

# The Southwestern Bangladesh's Experience of Tidal River Management: An Analysis of Effectiveness and Challenges

Md. Sajadul Alam, I. Ahmed, A. Naqib Jimmy, M. Haque Munna, N. Ahsan Khan

**Abstract**—The construction of coastal polders to reduce salinity ingress at greater Khulna-Jashore region area was initiated in the 1960s by Bangladesh Water Development Board (BWDB). Although successful in a short run the, the Coastal Embankment Project (CEP) and its predecessors are often held accountable for the entire ecological disasters that affected many people. To overcome the water-logging crisis the first Tidal River Management (TRM) at Beel Bhaiana, Bhabodaho was implemented by the affected local people in an unplanned. TRM is an eco-engineering, low cost and participatory approach that utilizes the natural tidal characteristics and the local community's indigenous knowledge for design and operation of watershed management. But although its outcomes were overwhelming in terms of reducing water-logging, increasing navigability etc. at Beel Bhaiana the outcomes of its consequent schemes were debatable. So this study aims to examine the effectiveness and impact of the TRM schemes. Primary data were collected through questionnaire survey, Focus Group Discussion (FGD) and Key Informant Interview (KII) so as to collect mutually complementary quantitative and qualitative information along with extensive literature review. The key aspects that were examined include community participation, community perception on effectiveness and operational challenges.

**Keywords**—Sustainable, livelihood, salinity, water-logging, shrimp fry collectors, coastal region.

## I. INTRODUCTION

**P**OLDER is a piece of land that has been reintegrated from waterbody by building canals and dikes. The first construction in Bangladesh region was institutionalized by the Bangladesh (then East Pakistan) Water Development Board (BWDB) through the USAID funded CEP during 1960-1980 [2], [6]. Out of the 4000 km long embankments with 780 sluices built under the project enclosing the coastal region within 92 polders, 1566 km of the embankments with 282 sluices enclosing 39 polders were situated in the greater Khulna region alone. The CEP resulted in a sudden increase in rice production and employment in the region with up to three bumper crops per year [5], [19]. The temporary drainage

Md Sajadul Alam and Masudul Haque Munna are with the Environmental Science and Management Department, North South University, Dhaka Bangladesh (e-mail: saimonurp@gmail.com, m.munna491@gmail.com).

Intiaz Ahmed is with the Food and Agricultural Organization (FAO) of UN, Dhaka, Bangladesh. (e-mail: sashoto\_dungeon@yahoo.com).

Abdun Naqib Jimmy is with the North South University, Dhaka Bangladesh, (e-mail: abdun.jimmy@northsouth.edu.).

Nazmul Ahsan Khan is with the Environmental Science and Management Department, North South University, Dhaka Bangladesh (corresponding author, phone: +01914444604; e-mail: nazmul.khan@northsouth.edu).

congestion in 1982 gradually became permanent water-logging of an area of 100,600 hectares in Khulna and Jashore districts alone in the early 1990s [3]. It affected almost 1 million people through disrupting agro production and forcing people to out-migrate as a coping mechanism [14], [24], [26]. The then planned Coastal Embankment Rehabilitation Project (KCERP) in the 1990s was suspended before any major civil works in the face of public protests and actions [11]. To finally solve these long-standing problems, a series of sluice gates and regulators were established under the 62 million USD Khulna-Jessore Drainage Rehabilitation (KJDRP) Project during 1994-2002 [1], [27]. The final evaluation report of this project states it to be a success to “solve the water-logging problem to increase agricultural production and alleviate the poverty of the area through farm-based employment generation” [12]. But on the contrary, the local civil society organizations hold this ADB funded project accountable for further contributing adversely to this ecological disaster [13], [15].

