e-journal of
Social and Legal Studies

ASSESSMENT OF RAINWATER HARVESTING IN COASTAL BANGLADESH: A COMPARATIVE STUDY BETWEEN SOUTHWEST AND CENTRAL COAST OF BANGLADESH

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Abstract

Despite being a tremendous development potential area, the people of coastal belt usually lead their life fighting against cyclone, salinity intrusion, tidal surge, flood and so on. There are rivers, pond and other water sources but people have no safe source of drinking water due to intrusion of saline water in both surface and groundwater, and they very commonly face scarcity of safe water. Climate change has further worsened the situation. People adapted and adopted various technologies to cope with the devastated situation. Rainwater harvesting system is one of such technologies. The main aim of this paper is to assess comparatively on Rainwater Harvesting (RWH) system in southwest and central coast of Bangladesh. Two household based rainwater harvesting systems have been considered for assessment in this study. One is located in Rampal Upazila in Bagerhat district under South West Coast and another is Monpura Upazila in Bhola district under Central Coast of Bangladesh. To assess rainwater harvesting system as context specific, user friendly and climate resilient technology a checklist has been prepared by focusing the indicators i.e: hydrological feasibility, local reparability and affordability, user friendliness, gender friendliness, local acceptability, durability and sustainability and functionability under climatic disaster and operation, maintenance and management. These indicators highlights that south west coastal people are habituated and adapted with careful operation and maintenance and management of the technology. On the other hand, central coastal people have adopted this technology but still people are not habituated and accepted and the operation, maintenance and management system is weak. Through action research this study has tried to find out how rainwater harvesting system can be an appropriate and context specific climate resilient technology in southwest and central coast of Bangladesh.

Key words: *Rainwater Harvesting (RWH), climate change, south west coast, central coast, sustainable technology*

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1. Introduction

Bangladesh has about 710 km long coastal belt which is different from rest of the country due to its geophysical, socio cultural, environmental and political perspectives (Ministry of Water Resources, 2005). People are frequently affected by natural disasters because of its geographical location, shape and structure. Again, climate change is exacerbating the situation due to sea level rise, poor rainfall in winter, high rate of evaporation and various disastrous events like cyclone and storm surge. Further, higher saline concentration in the surface and ground water compels in coastal people (Seal, 2011). Safe water scarcity is an increasing problem in this coastal belt (Karim *et.,al.,* 2004). The average rainfall in the coastal region is more than 3000 mm against an average rainfall about 2400 mm (Ahmed and Rahman, 2003). People are now more depending on rainwater. The rainwater is free from arsenic contamination, salinity and other harmful infectious organisms and pathogens. Beside this the physical, chemical and bacteriological characteristics of harvested rainwater represent a suitable and acceptable means of potable water (WaterAid Bangladesh, 2006). Thus this study tries to find out the result of how RWH system can be a context specific, user friendly and climate resilient technology through action research[4] in south west and central coast of Bangladesh by focusing the indicators of hydrological feasibility, local reparability and affordability, user friendliness, gender friendliness, local acceptability, durability and sustainability and functionability under disaster situation and operation, maintenance and management. Finally these indicators points out some lessons and provide guidelines on context specific, climate resilient technology in southwest and central coast of Bangladesh.

2. Methodology of the Study

The first step of the action research was to involve the beneficiary with the process to build awareness regarding use, operation maintenance and management of the technology. To identify context specific, user friendly and climate resilient technology, on site field observation, meeting with the users and local communities and relevant actors has been used as tool for the assessment. Finally all data community views and reflection, expected outcome efficiency and effectiveness, user's problem on operation and maintenance, challenges faces of using the technologies etc. has been highlighted to identify context specific, user friendly and climate resilient water supply technology in coastal Bangladesh. Field level information was collected through a checklist from the month of November 2012 to May 2013. The checklist highlights existing climatic environment or vulnerability factors of the site, user friendliness, gender friendliness, water quality, local acceptance, situation of disaster resiliency, functional status in disaster period, operation and maintenance, limitations, suggestions etc. of the technologies. Regular data has been collected by the

[4] Action research is a research initiated to solve an immediate problem or a reflective process of progressive problem solving led by individuals working with others in teams or as part of a "community of practice" to improve the way they address issues and solve problems. It sometimes called participatory action research (Wikipedia, 2013).

beneficiaries. However, every two months feedback and reflection on the technologies has been taken through meetings with users and the community. Water quality has tested by the NGO Forum team for the determination of total dissolved/suspended solids, total coliform, faecal coliform etc.

