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Water supply in low water table areas

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OVER THE PAST decades, Bangladesh has achieved commendable success in the provision of safe drinking water supply, primarily through extensive use of shallow hand tubewells. Shallow tubewells are easily sunk and use the well-known No. 6 handpump. Virtually all wells in urban slums and fringe areas are of this type. In rural areas about 87 per cent of public and 94 per cent of private tubewells are shallow tubewells (Rashid et al., 1994). They are relatively inexpensive to install and maintain, but can lift water from only about 7 metres below ground level. Indiscriminate withdrawal of groundwater for irrigation over the past decades is causing a progressive depletion of groundwater table. Lowering of ground water table is rendering many suction handpumps inoperable especially during the peak dry spell of March-May. Despite the growing problem of groundwater overdrafts during the dry season when farming needs irrigation, there is as yet no legal instrument to control extraction rates in the country and as a result, low water table areas continue to increase.

To sustain the pure drinking water supply in the rural areas of low groundwater table, particularly during the dry months, the Tara handpump (extractable and non-extractable models) was introduced in 1986. Tara handpumps can withdraw water from a depth of up to 15-metres. As of December 1995, about 84,000 Tara handpumps are in operation in Bangladesh which were installed primarily by DPHE (Department of Public Health Engineering) with the assistance from UNICEF. If the current trend of the lowering of groundwater table continues, an estimated 1.2 million suction handpumps may require to be replaced by direct action Tara handpumps by the year 2000 according to predictions by UNDP (1991).

Similar to No. 6 handpumps, the Tara handpump is also simple but people are not yet well acquainted with the technology (Rashid et al., 1994). The skill to operate and maintain Tara handpumps is limited to a few well trained caretakers or DPHE tubewell mechanics who also provide the spare parts. In recent years, concerns have been expressed over the possible unsatisfactory performance of Tara handpumps which are the primary source of drinking water in low water table areas. The overall objective of the present study was to assess the performance of Tara handpumps. The specific objectives were: (i) to evaluate the performance of Tara handpumps with respect their age, installation location e.g., urban and rural, and hydrogeological conditions e.g., low water table (LWT) and seasonally low water table (SLWT) areas; (ii) to identify strengths and weaknesses of the concerned institutions and assess their potentials to improve services; and (iii) to assess the potentials for promotion of the Tara handpumps with respect to technical acceptability and socio-economic issues related to installation and O&M. The study is based on a survey of 5717 Tara handpumps throughout the country. These pumps were selected on the basis of administrative division and geographic regions of the country.

Performance of Tara handpumps

In this study, performance of 5717 Tara handpumps was evaluated based on their working conditions in terms of a number of variables, e.g., age of pumps; installation locations e.g., urban and rural, hydrogeological conditions e.g., LWT, SLWT and SWT areas; and extractable and non-extractable models. It should be noted that extractable refers to the model of 75 mm Tara handpumps which could be fully extracted and re-installed after repairing and non-extractable refers to the model of 51 mm Tara handpumps whose pump rod assembly can only be extracted and re-installed. Of the two models, non-extractable model costs less (the cost difference between the two models is about Tk. 3,000 or US$67) and has been extensively used. About 97 per cent of Tara handpumps surveyed in the present study are of non-extractable type.

The Tara pumps surveyed in the study were categorised into three groups based on age: (i) Group I: 1 to 3 years old; (ii) Group II: 4 to 6 years old; and (iii) Group III: 7 to 10 years old. Table 1 summarises the performance of Tara pumps for these three groups. Table 1 shows that the percentages of working Tara handpumps are 93 per cent, 79 per cent, and 70 per cent for Groups I, II, and III, respectively. Thus although there is an obvious decline in the number of functioning handpumps with age, the overall performance is quite satisfactory. A comparison between the extractable and non-extractable models revealed that the performance of both types are similar for Group I; however, the performance of non-extractable type is significantly better for Groups II and III, which indicates that the working condition of the extractable types deteriorates more rapidly with time.

Table 2 summarises the performance of urban and rural Tara handpumps. It shows that with respect to performance, urban Tara handpumps are performing marginally better (88 per cent working) than the rural ones (85 per cent working). Better access to spare parts and relatively better socio-economic conditions leading to higher degree of motivation and less problem in cost sharing (for installa-

tion and O&M) may be responsible for the better performance of the urban pumps.

