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COST EFFICIENCY ESTIMATION FOR THE SLIPPAGE OF WATER SUPPLY SERVICES FROM DEFLUORIDATION TECHNIQUE: A CASE STUDY OF GUJARAT

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Abstract: *Drinking water crisis in Gujarat is a major problem where the water is not suitable for drinking purpose. High fluoride, salinity and nitrate in drinking water can affect the health problem of human being in a long run. The technological solution to such problem needs to be sound and cost effective. The blind rush behind the technology is not only the solution. This paper has assessed such solution in terms of cost efficiency of a defluoridation plant. The paper shows that such technological solution fail if not properly maintained. It is better to have some alternative cost effective approach such as rain water harvesting.*

Keywords: Slippage of water supply, Defluoridation technique, Cost Efficiency

Introduction

As far as chemical quality of drinking water is concerned in Gujarat, the major problems are related to high fluoride, salinity and nitrate. WHO recommends the maximum permissible limit of fluoride in drinking water to be 1.0 mg/liter? While Government of Gujarat gives some relaxation to this limit and considers fluoride up to 1.5 mg/liter permissible in drinking water. As per the latest estimation made by the state government, the drinking water sources of 12 percent habitations is affected by high fluoride (more than 1.5 mg/liter), 7 percent of habitations affected by high salinity and 3.4 percent of habitations affected by high nitrate. Thus, the higher content of fluoride in drinking water is a major threat for drinking water issues in Gujarat. The problem is very acute in North Gujarat. The fluoride content in ground water remains as high as 25-35 mg/liter during the summer season in North Gujarat region. A generation of rural people has been drinking such water in this region. Gujarat water supply and sewerage board intervened in this region and established big Defluoridation plants in 16 villages of Mehsana district. The state government gave a contract to private agency to establish and run the plant for three years. Out of sixteen, fifteen plants became defunct after three years of contract. Only one plant located in Laxmanpura remained working for six more months. We selected the case of Laxmanpura as a representative case in slippage of water supply services from Defluoridation plants in 16 villages of Mehsana district.

The state water supply issues are studied by many experts in a regional context. Among them Usha Sharma's study includes randomly selected 29 RWSSs located all over the state (Sharma 1996), Haskoning's study includes the Netherland supported RWSSs in Banskantha, Mehsana, Amreli and Bhavnagar (Haskoning 1999), CEPT's study includes Lathi-Liliya RWSS in Amreli (Sharma and Soni 2003), DANIDA's study covers two RWSSs located in Banaksantha and Mehsana (DANIDA 1996), while the CAG Report (2001) refers to RWSSs in general in Gujarat. One major finding of this study is that the village level availability of water supply is not satisfactory. The studies show that (1) tail end villages are usually deprived of water supply, (2) for the other villages also the water supply is frequently irregular and unreliable, (3) the quantity of water supply is many times far from adequate (less than 10 lpcd some times), (4) the quality of water is not potable either because of the problems with

the source or because of contamination caused by leakages and breakages. Therefore, it is Important; to assess the cost efficiency of water supply services in the state.

Methodology and Study Area

The paper has used participatory rural appraisal to calculate the cost of slippage of water services. Participatory rural appraisal (PRA) is a methodology to enhance the researcher's understanding of the rural reality for the planning, development, evaluation and monitoring of projects. It facilitates the feeling of a greater degree of ownership and responsibility in the rural poor for better results and social acceptance of any programme. Around 100 households participated in the group discussion. In order to have response from poor women, focussed groups' discussion was also carried out separately. The study also reviewed the documents provided by Panchayat office. Laxmanpura is a village of about 210 households located in Kadi taluka of Mehsana district in North Gujarat. Village is quite developed in terms of amenities and facilities. It has all weather pakka roads with good frequency of bus services. It is hundred percent electrified and has one primary school. In fact the village had higher secondary school which is now closed due to less number of students. Most of the children go to Mehsana or Ahmedabad for higher education. As far as health facility is concerned, village has two private doctors running its clinic very successfully. The nearest primary health centre is three kilometer far located at Medha village. However, as doctors are available, people of this village never go to the government health centre.

Village is dominated by Patel community. A small number of households are also from Harijan, Suthar (Carpenter) and Thaker community. Although the main occupation is agriculture, about 55 percent of households have one or more persons working in service sector. Animal Husbandry is also very dominant occupation. Almost 90 percent households have secondary occupations as animal husbandry. The major crops are paddy, wheat and Juwar. Farmers take three crops in a year Paddy in Kharif season, Wheat in winter and Juwar (mainly used for green fodder) in summer. Both winter and summer crops are irrigated. The withdrawal of ground water is extremely high in this village. Extraction of ground water from the deep pores of the rocks for long periods makes the high risk of fluoride contamination in drinking water.

