

Willingness to Pay for Water Supply Services in the Southwest Coastal Region of Bangladesh: Comparison of Pond Sand Filters and Reverse Osmosis Water Purification Systems

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Abstract

This study's dual purposes were to investigate residents' willingness to pay for the maintenance and management of water supply facilities and access to drinking water and to identify water supply facilities capable of providing a sustainable drinking water supply in the southwest coastal region of Bangladesh. The study adopts unstructured and semi-structured interviews and participant observations in a settlement of Shyamnagar Upazila where drinking water is a serious issue due to salinisation of groundwater and surface water. Residents in this rural region have difficulty collectively maintaining and managing water supply facilities and that they select drinking water sources based on multiple criteria. The study argues that the 'tragedy of the commons' has not been overcome for drinking water in that region. Although residents are willing to pay for drinking water, to stimulate this behaviour, household-level water supply services maintaining good water quality and reducing the labour of collecting water should be implemented. The study's scope does not include the poverty issue, and because the recommendation above requires payment by household, such a water supply might become a significant financial burden. Future studies should assess the feasibility of rolling out household-level water supply systems in the study region.

Keywords: Commons, Drinking water, Sustainability

1. Introduction

Essential for human survival, water is an extremely important resource, and drinking water that humans consume directly is vital to sustain life. Despite many years of international effort, however universal access to safe drinking water has not yet been achieved. Under the Sustainable Development Goals (SDGs), Target 6.1 of Goal 6 sets forth the objective of 'achieving universal and equitable access to safe and affordable drinking water for all by 2030'. As of 2024, however, 2.2 billion people still lack access to 'safely managed drinking water' (United Nations, 2025).

The southwest coastal region of Bangladesh, this research study's site, faces serious drinking water problems caused by groundwater and surface water's salinisation (Khan et al., 2011; Khanom & Salehin, 2012; Rahman & Bhattacharya, 2014). Consequently, there are concerns about

adverse effects on human health resulting from excessive salt intake derived from drinking water in that region (Khan et al., 2011; Khanom & Salehin, 2012), and the Bangladeshi government has designated the country's coastal areas as 'hard-to-reach' for drinking water supplies (Local Government Division, 2011). Mahmuduzzaman et al. (2014) classifies causes of salt damage into natural, socioeconomic and political factors. Among these, cyclones' frequent occurrence along the southwest coast of Bangladesh (Alam et al., 2003) and saline water's penetration into groundwater due to the shrimp aquaculture industry (Haque et al., 2010) are particularly significant factors.

Therefore, from 2005 onwards, the Bangladeshi government began considering specific measures to address drinking water problems caused by salinisation¹. First was 'Coastal Zone Policy' (Ministry of Water Resources, 2005) and then 'National Adaptation Programme of Action (NAPA)', which explicitly states that drinking water supply projects worth 150 million USD are to be implemented under the leadership of the Department of Public Health Engineering (DPHE) (Ministry of Environment and Forests, 2005). Moreover, 'Coastal Development Strategy', formulated in 2006, sets forth drinking water projects for the ten coastal districts (Ministry of Water Resources, 2006). 'The Bangladesh Climate Change Strategic and Action Plan', revised in 2009, incorporates in its programme plans and investments additional water supply in areas vulnerable to effects of climate change, including coastal regions (Ministry of Environment and Forests, 2009). 'Bangladesh Delta Plan 2100: Bangladesh in the 21st Century', the government's long-term plan to address the challenges of climate change and natural disasters, also identifies achieving a balance between water supply and demand as a key strategy for coastal areas' sustainable growth (General Economics Division, 2018). In 'National Strategy for Water Supply and Sanitation: Revised and Updated Edition 2021', the current operational level strategy for achieving SDG 6 by 2030, that is, promotion of climate-resilient technologies, is specifically identified (Local Government Division, 2021).

Such policy documents also specify installation of water supply facilities to combat salinity. These include pond sand filters (PSFs) that utilise a slow sand filtration system (Ministry of Water Resources, 2005, 2006), rainwater harvesting (Local Government Division, 2021; Ministry of Environment and Forests, 2005; Ministry of Water Resources, 2005, 2006) and reverse osmosis (RO) units for purifying groundwater (Local Government Division, 2021). Furthermore, in response to such policy documents, not only the Bangladeshi government but also government agencies from other countries, international aid organisations, nongovernmental organisations (NGOs) and private individuals are installing PSFs, rainwater harvesting and RO units to resolve the country's drinking water crisis.

