects the economy of the city. With the increased capital cost, storage, supply and distribution cost of a good, the cost of production is also increasing. Thus, the un-priced good is the water and can be considered as an economic good.

The now famous proclamation that water should be treated “as an economic good” originated in Dublin conference (Perry, 2006). This conference was mainly among non-economist and the economist, whether to treat water as a private good or not. But according to Perry (2006), the more important question is whether water a private or a public good. In order to analyze such critical issues related to water a new branch originated known as Water Economics, as one branch of applied economics, water economics shares many tools and similarities with regard to systems analysis (Karl, 1980). Water economists obviously draw on, and adapt, those lessons of other branches as well as on fundamental theory dealing with supply, demand, pricing, values, allocation, and the root problem of scarcity (Karl, 1980).

II. STUDY AREA

Mandya City, also known as Sugar City, with a population of 137,735 is situated at 100 kilometers from the State Capital with 12° 31' 12" N 76° 54' 0" E co-ordinates by WGS84 and at an elevation of 678 meters mean sea level. The city is spread across 30 square kilometer area, out of which 17.05 square kilometer area is used for water supply (Source: www.mandyacity.gov.in/). The city has 35 wards. River Cauvery, which is about 25 kilometers away, is the major source of water supply to Mandya City. The per capita consumption is about 100-135 LPCD and pumped by means of gravity and a booster pump. Water is supplied by means of 18 Over Head Tanks of different capacities. The treatment facility is situated about 13 Kilometers upstream from the city with a capacity of 14 Million Liters per Day. The supply is controlled by the Karnataka Urban Water Supply and Drainage Board, which is a Government agency. (Source: KUWS&DB, 2014). The water is supplied by means of gravity from source to about 8 kilometers, and then a booster pump is used to lift water till it reaches the Treatment facility. Once the water reaches the treatment facility, due to low gradient, it flows by gravity to the city.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 10, October 2015

III. WATER PRICING

Water pricing is not a new concept to deal with. The question of pricing is equally contentious: some plead that water should be free, whereas others think it should be affordable and others that water should be priced at full or sustainable cost (Karen, 2011). USEPA states that the Full Cost Pricing is usually interpreted to mean factoring all cost-past and future, operations, maintenance and capital costs-into prices. Summarizing this, the Cost of production per kiloliter of water is calculated by combining the cost starting from pumping till the water reaches the consumer tap. However it is really difficult to access the complete supply of water, as some amount of water lost due to leakages and unauthorized connections.

Following table 1 gives the list of the particulars of Cost production, which includes starting from Investment, Operation & Maintenance, establishments of regular and contract workers, chemicals and consumables, electrical supply (excluding breakdown) till the storage i.e., water reaches the consumer end. It also includes the temporary and permanent civil works.

Table 1: Particulars of Cost Production

Particulars		
Investments	Materials	Repairs of Pipeline
Establishment Charges – Regular & Contract	Civil Works	Telephone Charge
Chemicals and Consumables	Water Quality Analysis	Maintenance of Vehicles
Electricity Charges	Computerization of Revenue Management	Printing and Stationary
Maintenance of Power and Hand Pumps		Water Tanker
Maintenance of Pumping Machinery		
Maintenance of Electrical appurtenances		

After a thorough investigation the above mentioned particulars has been identified, irrespective of losses, in order to calculate the production cost, eventually summarized and projected in equation 1.

$$\text{Cost production perKilo liter of water} = (\sum \text{Expenditure} (\pm \text{Investments}) / \text{Rate of Supply}) \times 1000 \quad (1)$$

Using the above equation 1, the cost of production per kiloliter of water for Mandya city was found to be INR 3-5 (Without investments) and INR 38-40 (With investments). The values obtained without investments are in line with the cost production value of the State water supply system which range between INR3-5 (Sastry, 2006). The above equation is an outcome of monthly expenditure associated with the water supply excluding initial investments, and it fits to find cost production at most of the context.

IV. MARKET AND WATER

Markets allow us to trade not just by buying and selling of goods but instead they help us to gain some economic values. Quoting the example of bottled water, markets allow us to trade water, considering water as an economic good. But, these Markets fail too. As stated by Hanley (2013), a market failure occurs when the market does not allocate scarce resources to generate the greatest social welfare. There exists a wedge. Wedge of wastefulness or economic inefficiency. Externality is also a type of market failure. Kolstad (2000) defines; externality exists when one person enters the utility or production of another person without permission or compensation. This market fails only when it sends bad signals and during such critical situation, a new body intervention is need. Government intervention can improve market performance, the modus operandi in a cost effective manner and how the cost and benefits of such interventions should be distributed (Tapati, 2003).Some of the externalities identified in the current water supply system are Power breakdown, Unaccounted for Water, Pump breakdown, time spent queuing and hauling, delay in repairs. No compensation is provided in the above mentioned cases. Hence they strictly signify as externalities.