Drinking water status in the village

Coverage: All most all the houses in the village have individual tap connections. The Panchayat supplies water daily for three hours in the morning (during 5:30 am to 8:30 am) and one and half hours (3 pm to 4.30 pm) in the evening. The water supply is adequate in terms of quantity but not in terms of quality. Villagers know about the high fluoride in water supply but do not care much about it. This is mainly because the presence of fluoride in water does not reflect in the characteristics of water such as its colour, taste or visibility. Further, the effect of fluoride is visible only after long duration of intake of fluoride affected water. It is not that the people are not aware and educated, but their negligent mindset and attitude towards the health hazards seems to be the main reason for not demanding potable fluoride free drinking water. People are happy with whatever is available at present and as they think that the responsibility of providing water lies with the state government.

Sources of water supply

Bore well: A mainstay for water supply system

As the village has excessive fluoride in ground water, there have been other sources explored in order to provide safe drinking water. However, such sources did not remained successful and ultimately, the ground water has remained the main source of drinking water here. As a result, water comes from 700 feet depth and has high fluoride content. Since withdrawal of ground water for agriculture continues in the village, the water tables are going down by

almost 10 feet every year. For the last five years, the Panchayat bores go down by 10 feet a year to access water from deeper aquifers.

Village lakes

The village has two big lakes but those are not maintained well. This water is used for washing and cleaning only. These two big lakes, spread on about 13.94 ha of land were deepened under a scarcity programme. The water in the tanks can last for 8-10 months. But no efforts are made for local recharge. During the year of 2001, the youth association of the village tried to clean the lake in order to get pure drinking water. They cleaned the shallow well located in the lake and protected it from animals getting into it. As most of the villagers were tired of joints pain due to fluoride affected bore well water, they started fetching water from this shallow well. However this lasted only for one or two months. As women had to walk long distances for fetching water they stopped using it and started using bore well water again. As a result, the unused shallow well was not protected any longer.

Narmada Pipeline water

Recently in the end of 2008, village is getting water from Narmada pipeline scheme. The water supply is irregular and there is no fix time for the provision of water. Nonetheless, the important point to note here is that people of this village do not prefer to drink this water. Whenever, water from Narmada pipeline is provided, villagers fetch water from bore wells. This is because they think that water is dirty only if its visibility is not clear. Further, they do not like the taste of water. They also believe that the river water is not pure as it is open surface water system and collect much waste into it. As a result, they again prefer to drink fluoride affected water from their bore well.

Quality of drinking water supply

In spite of exploring various alternative sources of water supply, villagers are drinking fluoride affected water from the bore well. High concentration of fluoride poses a risk of dental fluorosis as well as skeletal fluorosis and Osteoporosis. The excess fluoride in water has affected people's health adversely, but not too much so far. Pain in bones and pain in the joints are experienced by many, but no serious health impact is felt so far, as the high fluoride content (3.2 ppm) is tolerated. It appears that it will be tolerated till serious impact is felt by people. The behaviour and attitude of village people towards preventive measures seems to be far from satisfactory.

Financial burden of drinking water supply

The Panchayat charges Rs. 100 per tap or per connection per year and an additional levy of Rs. 50 per tap. If one tap is used by more than one household, each one is charged separately. In addition, Rs 20 - Rs 40 are charged per animal per year. However, half the households have not paid water charges this year! The village Panchayat expects to earn Rs 76,045, which includes last year's unpaid charges, this year against the budgeted expenditure of Rs 57,000. However, if the charges are not paid, the Panchayat will find it difficult to manage. It will then depend on the GWSSB for support.

Table 1: Income Expected and Expenses on Water Supply in Lakshmanpura:

No.	Description	Income	Description	Expense
1	Usual charges	44,700	Maintenance	40,000
2	Specific Levy	17,415	Salary of Bore Operator	12,000
3	Water charges for animal	13,930	Stationary for Panchayat Office	5,000
	Total Income	76045		57,000

Source: Primary Survey

The bimonthly electricity bill of the village for water supply used to come about Rs 4500 during the year of 2003-04 which increased drastically to Rs. 29540 in the year of 2008. The bill is expected to be paid by the state government. The state government has not paid the bill since July 1998, and the total dues today is more than Rs 3 lakhs, which is to be paid to the GEB.