Previous studies have analysed users' attitudes towards water supply facilities and their willingness to pay maintenance and management costs. For example, 'Guidelines for Drinking Water Quality: Fourth Edition Incorporating the First and Second Addenda', which sets out the World Health Organisation's global standards for safe drinking water, indicates that even if a drinking water source or supply facility is capable of providing safe drinking water from a scientific perspective, users may still doubt its safety if acceptability factors like appearance, odour

and taste, are not considered (World Health Organisation, 2022). Sobsey (2006) also notes that water resources are linked to such cultural and social factors as people and communities' values, practices and perceptions. Moreover, Wilderer (2005) argues that drinking water supply technologies from developed countries are difficult to introduce to developing countries for economic and environmental reasons, so drinking water supply methods suited to target regions must be devised. Furthermore, planning and implementation of projects driven by demand rather than supply are crucial to resolving drinking water issues (Montgomery & Elimelech, 2007).

To examine how rural residents perceive water supply facilities, studies have been conducted in Bangladesh. For example, in areas with severe drinking water shortages, residents want rainwater harvesting, but in areas with moderate drinking water shortages, they prefer a piped water supply (Abedin et al., 2014). Another study clearly demonstrates strong preference for piped water supplies in both arsenic-contaminated and uncontaminated groundwater areas; it also indicates that more than 10% of construction costs could be collected (World Bank, 2022). Research conducted in Khulna, a city in southwestern Bangladesh, estimates that residents are willing to pay an additional 0.67% of their monthly income for improved drinking water services (Ahsan et al., 2021). In rural coastal areas, approximately 85% of residents have indicated willingness to pay 263 Bangladeshi taka (BDT)² per month for a disaster-resilient, safe drinking water supply system. Indeed, households with poorer access to water are more willing to pay (Islam et al., 2019). Furthermore, Hoque and Hope (2020) suggest that water's affordability should be assessed by available water's safety and reliability, by seasonal variations and by how people combine and utilise different water sources. Additionally, a sustainable drinking water supply in Bangladesh requires government agencies' support rather than sole reliance on residents to maintain and manage water supply facilities (Hasan et al., 2020).

However, previous studies have not focused on mechanisms that give rise to willingness to pay. Specifically, they have not examined which water supply facilities or methods of providing drinking water for which residents would be willing to pay maintenance fees or purchase the water itself. In other words, which water supply methods would sustain a supply of drinking water while also considering local characteristics. Consequently, this study aims to provide important insights by investigating local residents' willingness to pay for the management and maintenance of water supply facilities and for access to water in the southwest coastal region of Bangladesh, whilst focusing on the discrepancy between stated willingness to pay and observed or actual payment behaviour. Furthermore, the study aims to identify water supply facilities capable of ensuring a sustainable supply of drinking water in the region. Furthermore, the study partly clarifies that Ostrom's (2015) assertion that local communities can achieve sustainable management by establishing their own rules has not been realised for drinking water supply in rural Bangladesh and that the 'tragedy of the commons' (Hardin, 1968) has not been overcome. Thus, this research provides a significant case study for the debate on the theory of the commons.

2. Methods

As a case study, this research compares PSFs, the primary water supply facility in the southwest coastal region of Bangladesh (Rahman et al., 2017), with RO units, which have increased in number in recent years (Hope et al., 2021). As these two water supply facilities differ not only in technical terms but also in terms of ownership, operational structures including the method of payment for maintenance costs, and the methods of service provision, it is worthwhile to conduct a comparison. The study site is a village settlement in Munshiganj Union, Shyamnagar Upazila, Satkhira District (Figure 1). In Munshigoanj Union, Cyclone Aila exacerbated salinity damage in 2009, and no tubewells were used as drinking water sources in the surveyed settlement. Residents attributed this to the groundwater's high salinity, rendering it unsuitable for drinking. Consequently, as in neighbouring rural areas, rainwater and ponds were traditionally used as drinking water sources. Moreover, as explained below, an NGO installed a PSF in 2003, but because it became non-operational in 2021, RO units operated by NGOs or private individuals have come to be used as drinking water sources.