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 4, Issue 10, October 2015

V. ECONOMIC VALUATION OF DRINKING WATER

Valuing drinking water is gaining more concern and awareness among people irrespective of their class, culture or background. The cost of drinking water provision is directly linked to the quality of its raw water input, which is itself affected by upstream land use pattern (Yoanna et al., 2010). Several approaches are present to economically value the drinking water based on its quality. Benefit transfer is one of the methodologies to estimate the economic value of any ecosystem. During this study, the region from the source till the water treatment plant is assumed to be as one ecosystem and the benefits are transferred from source to the treatment plant. Using this assumption, qualitative analysis of the water is carried. It is also assumed that none characteristics change during the transfer. Thus, the quality of the water at the inlet point is same as the quality at the source.

This approach is found to be more feasible and less time consuming and can easily transfer benefits from site to plant (Yoanna et al., 2010). Among all the parameters analyzed during Qualitative analysis of drinking water, Turbidity is chosen to study the economic valuation of drinking water, because it was found to be higher in concentration compared to other parameters. Yoanna et al., (2010) has also used the same parameter to analyze the economic value of drinking water.

Considering turbidity as major parameter, the change in cost of treatment by altering the turbidity at lab scale level is calculated. It is found to be 0.2% i.e., 1% increase in turbidity increases 0.2% of treatment cost. As per Cobb Douglas mentioned by Bao, Tao (2008), if $\alpha = 0.2\%$ then elasticity cost turbidity is 0.2%, where α is the elasticity constant. In the present study ϵ_j has been used on behalf of α . The elasticity cost turbidity is calculated using available technology, for the present study Jar test has been adopted to see the change in turbidity by varying dosage of Alum.

In order to identify the difference in the change in cost, two methods are adopted. One is by using the Jar test as per APHA standard methods and the other by using the equation given by Yoanna et al., (2010). By using these two methods, the change in cost of treatment of water using chemicals and consumables as one of the particulars of cost of production per kiloliter of water the cost can be reduced. The major difference in cost, of INR 78,000 per day by Jar test and INR 600 per month per 1% increase of turbidity has been identified for Mandya city (Source: KUWS&DB).

Following equation 2 has been adopted by Yoanna et al., (2010), and herein it is used to calculate change in cost with respect to existing turbidity, the equation is found to be subjective to percentage change in turbidity ($\%T_i$), which also alters the elasticity cost turbidity,

$$\Delta C_{ij} = \epsilon_j * C_i * \% \Delta T_i \quad (2)$$

Where,

$\Delta \hat{C}_{ij}$ = Estimated change in cost of treatment in INR

ϵ_j = Elasticity cost turbidity

C_i = Average Operation & Maintenance cost in INR

$\% \Delta T_i$ = Percentage change in Turbidity

Thus, the estimated change in cost of treatment is found to be INR 7200 per year using the equation method. Whereas the estimated change in cost is found to be INR 78000 using the jar test method.

Following table 2 depicts the jar tests results conducted at KUWS&DB laboratory to calculate the change in cost manually; at varying dosage of pH, alkalinity and turbidity is measured. These results are also used to calculate Elasticity cost turbidity for the equation method.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 10, October 2015

Table 2: Jar Test Results at varying Alum dosage

Dosage	pH	Alkalinity, mg/L	Turbidity, NTU
0	7.98	176	12.8
2	7.95	164	6.9
4	7.91	160	7.6
6	7.84	164	8
8	7.79	156	8.5
10	7.74	156	6.7
12	7.69	144	4

Following figure 1 depicts the optimum dosage of alum, corresponds to varying pH, Alkalinity and Turbidity, at room temperature, which is used as a base to calculate the estimated change in cost. The values indicate that pH and alkalinity are within limit and turbidity value fluctuates with alum dosage variation .

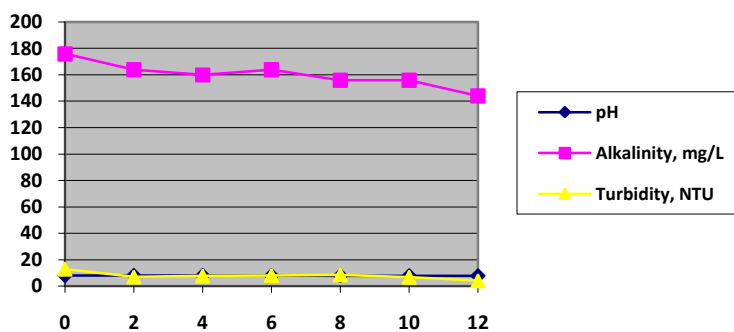


Figure 1: Optimum Dosage of Alum

We can clearly note that there is a link that exists between economy and water. Thus, the economy can be used as a tool to improve water management practices.

VI. CONCLUSIONS& RECOMMENDATIONS

- The present water supply at Mandya city is intermittent
- The cost of production per kiloliter of water is high when investments are included and in line with the State Board standards excluding investments
- The difference in valuation of drinking water can be seen & how they vary when two different techniques are adopted.
- The valuation done on drinking water are completely based on turbidity

In order to reduce the externalities following recommendations can be provided,

- Leak detection study has to be carried out for the water supply scheme to reduce unaccounted for water
- Use of Hydropower generation at Head works and at Booster pumping stations to avoid power breakdown
- Regular check and proper maintenance of the pumps' breakdown

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ISSN(Online) :2319-8753

ISSN (Print) : 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 4, Issue 10, October 2015

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