The performance of the Tara handpumps in low water table (LWT) areas and seasonally low water table (SLWT) areas are similar as shown in Table 3. In LWT areas 82 per cent of Tara pumps are in working condition while in SLWT areas 86 per cent are working. In the present study, repair and maintenance status of Tara handpumps were also analysed and it was revealed that most of the repair and maintenance works are done by the users themselves. It was found out that about 60 per cent of the pumps are repaired by the users themselves; spare parts supplied by the DPHE serves about 42 per cent of the pumps, while for the rest the spare parts are supplied by the users themselves. With respect to major spare parts, it was revealed that the top and bottom connectors and guide bush are required to be replaced for large number of pumps as they get older (9-10 years). According to users opinion, the price of the top and bottom connectors are high and the users find it difficult to replace these parts leaving the pumps in non-working condition for long time. Among other spare parts, cupseal, flap valve and O-rings were found to have the highest breakdown rate and need frequent replacement.

Institutional and social issues

Currently, the Department of Public Health Engineering (DPHE) of Bangladesh Government with assistance from UNICEF and UNDP/World Bank, is responsible for installation of Tara handpump in low water table areas. DPHE's involvement includes procurement of handpumps from the manufacturers and distributing them through its district and thana level offices along with installation of pumps through contractors and providing sale of spare parts. In addition, DPHE provides training to its mechanics and the caretaker families of Tara handpumps.

In the present DPHE system, one Tara handpump is allocated to ten families and is installed at the premises of one of these ten families who becomes the caretaker family and is made responsible for proper functioning of that pump. Representatives from each of these ten families constitute the "user committee" which is trained by the DPHE officials immediately after installation and is given the responsibility for proper maintenance and repair. It is worth noting that although the caretaker family is selected by the user group, yet the locally influential and affluent people allowing their land for installation of the pumps become the caretakers and major financial contributions are borne by them.

The system works as long as the pump remains operational or requires minor repair without major cost involvement e.g., replacement of small spare parts like cupseal, flap valve and O-ring. Such minor repair works are often taken care of by the caretakers. However, in case of major breakdown (e.g., those involving top and bottom connectors, T-handle, Grapple, Foot Valve and Guide bush), the pump is not promptly repaired because no one wants to share responsibility. The common feeling among the users is that the Tara handpump actually belongs to the caretaker family where it is installed and the responsibility for major repair, therefore, also lies with the caretaker family. An obvious reason for such feeling is the relatively high cost of major spare parts. It should be mentioned that while the total cost of installation of the Tara handpump ranges from Tk. 14,000 to Tk. 16,000, users' contribution is only Tk. 1,000 that is, Tk. 100 per user family. On the other hand, the survey revealed that the repair and maintenance cost of one Tara handpump is estimated to be of the order of Tk. 200 t0 250 per year, meaning that one user family would require to spend Tk. 20 to 25 each year for maintenance. This seems high compared to what they contribute initially for a new Tara handpump discouraging them to do major repairs. A survey (DPHE-UNICEF-DANIDA, 1986) on rural handpump tubewells revealed that about 61 per cent of caretakers had borne the total contribution themselves, and 64 per cent of user households had contributed nothing towards allocation of a tubewell. In many cases a similar situation prevails for Tara handpump as well.

The survey results suggest that change is needed to make selection of the caretaker more appropriate. Another area that needs immediate attention is the financial contribution toward allocation of a Tara handpump. Financial contribution has an obvious influence on perception of ownership and access. As already mentioned, in many cases, the affluent pays the major contribution and the rest of the users lack the feeling of ownership of the tubewell. Consequently, they do not show their interest during a major breakdown or are unwilling to share costs of major spare parts. It is therefore essential that a mechanism be devised so that every user family actually shares the contribution and thus effectively participate in the operation and maintenance of the Tara handpump.

User-participation is extremely important firstly, because it is necessary in order that local people can assume the responsibility for the system that are installed , including repair and maintenance and secondly, hygiene education is closely linked to user community participation. More user families should eventually be trained with major focus on O&M, knowledge of spare parts, their availability, cost sharing and fund management. Women's participation is vital in the promotion of Tara handpump technology. Although women are seen as the main users of Tara handpumps, the study found that in the users committee the participation of women is very low. To ensure the participation of women, the allocation procedure should be supported by them which will enhance their responsibility in the operation and maintenance of the Tara handpumps. It should be noted that the DANIDA-UNDP/World Bank assisted "Handpump Training and Monitoring Project (HTMP)" which was implemented by the DPHE emphasised the participation of women in the O&M of Tara pumps (UNDP/World Bank, 1996) and HTMP's two day long caretaker training ensured 50 per cent female participation.