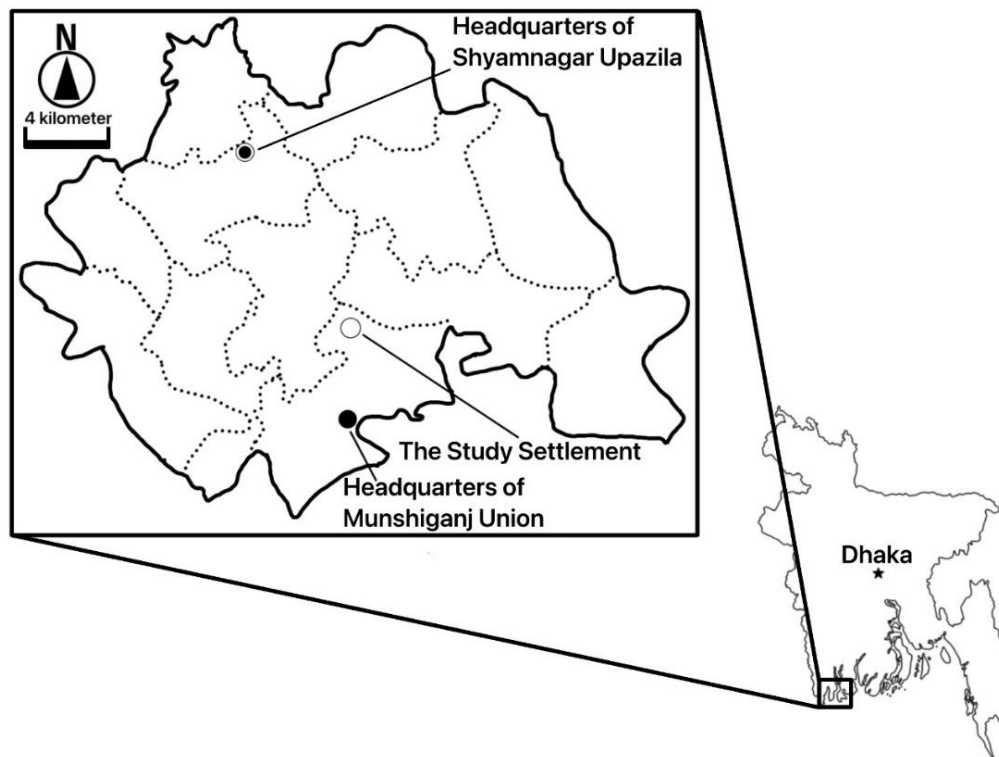


Figure 1. Map of the Study Site

Source: The author compiled the map with the help of the Local Government Engineering Department (2016).

As of March 2023, 47 households (252 people) occupied the surveyed settlement. Of these, 39 households (210 people) were Muslim and 8 (42 people) were Hindu. Although residents' main livelihood was agriculture as in neighbouring rural areas, only two households engaged solely in

agriculture; residents commonly combine farming with work in commerce, the service sector or day labour. In rural Bangladesh, as van Schendel (1981) indicates, residents typically derive their income from both agricultural and non-agricultural sources. Consequently, the surveyed settlement's livelihood situation can be considered typical of a rural community, rendering it suitable as a case study.

The study mainly utilises and analyses data from field surveys that the author has been intermittently conducting in the study settlement since 2017; specifically, this study utilises data from comprehensive surveys conducted during February–March and August–September 2023. During the fieldwork, unstructured and semi-structured interviews and participant observation were conducted in Bengali with the help of an English–Bengali interpreter. Data were collected on drinking water sources used by villagers during the rainy and dry seasons and the costs incurred. As mentioned, the surveyed settlement had 47 households, two of which had moved to the settlement after 2020 (Muslim households; 12 people). Because the study examines residents' changes in water resource use, including these two households in the analysis would have been inappropriate. Therefore, of the settlement's 47 households (252 people), 45 (240) were included for analysis.

3. Results and Discussions

3.1. Installation and Maintenance of Pond Sand Filter in the Study Settlement

In the southwest coastal region of Bangladesh, people rely on multiple water sources to secure drinking water (Hoque & Hope, 2020), and traditionally, rainwater has been a source of drinking water during the rainy season, with pond water used during the dry season (Kränzlin, 2000). However, pond water, often contaminated with bacteria and other microorganisms, is unsuitable for drinking (World Health Organisation, 2004). Consequently, PSFs have been installed by government agencies, international aid organisations and NGOs, thus becoming the area's main source of drinking water (Rahman et al., 2017). As mentioned, above, the government of Bangladesh has also promoted PSF installation through various policies to address drinking water issues (Ministry of Water Resources, 2005, 2006).

In the surveyed settlement, villagers had traditionally used two ponds as sources of drinking water, and in 2003, a Bangladeshi NGO installed a PSF at one pond. Afterwards, all study households except three (approximately 93.3%) used the PSF for drinking water during the dry season, while continuing to use rainwater during the rainy season. Of the three households not using the PSF at that time, one had moved into the settlement in 2015 following PSF installation and was using the RO unit (described below) for water quality reasons. The other two households still obtained their drinking water directly from the pond, the PSF source, even after the PSF had been installed.

To operate and maintain the PSF, the NGO established a management committee at the time of installation. The committee was to ensure the PSF's sustainable operation by collecting maintenance fees from users and implementing PSF cleaning operations. Approximately six people, including the owner of the pond supplying water to the PSF, were selected as committee

members. However, due to busy lives and earning their livelihoods, they were not actively involved in committee activities, so the management committee was eventually dissolved. Following that, a small group of residents who used the PSF took it upon themselves to conduct maintenance work.