Identifying the limitation in controlling tidal flows through sluice gates [18], the local communities rather suggested the adoption of a local indigenous method as an alternative called “Jowar-BhataKhelano” (free play of tidal flow) commonly referred as TRM [23], [25]. Realizing the potential outcomes in ensuring the natural flow the GoB adopted the ideas of TRM and succeeded in partially resolving the prevailing drainage congestion and achieved quite some agricultural, social and economic benefits. So far, the initial performance of the TRM approach seems encouraging but still needs to be assessed for effectiveness, viability, sustainability, and replicability. Hence, the main objective of this research is to investigate the experience from different river management interventions and their community participation status as well as the effectiveness of TRM schemes along with their perceived socio-economic impact.

## II. METHODOLOGY

The study area is located in the southwest region of Bangladesh and falls under the administrative jurisdiction of Jashore district. It includes Abhaynagar, Manirampur, Keshabpur and JashoreSadarUpazilas of Jashore District and Dumuria of Khulna District also known as “Bhabodaho” area. Then the two beels i.e. East BeelKhukshia – EBK (TRM is fully operational) and BeelKapalia – BK (TRM yet to be established), were selected purposively to compare the local perceptions (Table I). Then based on consultation with the

local elected representatives and BWDB officials the following eight villages were selected for the study for being the most affected by the projects.

TABLE I  
 GENERAL ATTRIBUTES OF THE STUDY SITES [3]

	BeelKapalia	BeelKhukshia
Total area	1001 ha	920 ha
Intervention area	600 ha	848 ha
Sampled villages	manoharpur kapalia panchakari balidaha kalisakul	katakali kalicharanpur kalagachhi
No of HHS	4,496	893
Population	18,564	3,602

For the completion of the study, a variety of tools and techniques have been adopted. In this study, the method of TRM guideline was adopted which is participatory in nature and 3 FGDs were administered for descriptive and explanatory purposes to know the process of practice TRM. Primary data on the local perception of the effectiveness were collected through a questionnaire survey. For this research, systematic random sampling method was used for field data collection (Household level) and 67 respondents associated familiar with TRM operation were interviewed. The respondents have been classified based on occupation and land tenure. Also, KII have been conducted with Water Development Board officials and other relevant stakeholders. The on-going government and non-government projects aiming at reducing waterlogging in the study area were explored through literature review. Maps, images, and government project related data were collected from the BWDB and other offices. Also, important data and information were explored from different organizations working in that area.

### III. RESULTS AND DISCUSSION

IUCN-Bangladesh mentioned TRM as “people’s traditional wisdom”. It is an eco-engineering concept and functions with a bottom-up approach. It is nearly cost-less to construct and requires little operation and maintenance. It needs to be noted here that even the KJDRP Project Completion Report, 2004 recognized that project implementation delays could have been reduced considerably if the communities’ demand for the TRM system had been appreciated earlier [19]. It rather takes accounts of silt as a positive component to solve waterlogging [10], [21]. It involves taking full advantage of the natural tide movements in rivers. Floodtide is allowed to enter into an embanked low-lying area (tidal basin) where the sediment carried in by flood tide is deposited. In ebb tide, water flows out of the tidal basin with greatly reduced sediment load and eventually erodes the downstream riverbed [16]. The natural movement of flood and ebb tide along the tidal basin and the downstream river helps to maintain a proper drainage capacity. But the EIA/SIA study recommended that the development of the TRM option should be based on detailed surveys and studies and planned carefully through intensive interaction with stakeholders, which should be facilitated

through a properly planned and implemented monitoring and feedback mechanism.

#### A. Shortcomings of the Non-TRM Approaches

As per the feedback from the community during this study, KJDRP did not consider the geo-characteristics of the region, ignoring the positive role of the alluvium in the process of land formation [17]. The main idea was to keep the tidal water from entering the vicinity of the established project, restricting the alluvium out. This would allow smaller rivers to silt up but maintain the navigability of a few selected rivers. In comparison to waterlogged polders, this plan would keep water levels outside the proposed regulators during the ebb tides lower. However, this overlooked the fact that the rivers have an interconnected nature and ignored the overall drainage system that the rivers have built up over time [3]. The ecological changes that might take place have not been given any consideration either.