As indicated earlier, DPHE is playing the main role in the provision of water supply in LWT area using Tara handpump technology. Private sector participation is limited to manufacturing the Tara handpumps and spare parts which are again channelled primarily through DPHE. Participation of other institutions particularly NGOs is not significant as it is in case of No. 6 handpumps. The main reasons are firstly, the technology itself is not easily understood by the NGO workers and secondly, the cost of installation as well as O&M of Tara handpumps is high compared to No. 6 handpumps. It might prove useful to involve more NGOs in LWT areas with Tara technology instead of just having a single channel delivery of services.

Smooth O&M of Tara handpumps mainly depends on availability of quality spare parts. For No. 6 handpumps, spare parts are available in markets of villages where the users have a choice to make. For Tara handpumps however, such a system has not yet been in place and the spare parts need to be purchased primarily from DPHE stores at thana or district level offices. It was observed that many existing Tara handpumps remain inoperative for days together due to lack of even minor spare parts like flap valves, cupseals, O-ring, etc. Buying minor spare parts from the district or thana level stores is troublesome and costly as the travel and other incidental expenses become higher than the price of the spare part itself. It is therefore clear that bringing the spare part outlets within the reach of the users is the key to smooth functioning of the Tara handpumps. This can be done through building linkages between manufacturers, wholesalers, retailers and consumers and providing information on spare parts consumption pattern and demand.

Technical issues

Compared to the No. 6 handpump, which is the key to the successful water supply programme in the country, the Tara pump technology, though simple, is relatively new and less familiar. The No. 6 handpump is simple, low cost, its technology is known and widely accepted to people, and its operation and maintenance are easily handled by the users themselves. On the other hand people are not yet fully acquainted with the Tara handpump technology. There are certain areas which need attention for further improvement of the technology.

The ease of direct action Tara handpumps depend on the buoyancy of the hollow pump rods. It was revealed that the pump rod of Tara handpumps often get filled with water and as a result these direct action pumps become quite heavy to operate and this becomes unacceptable to the users. The reasons of such leakage of pump rods are attributed to either improper installation or improper withdrawal of the rod during repair. To overcome this problem, it is suggested that the 17 m long pump rod be replaced by three or four shorter pieces threaded together to avoid cracks during withdrawal for repair and maintenance.

There is a general belief that the direct action Tara handpumps are hard to operate and that a lever action system like the No. 6 handpumps would be preferable. However, in this study, users opinion regarding conversion from direct pumping to lever pumping system was found to be diverse (BETS-UNICEF, 1997). The ease and comfort of direct pumping, as already mentioned, depends on the buoyancy effect of the pump rod. If this buoyancy effect can be maintained by preventing water leakage into the pump rod it can be concluded that people who faces acute shortage of water would be content with the existing direct action Tara handpumps. In addition, Corrosion of underground mild steel component of Tara handpumps need attention and alternative materials should be investigated to overcome such problem.

Conclusions

Tara handpumps are playing a vital role in providing safe drinking water supply in low water table areas and with the gradual expansion of low water table areas, the performance of Tara handpumps is likely to be crucial for ensuring safe water supply in these areas. The present study reveals that so far the performance of Tara handpumps is reasonably good. Over 90 per cent of Tara handpumps of 1 to 3 years of age are in operating condition, while about 70 per cent of the pumps are in working condition are in working condition even after 7 to 10 years of installation. However, the study reveals that service delivery mechanism, institutional aspects, and attitude of users are important aspects for successful implementation water supply program in low water table areas of Bangladesh. Effective user participation in cost sharing and O&M shall have significant impact on the performance because this would mean enhanced working duration of Tara handpumps. Women are the major users of Tara handpumps and hence they should have greater role in decision making. Through increased participation in caretakers training, women can play a vital role in proper O&M of Tara handpumps. Easy access to spare parts outlet and quality spare parts are essential for smooth operation of Tara handpumps. Private entrepreneurs should be encouraged in providing quality spare parts at affordable cost. This would lead to easy access to quality spare parts outlets resulting in improved O&M of Tara handpumps.

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Table 1. Performance of Tara handpumps according to age group

Age Group	Total No.	Working No.	% Working
1 – 3 Yrs	2859	2666	93
4 – 6 Yrs	2102	1656	79
7 – 10 Yrs	717	502	70

Table 2. Performance of urban and rural Tara handpumps

Area	Total No.	Working No.	% Working
Urban	1272	1113	88
Rural	4445	3784	85
Total	5717	4897	86

Table 3. Performance of Tara handpumps in LWT and SLWT areas

Area	Total No.	Working No.	% Working
LWT	1360	1112	82
SLWT	3181	2721	86