Consequently, residents conducted simple tasks, for instance, cleaning the PSF's septic tanks, which are filled with sand and gravel, and picking up rubbish around the PSF. Although cleaning occurred approximately three times a year, there was no fixed schedule; residents reported cleaning when the post-filtration water flow became sluggish. Although costs associated with clean-up operations were collected from users, the amount was not fixed. Interviews with PSF users revealed that ten households, including that of the pond owner, had not paid maintenance fees (Figure 2). Of these, five households provided labour instead of money during maintenance activities. However, the remaining five households, including the pond owner, had neither participated in maintenance activities nor paid maintenance fees. The amounts paid by contributing households were as follows: 10 BDT for seven households; 20 BDT for six; 30 BDT for one; 40 BDT for one; 50 BDT for two; 100 BDT for eight; 150 BDT for one; 200 BDT for five; 250 BDT for one. Clearly then, the collection rate was approximately 76.2%. Furthermore, the household paying the highest annual amount was 750 BDT, whereas all the households' average annual payment was approximately 182.9 BDT. Individual households obviously paid significantly different amounts.

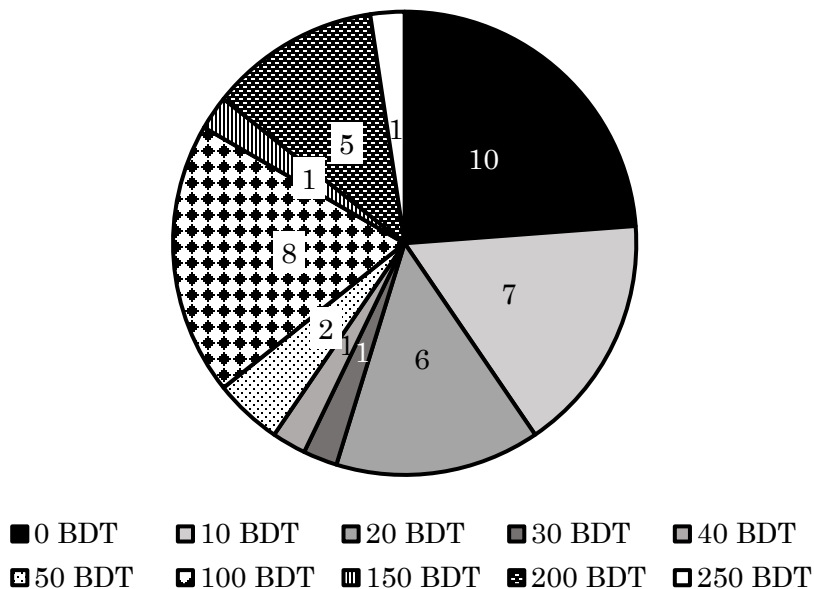


Figure 2. Maintenance Costs' Payment Status by Households Using the Pond Sand Filter in the Surveyed Settlement

Source: Fieldwork data

3.2. Operational Inactivity of the Pond Sand Filter and the Use of Reverse Osmosis Units for Groundwater Treatment in the Study Settlement

In the surveyed settlement, the PSF had been non-operational since 2021; the pond owner had prohibited residents' use because, while they had planned to re-excavate the pond due to falling water levels, PSF users had refused to pay those associated costs. Moniruzzaman, Rahman & Hossain (2012) have also noted that households allowing use of their ponds hold significant power over water facilities' operations. Notably, PSF users reported complaints from the pond owner and his family regarding users' bathing and washing dishes in the pond while the PSF was in operation, indicating one reason for reluctance to provide funding for the pond's re-excavation. Additionally, the pond owner had purchased two 2,000-litre plastic rainwater harvesting tanks, one in 2019 and the other in 2020, so that the family's annual supply of drinking water could come solely from rainwater.

Of the surveyed households, 39 (approximately 87%) were purchasing drinking water from RO units established by NGOs or private individuals in neighbouring villages at the time of the survey, while the PSF, their source of drinking water during the dry season, was out of operation. Of these, five households had been using an RO unit installed by an NGO approximately 1.8 km from the surveyed settlement since 2014, when the PSF was still in operation. The remaining 34 households had begun using RO units after the settlement's PSF became inoperative. Two of these households obtained their entire annual supply of drinking water from RO units alone.

The first RO unit, installed by an NGO, in the study's vicinity was approximately 1.8 km from the settlement, and its operation was entrusted to a private individual in 2014, following Cyclone Aila's devastation in 2009. In the surveyed settlement's surrounding area, there were three RO units including the one just mentioned and a further three near the council of Munshiganj Union, approximately 5 km from the surveyed settlement, whose residents relied primarily on these six RO units to secure drinking water.