3. Study Area

The study area is selected in two different coastal zones of Bangladesh one is Southwest Coast (SWC) and another is Central Coast (CC). The assessment has conducted on a same type Rainwater Harvesting (RWH) tank in both zones. The beneficiary of the RWH tank in SWC zone named Zinufa Begum of Singhorbunia village at Perkhali union in Rampal Upazila under Bagerhat district. According to Program Development Office for Integrated Coastal Zone Management Plan (PDO-ICZMP) 2005, Rampal is considered as an interior coastal upazila. Pramanik (1983) has delineated it Western Coastal Region[5]. It is located close to world largest mangrove Sundarban at the south west part of the country. The main economic activities of the people are shrimp culture, fishing, etc. The freshwater aquifer is very rarely available and the geological condition is not suitable for ground water development and the shallow tubewells are not operating to supply domestic water in this area. The excessive sedimentation makes Perikhali a dead river. It contains very high salinity. People normally use harvested rainwater either at ponds or at households or institutional big RCC reservoirs for drinking and other domestic purpose. The monsoon rainfall starts earlier in this region by the end of April and continues upto September and the rainfall is higher than the average rainfall in Khulna region.

The another study area was conducted a beneficiary of Rainwater Harvesting Tank named Md. Bokkar Miah of Uttar Sakuchia village at Uttar Sakuchia union under Monpura Upazila in Bhola district. According to PDO-ICZMP 2005, it is considered an exposed coastal upazila. Pramanik (1983) delineated as Central Coast of Bangladesh. It is an island on the estuary of the river Meghna. The main economic activities of the people are fishing and farming. The freshwater aquifer is available and the geological condition is suitable for ground water development and the shallow tubewells are operating to supply domestic water in this area. Presently, the river Meghna is tidal river contain salinity and turbidity. There are very limited numbers of tubewells in this upazila. The monsoon rainfall starts earlier in this region by the end of April and continues up to September and the rainfall is higher than the average rainfall in Barisal region.

[5] Pramanik (1983) has divided the Bangladesh coastal zone into three regions namely: eastern, central and western coastal region. The eastern zone starts from Bodormokam, the southern tip of mainland Teknaf to the Feni river estuary. The Central Coastal Zone extends from Feni river estuary to the eastern corner of the sundarbans, covering Noakhali, Barisal, Bhola and Patuakhali districts. The zone receives a large volume of discharge from the Ganges-Brahmputra-Meghna river system, forming high volume of silty deposition. Numerous islands are located in the area including the country's only island district Bhola. Many islands have been formed in the last few years in the area by the process of land accretion. The Western Coastal Zone is covered by the Sundarbans mangrove forest, covering greater Khulna and part of Patuakhali district. Because of the presence of mangrove forest, the zone is relatively stable of soil erosion. Mangrove swamps, tidal flats, natural levees and tidal creeks are characterstics of the zone.

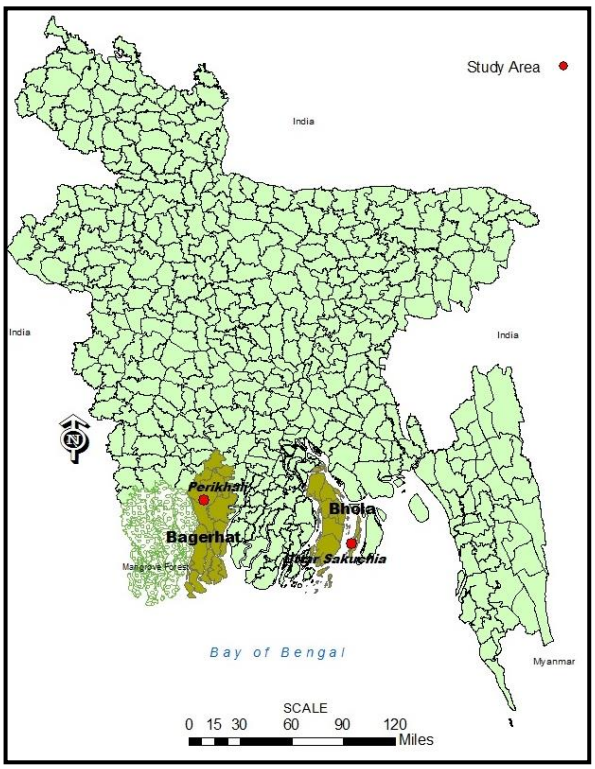

Figure 1: Location map of the study areas

4. Results and Discussion

A brief finding from NGO Forum for Public Health staffs, on site field observation, meeting with the users and local communities and relevant actors of the indicators like hydrological feasibility, local reparability, user friendliness, gender friendliness, local acceptability, local affordability, durability and sustainability and functionability under climatic disaster and operation, maintenance and management is given below:

4.1 Technology design/ design considerations

Both of the assessed technology is called household based Rain Water Harvesting (RWH) tank. Its capacity is 3200 liter. Same design considerations have been followed both in south west and central coast (see picture 1). The reservoir or storage tank is constructed above the ground level. The catchment roof is made of corrugated sheets. Both of the catchments are located away from over-hanging trees. Semi circular gutter is used for the channel all around the edge of a sloping roof to collect and transport rainwater to the storage tank. Flushing system is applied to discharge first foul rainwater outside the tank easily. It is made with PVC pipe and GI pipe. The main component of RWHS is the storage tank which is made with ferro-cement, brick and base of this tank is made with concrete. For ensuring the hygienic use

of stored water a platform is made with brick, concrete etc. It has been considered the nearest distance of other drinking water points, nearest latrine pit and surrounding environment.

RWH tank in South West Coast	RWH tank in Central Coast
	

Picture1: Rainwater Harvesting Tank in SWC and CC zone

4.2 Use of the technology

In SWC area, the two households consisting of 6 members are using the installed tank regularly. However, around 30 members are using this tank rarely because there is no safe water storage availability in their household premises or close proximity of their houses. They are using only for drinking purpose. On the other hand in CC, one household consisting of 6 members are using this tank rarely. From field survey, it has been found that the beneficiaries are using for utensil cleansing, raw materials washing purpose.

4.3 Hydrological feasibility

In SWC, the trend of the creeping of saline water into deep and shallow aquifers as well as the extremely slow rate of rainwater seepage into the aquifers has lead to the shortage of quality drinking water. No safe drinking water is found if TW depth more than 1000 ft. the acquifer is arsenic free. According to the beneficiary, the preserved rainwater is insufficient to cover the demand for whole year. It will cover only 4 months. They have harvested during pre-monsoon period. However, they are using now and at the late monsoon period they will clean the tank and harvest for the next 4 months. In CC, the trend of the creeping of saline water into deep and shallow aquifers is low as well as the high rate of rainwater seepage into the aquifers. Safe drinking water is found above 750 ft depth. The beneficiaries are using the harvested rainwater only for household purpose according to their need.

4.4 Water quality

It has been found the water quality is quite good in both of the technologies. After testing in 22 November, 2012, no fecal coli form has found in both of the technologies. The total dissolved solid has found 47.3 mg/l and 39.6 mg/l (standard level of drinking water is 1000

mg/l) in Perikhali tank in Bagerhat and Uttar Sakuchia in Bhola respectively. In terms of physical water quality, no odor, color, taste and iron has been found in both of the technologies. Even, aquifer is free from arsenic in both of the sites.

4.5 Local reparability and affordability

It has been found that the rain water harvesting is easily repairable in both sites because caretakers from selected beneficiaries have taken training about reparability and maintenance. Even, materials or parts of the technology are available in the local market. During 3rd assessment in May 2013, it has been found in SWC tank that crack prevails around the tank. Both of the zones, people are not able to pay to install the technology. However, in both of the zones people are able to pay regular maintenance.

4.6 User friendliness

It has been found in both of the zones that this rainwater harvesting tank is easy to learn to operate and easily maintainable.

4.7 Gender friendly

The women of coastal people bring drinking water from a long distance from their household premise. The household of SWC area and CC area need to take a trip of almost 3 km and 1.5 km respectively to collect water. In an average, household spend close to 40 minutes and 25 minutes respectively for collecting drinking water. As RWH tank should locate close to the home thus women can access and collect water easily. There is no restriction to access and use to the technology for the other people. It is also reported that this technology is convenient for women to operate and maintain. They do not need to have to drink dirty water from nearby pond.

4.8 Local acceptability

From field survey, it has been found that the beneficiaries of SWC are habituated with quality of rainwater for drinking purpose. They have no other technological options like deep tube well, dug well etc. They found RWH is their appropriate option for safe and costless drinking purpose. Thus they highly accepted this technology. On the other hand, beneficiaries of central coast are not habituated with quality of rainwater for drinking purpose. They informed rainwater tastes *kosh* (sticky) to them. They respond that rainwater is mineral free and it has flat taste. They still collect deep tube well water from distant places. They harvest rainwater for utensil cleansing, raw materials washing etc. purpose. They have not accepted this technology for drinking purpose.

4.9 Durability and sustainability

South west coastal people are not able to maintain a certain level of performance around the year. Tidal surge and cyclone are the main climatic disasters in this area. During severe

cyclone Sidr and Aila, this area is submerged and intruded by salt water. Other climatic disasters in this area are water logging, flood, salinity etc. After installation, this technology has faced Mahasen but it was functional. It has ability to cope with future challenges. However in central coast, people are not able to maintain a certain level of performance around the year. Tidal surge and cyclone are the main climatic disasters in this area. The climatic disasters in this area are cyclone, flood, salinity etc. After installation this technology has faced Mahasen but it was functional. It has ability to cope with future challenges.