The proposed drainage plans of KJDRP were abandoned in the face of peoples’ resistance and the advocacy of the local NGOs. As a result, a new drainage plan was adopted based on the people’s concept of TRM that has historically been welcomed by the local population [4].

The TRM based plan altered the drainage plans, based on the contextual ecological characteristics. This is, in fact, a natural water management process with very little human intervention but it necessitates strong public participation and consensus with a great deal of sacrifice by the stakeholders for a period of four to six years as their land remain flooded depending on the tidal volume and area of the beel.

#### B. Previous Experience of TRM

Until now TRM has applied to the following four beels of the Bhabodaho area.

- BeelBhaiana 1997-2001, by the community
- BeelKadaria 2002-2005, by BWDB
- BeelKhukshia 2006-Present, by BWDB
- BeelKapalia, in the planning stage

The first TRM at BeelBhaiana was implemented by the affected local people in an unplanned way in 1997 by cutting the polder to connect the Hari River with BeelBhaiana. About 600 ha land was raised by one meter and the Hari River, downstream of the cut, revived for a length of 4 kilometers with more than 8-meter depth. Water from the upstream beels could drain out easily and became partly free of waterlogging [16]. The second TRM in the Bhabodaho area was initiated in BeelKedaria in 2002 by BWDB in a planned manner [22]. Local people welcomed the project without any objection. However, by 2005 it stated receiving opposition due to delay in compensation and loss of shrimp farmers. But monitoring data show that BeelKedaria performed as an effective tidal basin in maintaining the drainage capacity of the Hari River during its operation [16]. The net volume rose to 3 million m<sup>3</sup> in Beel Kedaria which was only 6 million m<sup>3</sup> before the implementation of TRM. After the phasing out of the TRM scheme in 2005, the land and gher owners stopped continuing the approach. As a result, a 17 km long Teka-Hari River

system was severely silted up. From October 2005 to November 2006 more than 18,100 ha of the Bhabodaho area remained water-logged [16].

The abortive outcome of TRM in BeelKedaria provoked the people of East BeelKhukshia to deny having TRM in their Beel [20]. After a series of meetings with the local government bodies, stakeholders, Water Management Associations (WMAs) and local elites, the TRM scheme in East BeelKhukshia started in April 2006 [16], [11]. There are positive results of the TRM scheme but people are unhappy with the delay in payment of crop compensation [16].

### C. Community Perception on TRM

Figs. 1-3 illustrate the community perception on the before and after condition in terms of drainage and siltation. It was found that 84% of the community perceives an improvement in the drainage condition after TRM at both beels. Only 12% of the respondents, who claimed that there were no changes after TRM implementations, are mostly too far from the vicinity of the TRM to obtain its full benefit. 84% of the respondents also perceive an improvement in the sedimentation condition. 8% of the respondents who perceive it to be worse have heavy sediment in their land.