Significantly, RO systems' installation has risen in Bangladesh in recent years (Hope et al., 2021), and many used by the surveyed residents provided delivery service, often using local vehicles called vans to supply drinking water for purchasing households. When delivering water, the van driver would visit households other than those of purchasers to increase the number of customers. Drinking water purchased via this delivery service cost 1 BDT per litre, but if people collected drinking water from the RO unit themselves, the cost fell by about 50%.

Although RO water's price varied depending on the method of sale, all households using RO units were paying for drinking water without any issues. As Figure 3 shows, while annual expenditure on water varied depending on purchases' frequency and volume, only three households each were in the less than 1,000 BDT and more than 6,000 BDT categories. Furthermore, seven households were each in the ranges $1,000 \text{ BDT} < x \leq 2,000 \text{ BDT}$, $2,000 \text{ BDT} < x \leq 3,000 \text{ BDT}$ and $3,000 \text{ BDT} < x \leq 4,000 \text{ BDT}$. The range $4,000 \text{ BDT} < x \leq 5,000 \text{ BDT}$ was the most common, with 12 households. Among surveyed households using RO units, the household with the highest expenditure spent 6,760 BDT annually, and the average annual expenditure was approximately 3,173 BDT. Finally, the average annual income of surveyed

households using RO units was 238,319 BDT, so, on average, they spent approximately 5.3% of their annual income on drinking water. As the World Bank (2005) states that expenditure on water supply among the poorest household accounts for between 1% to 3% of their income, it can be considered that the proportion of income spent on water supply in the surveyed settlement is relatively high; this suggests that even among the poor, there may be a willingness to pay for drinking water.

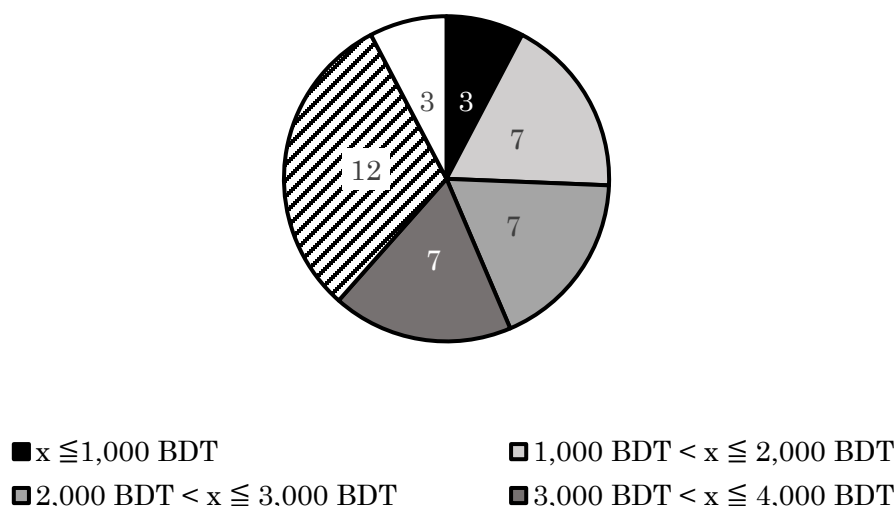


Figure 3. Households' Annual Expenditure on Drinking Water from Reverse Osmosis Units
Source: Fieldwork data

3.3. Willingness to Pay for Drinking Water Among Villagers in the Southwest Coastal Region of Bangladesh

Clearly, many residents bear financial costs for both PSF maintenance and drinking water purchases from the RO system. Water supply facilities in Bangladesh face problems such as a lack of funding for regular maintenance, a lack of cooperation from users, and inadequate management systems; in the worst cases, they may be neglected or cease to function (Moniruzzaman et al., 2012). However, in the villages surveyed, such a situation was likely avoided because the single PSF provided the entire drinking water during the dry season, and consequently most residents paid the appropriate maintenance fees. While a PSF is designed to serve a minimum of 40 households (200–250 people) (Ministry of Local Government, Rural Development and Co-operatives, 2017), the study settlement had only 47 households, making it relatively easy to verify the users' payments. Besides that, Lam (2017) notes that once a PSF is installed, people from neighbouring villages gather there to fetch water. Furthermore, because PSFs attract people from neighbouring villages to collect water once they are installed restricting users' access is not possible, so preventing 'free riders' from obtaining water is difficult (Hasan et al., 2020). However, no other villages were within a 2-kilometre radius of the study settlement, and the nearest village had drinking water facilities installed. Thus, the absence of free riders may have also contributed to maintenance fees' appropriate payment.