4.10 Operation, maintenance and management

In SW coastal zone, users are aware about operation and maintenance of the technology. They have cleaned the tank before monsoon by using bleaching powder, net etc. Users are not inspecting regularly. The overall management is good. During 3rd assessment in May, 2013 it has been found that platform is not visible and full of clay and dirt. However, in CC zone, users are not fully aware about operation and maintenance of the technology. They have not cleaned the tank before monsoon. They are not inspecting regularly. The overall management is bad.

4.11 Health situation after installation and use of the technology

Rainwater is relatively free from impurities except those picked up by rain from the atmosphere. It is slightly acidic and very low in dissolved minerals; as such, it is relatively aggressive. A well designed rainwater harvesting systems with clean catchments and storage tanks supported by good hygiene at point of use can offer drinking-water with very low health risk. In SWC, during meeting with beneficiaries has reported that they keep clean of catchments, cover water pot after water collection and also cover food and food containing pot. Their health condition is better after using the technology. They frequently faced waterborne diseases and now they are facing rarely. In CC, during meeting with beneficiaries has reported that they are not aware about first flash and clean catchments by trimming trees and they do not cover water pot after drinking water collection from distant tube well. Their health condition is same as before.

5. Concluding Remarks

Rainwater is a milestone in the pace of safe water consumption in the world. It has been found a common practice in south west coast of Bangladesh for a long time. The beneficiaries are operating and maintaining this tank effectively. But central coastal people are still not habituated for drinking purpose but they are adopted this technology for domestic purpose. However, this technology is context specific in both of the zones. Modification like providing double filtering system for ensuring water quality, raising storage tank platform to protect from tidal surge and saltwater intrusion, training on operation and maintenance, awareness rising on the use of rainwater etc. can give solution towards a climate resilient technology. Again, from the review of the policies like national water policy 1999, National policy for safe water for safe water supply and sanitation 1998, National environmental policy 1992 is not well addressed as it would be (Haq, 2013). However, the national strategy for water and sanitation hard to reach areas of Bangladesh has addressed rainwater harvesting as for sustainable solutions. Thus not only in coastal zone but also other zones in Bangladesh are needed to promote this rain water for domestic purpose as first priority basis and then

gradually habituate drinking purpose otherwise people have to pay huge cost due to overexploitation of ground water in the future.

5. Acknowledgements

This study is a part of action research study under the project of "Promotion of Water Supply, Sanitation and Hygiene in Hard to Reach Areas of Rural Bangladesh" supported by Swiss Agency for Development and Cooperation and implementing by Bangladesh Centre for Advanced Studies (BCAS) and NGO Forum for Public Health. We thank to NGO forum staffs and BCAS colleagues for supporting required information.

6. Reference

Ahmed, M. F. and Rahman, M.M, *Water Supply and Sanitation, Rural and Low Income Urban Communities*, 3rd Edition, ITN - Bangladesh, Center for Water Supply and Waste
Management, BUET, Dhaka, p. 430, 2003

Ministry of Water Resources, *Coastal Zone Policy 2005*, Ministry of Water Resources Government of the People's Republic of Bangladesh, p. 1, 2005

PDO-ICZMP, *Delineation of the Coastal Zone (WP 005).* Program Development Office for Integrated Coastal Zone Management Plan, P. 6, 2003

Pramanik, M.A.H. *Remote sensing application to coastal morphological investigations in Bangladesh,* PhD thesis, Jahangirnagar University, Savar, 1983

Haq, S. A., *Promoting urban rainwater harvesting: policy support, gap and initiatives,* Rainwater Harvesting in Bangladesh: Potentials, Challenges and Stakeholders' responses, Rahman, M.A, and Rahman, S, WaterAid Bangladesh, pp. 42-43, 2013

Karim, M. R., Shelly, A, B and Biswas, M., *People Perception and Acceptance Of Rainwater Harvesting in a Coastal Area in Bangladesh.* 2004 http://public.balanceco2.com/WaterCatchment/pdffiles/Theme%20-%202/KARIM-Md.%20Rezoul.pdf (10 July, 2013)

Seal, L. *Addressing Fresh Water Scarcity in Coastal Zone*, http://archive.thedailystar.net/newDesign/news-details.php?nid=215398, December 24, 2011

WaterAid Bangladesh, *Step by Step IMPLEMENTATION GUIDELINES for RWHSs*, http://www.wateraid.org/~/media/Publications/rainwater-harvesting-systems-implementation-rural.pdf , 2006

Wikipedia, *Action Research* http://en.wikipedia.org/wiki/Action_research, July 1, 2013