Analysis of Estimating the cost of Slippage for Defluoridation plant
The state government set up a defluoridation plant in the village under the quality improvement programmes. This plant had two big tanks of 30,000 liters each and a big sump with a capacity of 60,000 liters. The cost of the plant was Rs 6 lakhs.

Slippage of the plant services
The private company was given a contract for three years. They run the plant for three years very successfully and then it was handed over to village Panchayat, and now it is not working. The plant was established in 2002 and completely stopped working in 2006. The major reasons for slippage in the services of plant found during the survey are;

Centralized approach of supply driven Services
The centralized approach of the state government did not allow people's participation. This resulted in a slippage of water services from defluoridation plant. There was no demand of such plant because there was no awareness regarding the fluoride affected water in this region.

Negligence towards safe drinking water
This village is prosperous. Villagers also have good status of education. In spite of this fact, people are not much aware about the long term consequences of fluoride affected water. As fluoride being chemical impurities, is not visible in case of drinking water. Therefore, it is not considered very seriously until and unless it starts showing the visible symptoms of its effect. There is no demand from villagers for better water. Since villagers do not bother about the quality, the local ground water is distributed and people drink it.

Institutional failure
The Panchayat says that it cannot handle the big plant. A Pani Samiti of 11 persons including 3 women has been set up. There are plans to repair local pipelines, water plants etc. but not the defluoridation plant, as there is neither any pressure from the GWSSB nor a demand from people to restart the plant. GWSSB is not interested as it wants to supply Narmada water to the village. People are not demanding as they are not serious about the potential health hazards of fluoride affected water.

The defluoridation plant thus remained as a typical top down step, and villagers do not much care for it. They are happy with the local bores. If water tables go down further, they expect the state government to dig deeper bore / tube wells.

Impact of Slippage
As the plant stopped working, the people of this village are under the risk of fluorosis. However, all of them may not be affected by fluorosis because the severity of impact also depends on the metabolism and degree of immunity of a person. The village is quite prosperous and the diet of villagers is also very healthy. More than 90 percent of households have animal husbandry as second occupation; people consume lot of milk in their diet. This may be one of the reasons for not having any serious adverse impact of fluorosis. However, more than 80 percent of the village people are suffering from joints pain. The severity of joints pain is high among women. Villagers are aware that they are having pain due to fluoride in drinking water. Whenever, they experience joint pain, they visit private doctors. Doctors

prescribe them painkiller to overcome the joints pain. Doctors have never related fluoride affected water with joint pain and has never referred any patient for blood and urine tests to check the fluoride level in blood and urine to diagnose fluorosis. Most of the villagers have to take a strip of (10 tablets) painkiller once in three months.

Consequences and cost of slippage

As the impact of fluoride affected water has still not started its visible adverse impact, the long term consequences are not realized by local people. However, once it starts affecting the human body in a visible manner, it is not possible to cure the adverse impact of fluorosis. Villagers have started experiencing joint pain which is one of the symptoms of intake of excessive fluoride from water. As far as costing is concerned there are two different approaches through which one can measure the impact of slippage of water services through Defluoridation plant. These are reinvestment cost and welfare cost approaches. The welfare cost of fluorosis due to excessive fluoride in drinking water in the villages of North Gujarat is estimated by Tusahr shah and Rajnarayan Indu. Their estimation included the cost for treatment of fluorosis as well as cost of productivity loss. The average welfare cost per person per year was Rs. 5567 during 2003. However, in this village, an only symptom of adverse effects is joint pain. Therefore, the full impact could not be captured in calculating the costing of slippage. However, we tried to calculate the welfare costs of the slippage as follows;

Cost of treatment

The average expense per person per year for treatment of joint pain is calculated as; Frequency of visiting the doctor * treatment cost including the cost of medicine = 6 * Rs. 70 = Rs. 480. This is because people have to visit the doctor every two months for the treatment of joint pain and doctor charges Rs. 70 per visit and provides painkiller to the patient. If we assume that joint pain is experienced by even one person of the households in a year, the cost would be Rs.480.