Even so, not all settlement users were paying the PSF maintenance costs, with several factors influencing this deficiency. The PSF management committee had been dissolved, and the pond owner held significant authority over the PSF's operation. Collection of PSF maintenance fees was conducted irregularly, and rather than visiting each user household, fees were collected when users came to the PSF to fetch water; thus, identifying users who had not obtained water on the maintenance-fee collection date was impossible. Finally, some users, when aware of the collection date, attempted to avoid payment by, for example, collecting water for several days prior to the collection date.

Consequently, as previous studies have noted (Hasan et al., 2020; Hasan, 2022), operating PSFs on a community-led basis while supplying adequate drinking water and ensuring maintenance fees' stable collection is considered difficult. PSFs are fundamentally characterised as club goods, but the drinking water they supply is classified as a public good. Furthermore, in rural Bangladesh, drinking water as a public good is prioritised, and as a result, PSFs are treated in a similarly, possibly leading to the 'tragedy of the commons' (Hardin 1968).

Interestingly, households using RO units were spending more to purchase drinking water than they paid in maintenance fees for PSF. Furthermore, all 11 households not paying PSF maintenance fees were paying appropriately for RO units. Users of RO units expressed satisfaction with superior water quality compared to the PSF and with the convenience of having water delivered. Previous studies (Shamsuzzoha, Rasheduzzaman & Ghosh, 2019; Islam, Akber & Ghosh, 2018) have also highlighted RO units' high-water quality. Furthermore, because RO units have high water-supply capacity, they are considered well-suited to the local context and regarded as desirable for achieving SDGs (Shamsuzzoha, Rasheduzzaman & Ghosh, 2019). Additionally, RO units are characterised as private goods: users must pay a fixed fee each time they purchase drinking water. And because individuals tend to operate RO units, problems associated with joint management, like those observed with the study settlement's PSF, are less likely to arise. Finally, because the number of installed RO units has been increasing, residents can choose their source of drinking water based on, for instance, water charges, water quality and provided services.

Given the information and data above, to stimulate residents' consistent purchase behaviour, implementation of household-level water supply services that maintain good quality and help reduce the labour of collecting water should be undertaken. As previous studies have stated, residents in rural areas along the southwest coast of Bangladesh have difficulty collectively managing and maintaining water supply facilities (Hasan et al., 2020; Hasan, 2022), and they select drinking water sources based on multiple criteria (Peters, Baroud & Hornberger, 2019; Talukder et al., 2020). Furthermore, this case study demonstrates that Ostrom's (2015) assertion that local communities can achieve sustainable management by establishing their own rules has not been realised for drinking water in the southwest coastal region of Bangladesh and that the 'tragedy of the commons' (Hardin 1968) has not been overcome.

4. Conclusion

This study suggests that residents of the southwest coastal region of Bangladesh may be willing to pay for drinking water. However, to achieve such payment, drinking water of good quality needs to be supplied via a household-based service rather than through community-managed water supply facilities. One underlying factor is the possibility that the ‘tragedy of the commons’ (Hardin 1968) may arise when residents undertake water facilities’ joint management (here, PSFs), which may result in abandonment or dysfunction. Thus, using private goods, such as RO units, is desirable.

However, for those in poverty, a drinking water supply that requires household payment may become a significant financial burden. Because this point lies outside this study’s scope, it requires further discussion and remains a topic for future research. For example, of the 45 surveyed households, six were not using RO units. Consequently, conducting interviews with these households and other, similar research will be crucial for assessing household-level water supply systems’ feasibility in the southwest coastal region of Bangladesh and for achieving a sustainable drinking water supply.

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Note

- 1) In Bangladesh, although salinisation was noted in the National Water Policy (Ministry of Water Resources, 1999), the reference acknowledged only the problem’s existence.
- 2) USD \$1.00 was nearly equal to 122.95 BDT (as of 25th of September, 2026).

References

- Abedin, M. A., Habiba, U., Shaw, R. (2014). Community Perception and Adaptation to Safe Drinking Water Scarcity: Salinity, Arsenic, and Drought Risks in Coastal Bangladesh. *International Journal of Disaster Risk Science*, 5(2), 110-124.
<https://doi.org/10.1007/s13753-014-0021-6>.
- Alam, M. M., M. A. Hossain, and S. Shafee. (2003). Frequency of Bay of Bengal Cyclonic Storms and Depressions Crossing Different Coastal Zones. *International Journal of Climatology: A Journal of the Royal Meteorological Society*, 23(9), 1119-1125.
<https://doi.org/10.1002/joc.927>.
- General Economics Division (2018). Bangladesh Delta Plan 2100 (Bangladesh in the 21st Century) Volume 2: Investment Plan. Bangladesh Planning Commission, Ministry of Planning, Government of the People’s Republic of Bangladesh, Dhaka.