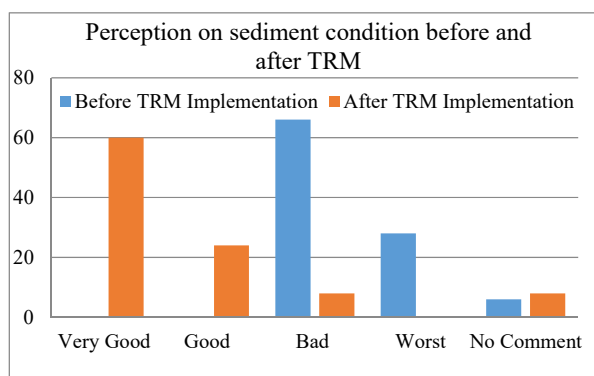


Fig. 1 Perception of Drainage Condition

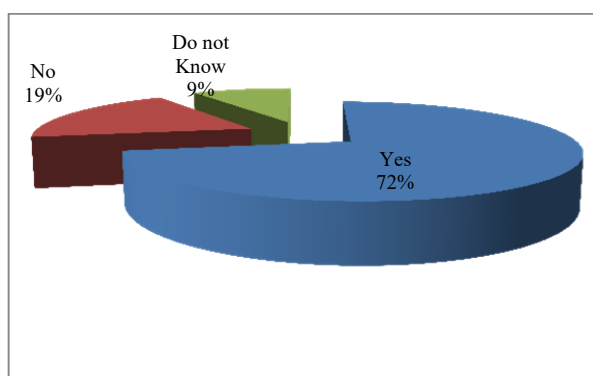


Fig. 2 Perception of Sediment Condition

During the study, the majority of the respondents also perceived that land fertility, fisheries resources, and navigable waterways have increased. Saline tolerant vegetation has increased but due to salt water ingress, normal vegetation was affected.

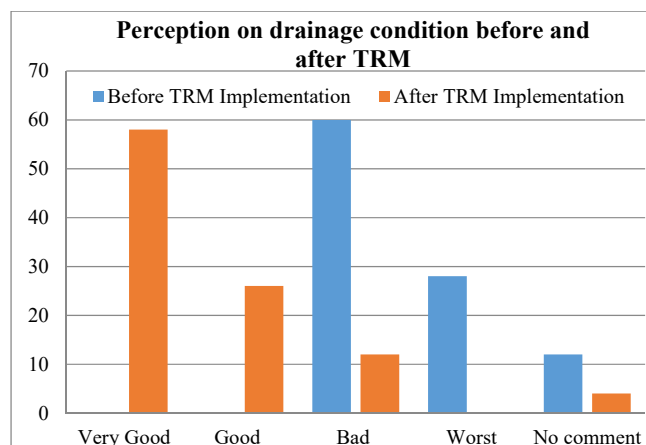


Fig. 3 Awareness on the scope of community participation in TRM schemes

The people from the Bhabodaho area have diverse understanding and perception on TRM. To some, TRM is a blessing whereas to others, TRM is a curse. But when asked specifically about viability, about 75% people of Bhabodaho area are in favor of TRM because they consider TRM as the only option to save the region. Table II presents a key summary of the overall perception of TRM among different social, economic and demographic groups.

TABLE II  
KEY PERCEPTION OF DIFFERENT STAKEHOLDERS ON TRM

Perception	Stakeholder	Reasons Behind this Perception
trm is a beel filling practice	uneducated farmers	locally grounded concept not based on a historical background or understanding of the major physical and political processes that shape the areas current reality.
trm mitigates drainage congestion and manages silt	elderly ersons educated professionals political leaders bwdb officials	well informed about the historical physical and political processes in the study area.
trm is a useless practice	shrimp farmers leasing in farmers landless farmers farmers who cultivate in vested property or khas land	economically unprofitable takes away land from hard-working farmers complex compensation mechanism

### D. Community Participation Status

TABLE III  
PHASE-WISE SCOPE OF STAKEHOLDER PARTICIPATION [3]

Project Phase	Involved Stakeholder	Role
Needs assessment	local people, wmas, iwm	To assess the necessity of trm and gather information on the problems in the beel area
Project planning	bwdb, iwm	Designing and planning for the best possible solution
Implementation	bwdb	Execution of trm
Monitoring and evaluation	bwdb	Regular checking of cut points and embankments

Table III elaborates the scope of community participation in the different phases of the schemes.

It was found that from Beel Khukshia that only 2% (see the

figure on awareness) of the respondents were aware of the consultation meetings. Even at the meetings, the community participation is quite limited to only sharing feedback. It is up to BWDB to either address the feedbacks or not. So people often do not find it useful to participate in the meetings. The

only acknowledged local participation platform WMA was found to be dysfunctional [7]-[9]. Local people participate in the project activities as paid laborers hired by contractors rather than actual participants.