The productivity loss

The wage rate in this village is Rs. 60 per day which is very low. Villagers informed that they have to take two days course of pain killer whenever they visit the doctor. The person suffering from join pain cannot work at least for two days in every two months. So the productivity loss for the person is Rs 60 * 6 *2 = Rs. 720. Where, person goes to the doctor 6 times in a year and cannot work for two days due to severe joints pain. We did not calculate the productivity loss of accompanying person because the joint pain is treated within the village and does not require accompanying person for help. The welfare cost due to the primary treatment for drinking fluoride affected water is Rs. 1200 per person per year. Further, our estimation of welfare cost is quite less than that estimated by Tushar Shah (Shah T. 1997). This is because they have selected the villages where the symptoms of fluorosis are quite visible and have to be treated in big hospital. Pain in Joints is experienced only by adults and not by children of the village. If we consider one adult from each households suffering from the joint pain, than the cost for the treatment of joint pain is Rs. 2400 per household per year. There are 210 households in the village. So the Welfare cost of the system is about Rs. 5, 04,000 per year in the village. This amount is just Rs. 1 lakh less than the capital cost of Deflouridation plant.

Conclusion

The top down approach of the government, – defluoridation in this case study– does not work. People's participation is inevitable for efficient working of any scheme. People tend to neglect local potable sources the moment they get outside sources. There is no incentive to promote local sources when outside sources enter the village. There is an urgent need to generate awareness among people about quality of water supply, sanitation and hygiene. The present awareness is not enough to ensure good health of people. People expect free water supply

from the government. Villagers do not pay the charges, even when they are very low. The cost of slippage in water supply is huge even in case of treatment for mild symptoms. The actual costing can be too high in future. Therefore, there is an urgent need to take immediate steps for providing safe and fluoride free drinking water. It is therefore an urgent need to adopt an alternative ways of water harvesting structures such as rain roof water harvesting structures or recharging shallow water aquifers which are not technologically demanded and costly.

References

1. CAG Report (2000 and 2001) Comptroller and Auditor General Report 2002, Government of India
2. DANIDA (1996) Community Participation in Rural Drinking Water and Sanitation Projects, A Comparative Study of Five Projects in India, RWS & Sanitation Group, SA, UNDP-WB & IIM-A
3. Government of India (1988) National Technology Mission on Drinking Water, Department of Rural Development, New Delhi
4. Government of India (1994) Report of the Expert Committee on Rural Water Supply Programme (with Special Reference to the Mini-Missions and Sub-Missions), Ministry of Rural Development, New Delhi
5. Haskoning (1999) *Netherlands Support to the Water Sector in India: Impacts on Institutional and Development and Change*, Haskoning, Netherlands
6. Hirway Indira and Lodhia Shital (2004) Assessment of the Status of Drinking Water and Sanitation in Gujarat, a paper prepared for Western Region Consultation, WATSAN programme conducted by Pravah
7. Hirway Indira and Lodhia Shital (2004) Status of Drinking Water in Gujarat: Towards a Sustainable Approach", A paper prepared for the state Government, which was funded by World Health Organization (WHO).
8. Hirway Indira and Lodhia Shital (2007) Status of Drinking Water in Coastal Region in India: A Case for Area Specific Approach ; a paper published in a proceeding of conference entitled Crisis in Drinking Water in Coastal Regions in India: Need for an Area Approach, 2007
9. Hirway Indira, Shital Shukla et all. (2009) Slippage in Water and Sanitation Services in Gujarat, a paper prepared for IRC, Netherlands, 2009
10. Lodhia Shital (2009) Managing urban water disasters in Gujarat: Risk Assessment and risk Reduction
11. Lodhia Shital (2009) Quality of drinking water in India: Highly neglected at Policy Level, paper in Anvesak, Vol.39. No.2 December 2009 published by Sardar Patel Institute of Economic and Social Research, Ahmedabad.
12. Shah, Tushaar (1997) *Concept Paper on India Water Sector Initiatives*, Water Sector Strategy: Draft Concept Paper, UNDP India
13. Sharma, U.S. (1996) *Some Aspects of Drinking Water Supply in Rural Gujarat (Adequacy and Operation – Maintenance)*, Proceedings of National Seminar On Rural Water Supply Sanitation, Organized by Centre For Development Studies, Thiruvananthapuram
14. Sharma, Utpal and Yashwant Soni (2003) *Effectiveness of Regional Rural Water Supply Scheme,* paper presented at the workshop on Policy Alternatives for Rural Water Supply in Gujarat: Issues for Research, Gujarat Institute of Development Research, Ahmedabad
15. WHO/UNICEF (2000) Joint Monitoring Programme for Water Supply and Sanitation, Global water and sanitation assessment 2000 report., World Health Organization, Geneva