- Haque, A. K. M. M., M. S. Jahan, and M. A. K. Azad. (2010). Shrimp Culture Impact on the Surface and Ground Water of Bangladesh. *Iranian Journal of Earth Science*, (2), 125-132. <https://oiccpres.com/ijes/article/view/5691>.
- Hardin, G. 1968. The Tragedy of the Commons. *Science*, 162(3859), 1243-1248. <https://doi.org/10.1080/19390450903037302>.
- Hasan, M. B. (2022). Constraints Related to the Community Management Model for Shared Drinking Water Systems Governance in Coastal Bangladesh. *Bangladesh Political Science Review*, 15(1), 174-196. <https://doi.org/10.57074/OLNU3609>.
- Hasan, M. B., Driessen, P. P., Majumder, S., Zoomers, A., van Laerhoven, F. (2020). A Community Management Plus Model for the Governance of Rural Drinking Water Systems. *International Journal of the Commons*, 14(1), 662-679. <https://doi.org/10.5334/ijc.1006>.
- Hope, R., Fischer, A., Hoque, S.F., Alam, M.M., Charles, K., Ibrahim, M., Chowdhury, E.H., Salehin, M., Mahmud, Z.H., Akhter, T., Thomson, P., Johnston, D., Hakim, S.A.I., Islam, S., Hall, J.W., Roman, O., El Achi, N., Bradley, D. (2021). Policy Reform for Safe Drinking Water Service Delivery in Rural Bangladesh. REACH Working Paper 9. University of Oxford, UK. <https://doi.org/10.3929/ethz-b-000523691>.
- Hoque, S. F., Hope, R. (2020). Examining the Economics of Affordability Through Water Diaries in Coastal Bangladesh. *Water Economics and Policy*. 6(03), 1950011. <https://doi.org/10.1142/S2382624X19500115>.
- Islam, M A., Akber, M. A., Ghosh, P. K. (2018). Water Quality of Small-Scale Desalination Plants in Southwest Coastal Bangladesh. *Water Science and Technology: Water Supply*. 18(5), 1606-1616. <https://doi.org/10.2166/ws.2017.222>.
- Islam, M. S., Afrin, S., Ahsan, M. N., Haider, M. Z., Mamun, T. M., Das, D. K. (2019). Households' Willingness to Pay for Disaster Resilient Safe Drinking Water Sources in Southwestern Coastal Bangladesh. *International Journal of Disaster Risk Science*. 10(4), 544-556. <https://doi.org/10.1007/s13753-019-00229-x>.
- Khan, A. E., Ireson, A., Kovats, S., Mojumder, S. K., Khusr, A., Rahman, A., Vineis, P. (2011). Drinking Water Salinity and Maternal Health in Coastal Bangladesh: Implications of Climate Change. *Environmental Health Perspectives*, 119(9), 1328-1332. <https://doi.org/10.1289/ehp.1002804>.
- Khanom, S., Salehin, M. (2012). Salinity Constraints to Different Water Uses in Coastal Area of Bangladesh: A Case Study. *Bangladesh Journal of Scientific Research*, 25(1), 33-41. <https://doi.org/10.3329/bjsr.v25i1.13048>.
- Kränzlin, I. (2000). Pond Management in Rural Bangladesh: Problems and Possibilities in the Context of the Water Supply Crisis. *Natural Resources Forum*, 24(3), 211-223. <https://doi.org/10.1111/j.1477-8947.2000.tb00945.x>.
- Lam, Y. (2017). *Adaptation to Salinity in Southwest Coastal Bangladesh: An Environmental and Qualitative Study of Water and Food Security in an Era of Climatic Change* [Doctoral dissertation, Johns Hopkins University, Maryland].