Fig. 4 Cutting Point and Silt Deposition point of Beel Khukshia

#### E. Operational Challenges

Due to the TRM scheme in Khukshia Beel, much of the Agarhati settlement and the government road are at the risk of both-side erosion.

The only way of draining out water from the 26 Beels is located up-stream at Beel Khukshia. As high tide and low tide take place two times in a day at Beel Khukshia, draining out water from these beels is hindered.

Each year the area gets flooded because of the tidal-surge, water pressure for springtide, infiltration of water during monsoon, wave in the beel water and incidents like tropical cyclones. But there is insufficient attention to peripheral embankment conservation in this regard.

During the dry or silt season, cross-dams are built, which is then removed during monsoon. This in turn sometimes affects adversely if the cross dam is not removed timely.

Construction of bridge below the Khukshia Beel at Sholgotia along with setting Vemti nets for catching fish obstructs river flow.

Cut points are often not placed at locations from which they can be connected to the main canal located in the beel, so that the flow of tide can continue allowing the silt to be carried away as far as possible.

Another common complaint on cut point against BWDB is that often they are not closed properly, and the community struggles often to do so (see Fig. 4 on cut point at Khukshia).

After the phasing of each scheme, many lands go underwater (into beels) while many beels fill up and turn into land. Then it becomes difficult to identify the land boundaries.

The compensation mechanism is based on the record from

1962 [20]. The process is also perceived as highly complex (under "The Acquisition and Requisition of Immovable Property Ordinance-1982), bureaucratic, time-consuming and insufficient. Also due to lack of alternative arrangements for compensating owners of ghers, or people living or cultivating in, vested properties and khash lands along with the perceived risk of job security during TRM has caused widespread agitation in the locality. There is also widespread distrust in the community regarding BWDB.

The proposed duration of the TRM scheme at Beel Khukshia was three years, yet it continues still now, causing prolonged sufferings to its dwellers. Eager to get back their land, the community has started protesting against TRM. This, on the other hand, has provoked the people of Beel Kapalia and they are not letting BWDB to start their work.

#### IV. CONCLUSION

For the success of any TRM scheme, detailed people-centered planning is the prerequisite. Also, it will require strong commitments of BWDB towards more accountable and transparent behavior to overcome operational challenges as establishing an efficient compensation mechanism, timely action, etc. These, on the contrary, will be able to eradicate the distrust among the various stakeholders and pave the way to extract the full benefits of TRM.

#### REFERENCES

- [1] Amir, S. I. I., (2010). Socio-technical Assessment of Sediment Management Options in Tidal Basins in Southwestern Bangladesh. MSc thesis. Institute of Flood and Water Management, Bangladesh, University of Engineering and Technology. Available in WOTRO