- Local Government Engineering Department. (2016). Upazila Map, Upazila Shyamnagar, District Satkhira. Local Government Engineering Department, Government of the People's Republic of Bangladesh, Dhaka.
- Local Government Division. (2021). National Strategy for Water Supply and Sanitation Revised and Updated Edition 2021. Local Government division, Ministry of Local Government, Rural Development and Co-operatives, Government of the People's Republic of Bangladesh, Dhaka.
- Mahmuduzzaman, M., Ahmed, Z. U., Nuruzzaman, A. K. M., Ahmed, F. R. S. (2014). Causes of Salinity Intrusion in Coastal Belt of Bangladesh. *International Journal of Plant Research*, 4(4A), 8-13. doi:10.5923/s.plant.201401.02.
- Ministry of Environment and Forests. (2005). National Adaptation Programme of Action (NAPA). Ministry of Environment and Forests, Government of the People's Republic of Bangladesh, Dhaka.
- Ministry of Environment and Forests. (2009). Bangladesh Climate Change Strategy and Action Plan 2009. Ministry of Environment and Forests, Government of the People's Republic of Bangladesh, Dhaka.
- Ministry of Local Government, Rural Development & Co-operatives. (2017). Operational Guidelines for WASH (Water Sanitation and Hygiene) in Emergencies – Bangladesh (Second Edition). Department of Public Health Engineering (DPHE), Bangladesh WASH Cluster, Dhaka.
- Ministry of Water Resource. (1999). National Water Policy. Ministry of Water Resources, Government of the People's Republic of Bangladesh, Dhaka.
- Ministry of Water Resource. (2005). Coastal Zone Policy. Ministry of Water Resources, Government of the People's Republic of Bangladesh, Dhaka.
- Ministry of Water Resource. (2006). Coastal Development Strategy. Ministry of Water Resources, Government of the People's Republic of Bangladesh, Dhaka.
- Moniruzzaman, M., Rahman, M. A., Hossain, M. S. (2012). Assessing the Physical Condition and Management System of Pond Sand Filter (PSF) of a Coastal Community of Bangladesh. *Journal of the Bangladesh National Geographical Association*, 40(1&2), 59-68.
- Montgomery, M. A., Elimelech, M. (2007). Water and Sanitation in Developing Countries: Including Health in the Equation. *Environmental Science & Technology*, 41(1), 17-24. <https://doi.org/10.1021/es072435t>.
- Ostrom, E. (2015) Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press, Cambridge.
- Peters, C. N., Baroud, H., Hornberger, G. M. (2019). Multicriteria Decision Analysis of Drinking Water Source Selection in southwestern Bangladesh. *Journal of Water Resources Planning and Management*, 145(4), 05019004. [https://doi.org/10.1061/\(ASCE\)WR.1943-5452.0001029](https://doi.org/10.1061/(ASCE)WR.1943-5452.0001029).
- Rahman, M.M., Bhattacharya, A.K. (2014). Saline Water Intrusion in Coastal Aquifer: A Case Study from Bangladesh. *IOSR Journal of Engineering*, 4(1), 7-13.

- <https://doi.org/10.9790/3021-04170713>.
- Rahman, M. T. U., Rasheduzzaman, M., Habib, M.A., Ahmed, A., Tareq, S.M., Muniruzzaman, S.M. (2017). Assessment of Fresh Water Security in Coastal Bangladesh: An Insight from Salinity, Community Perception and Adaptation. *Ocean & Coastal Management*. 137, 68-81. <https://doi.org/10.1016/j.ocecoaman.2016.12.005>.
- Shamsuzzoha, M., Rashedzzaman, M, Ghosh R. C. (2019). Drinking Water Supply Through Reverse Osmosis Technology: A Solution for Water Shortages in Coastal Rural Areas of Bangladesh., in Selim, S. A., Saha, S. K., Sultana, R., Roberts, C. (Eds.), *The Environmental Sustainable Development Goals in Bangladesh*. Routledge, New York, pp. 17-27.
- Sobsey, M. D. (2006). Drinking Water and Health Research: A Look to the Future in the United States and Globally. *Journal of Water and Health*. 4(S1), 17-21. <https://doi.org/10.2166/wh.2006.0039>.
- Talukder, M. R. R., Rutherford, S., Islam, K., Chu, C. (2020). Water Scarcity and Challenges for Access to Safe Water: A Case of Bangladesh's Coastal Area Vulnerable to Climate Change. *Asian Journal of Water, Environment and Pollution*, 17(4), 1-9. https://doi.org/10.3233/AJW200045?urlappend=%3Futm_source%3Dresearchgate.net%26utm_medium%3Darticle.
- United Nations. (2025). *The Sustainable Development Goals Report 2025*. United Nations, New York.
- van Schendel, W. 1981. Peasant Mobility: The Odds of Life in Rural Bangladesh. Van Gorcum, Assen.
- Wilderer, P. A. (2005). UN Water Action Decade: A unique challenge and chance for water engineers. *Water Science and Technology*, 51(8), 99-107. <https://doi.org/10.2166/wst.2005.0236>.
- World Bank. (2002). Willingness to Pay for Arsenic-Free, Safe Drinking Water in Rural Bangladesh - Methodology and Results. Water and Sanitation Program Field Note. World Bank Group, Washington, D.C.
- World Bank. (2005). Water, Electricity, and the Poor: Who Benefits from Utility Subsidies? World Bank Group, Washington, D.C.
- World Health Organization. (2004). Occurrence of Cyanobacterial Toxins (Microcystins) in Surface Water of Rural Bangladesh: Plot Study. World Health Organization, Geneva.
- World Health Organization. (2022). Guidelines for Drinking-Water Quality: Fourth Edition Incorporating the First and Second Addenda. World Health Organization, Geneva.