- library, Irrigation and Water Engineering group, Wageningen University (arjen.zegwaard@wur.nl).
- [2] Asian Development Bank (ADB). (2007). Performance Evaluation Report: Bangladesh, Khulna-Jashore Drainage Rehabilitation Project, Operations Evaluation Department, Asian Development Bank.
- [3] BWDB. (2002). Monitoring and Integration of the Environmental and Socio-economic Impacts of Implementing the Tidal River Management Option to Solve the Problem of Drainage Congestion in KJDRP Area, Final Report, Part C: IWRM Plan, Khulna-Jashore Drainage Rehabilitation Project. ADB Loan No. 1289-BAN (SF). Bangladesh.
- [4] BDNews24. (2009). Tidal river plan could allay climate threat in southwest <https://bdnews24.com/bangladesh/2009/09/06/tidal-river-plan-could-allay-climate-threat-in-southwest>.
- [5] CEGIS. (2005). Coastal Land Use Zoning in the Southwest: Impact of Sea Level Rise on Landuse Suitability and Adaptation Options. Centre for Environment and Geographic Information Service, Dhaka.
- [6] Die, L. (2013) Tidal River Management: Temporary depoldering to mitigate drainage congestion in the southwest delta of Bangladesh M.Sc Thesis, Wageningen University, Netherlands.
- [7] Government of the People's Republic Bangladesh, National Water Policy, Dhaka, 1999.
- [8] Government of the People's Republic Bangladesh (2001), Guidelines for Participatory Water Management, Dhaka
- [9] Government of the People's Republic Bangladesh. (2002), National Water Management Action Plan, Dhaka
- [10] IWM: Institute for Water Modeling, Development Design Consultant Ltd. (2010), Feasibility Study and Detailed Engineering Design for Long Term Solution of Drainage Problems in the Bhabodaho Area Dhaka
- [11] Kibria, Z. (2011) Climate Change Adaptation and Community Based River Basin Management and in Southwest Coastal Region of Bangladesh, Uttaran, Dhaka.
- [12] Mirza, Q.M. and Ericksen, N.J. (1996). Impact of Water Control Projects on Fisheries Resources in Bangladesh. Environmental Management, Vol. 20, No. 4, pp. 523-539, Bangladesh.
- [13] Nishat, A., Nishat, B. and Khan, M. (2010). A Strategic View of Land Management Planning in Bangladesh: in Flood Risk Science and Management. Wiley-Blackwell, Oxford, UK.
- [14] Qaium, D. A. A tidal river basin management (TRM) approach for solving water logging problem of some areas in south-western Bangladesh. Water resources planning organization (WARPO), Bangladesh
- [15] Rahman, A. (1995) BeelDakatia: Environmental Consequences of a Development Disaster. Dhaka: The University Press Ltd., 175.
- [16] Rezaie, A., Islam, T. and Rouf, T., (2013). Limitations of institutional management and socio-economic barriers of Tidal River management, a semi-natural process to save Bhabodaho from water-logging problem. Advances in River Sediment Research, Taylor & Francis Group, London.
- [17] Stiefel M. and Wolfe M. (1995) A Voice for the Excluded: Popular participation in Development: Utopia or Necessity? London: Zed Books.
- [18] Tutu, A. (2005). River management in Bangladesh: a people's initiative to solve waterlogging. Coastal Development Partnership (CDP), Khulna.
- [19] Tutu, A., Masum, S., Tipu, A., Hasan, M., (2009). People's Initiative on Coastal River Basin Management to Solve Waterlogging in the Southwest Coastal Region of Bangladesh. Water for the People Network, Philippines.
- [20] Ullah, W.M. and Rahman, S. (2002). Participatory compensation mechanisms for tidal river management: an exploratory study on BeelKhukshia. Dhaka Bangladesh.
- [21] WARPO (2001). National Water Management Plan: Volume 2: Main Report. Ministry of Water Resources, Bangladesh.
- [22] World Bank. (1995). World Bank Participation Sourcebook, Environment Department Papers Participation Series Washington D.C. World Bank
- [23] Intergovernmental Panel for Climate Change (IPCC). Climate Change 2007: Impacts, Adaptation and Vulnerability. (2007). Cambridge University Press. England.
- [24] McAdam, J. and Saul, B. (2010). Displacement with Dignity: International Law and Policy Responses to Climate Change Migration and Security in Bangladesh. University of New South Wales, Australia.
- [25] Ministry of Environment and Forest (MoEF). National Adaptation Program of Action (2005), GoB, Dhaka.
- [26] Piguet, E. (2008) Climate Change and Forced Migrating. UNHCR, Geneva.
- [27] International Water Management Institute. (2012). Review of the historical evolution of policies and institutions of community based management in coastal Bangladesh. Retrieved from [https://assets.publishing.service.gov.uk/media/57a08a9ee5274a27b20006ab/LitReview\\_Historical-Analysis.pdf](https://assets.publishing.service.gov.uk/media/57a08a9ee5274a27b20006ab/LitReview_Historical-Analysis.pdf)