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Original Article

Impacts of Tipaimukh Dam on the Down-stream Region in Bangladesh: A Study on Probable EIA

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Abstract

Amidst mounting protests both at home and in lower riparian Bangladesh, India is going ahead with the plan to construct its largest and most controversial 1500 mw hydroelectric dam project on the river Barak at Tipaimukh in the Indian state Manipur. In the process, however, little regard is being paid to the short and long-term consequences on the ecosystem, biodiversity or the local people in the river's watershed and drainage of both upper and low reparian countries . This 390 m length and 162.8 m. high earthen-rock filled dam also has the potential to be one of the most destructive. In India too, people will have to suffer a lot for this mega project. The total area required for construction including submergence area is 30860 ha of which 20797 ha is forest land, 1195 ha is village land, 6160 ha is horticultural land, and 2525 ha is agricultural land. Cconstruction of the massive dam and regulate water flow of the river Barak will have long adverse effects on the river system of Surma and Kushiyara in the north-eastern region of Bangladesh which will obviously have negative impacts on ecology, environment, agriculture, bio-diversity, fisheries, socio-economy of Bangladesh. To assess the loss of Tipaimukh dam on downstream Bangladesh, an Eivironmental Impact Assessment (EIA) has been conducted based on probable affect parametes. Present study intends to depict Tipaimukh dam construction post scenerio in Bangladesh thru assessing probable loss and damage of the Tipaimukh dam construction. The most effective *Batelle* method of EIA has been applied in this study. It is found -5 scale severity impact will be imposed if the proposed dam is being construct after assessing values of each parameter. [*Journal of Science Foundation 2015;13(1):3-10*]

Keywords: Tipaimukh dam, downstream impacts, EIA, India, Bangladesh

Introduction

The rate of dam construction has been competitively increased after 1950. Every year about 600 dams are being constructing all over the world now. Among Asian countries China, India and Japan are top position in building dams. India has alrady constructed 5102 dams and its 1000 dam construction mega project is on progress. Additionally, India has taken 300 dams construction project only in Himalayan piedmont region within 2030 (ICOD 2016). Tipaimukh dam is one of them. India is going to implement this dam without prior any discussion or information sharing with Bangladesh. Large diversion project on transboundary rivers have long been a source of enormous tension between riparian states. In the 1997 UN Convention on River Course, Article 5 (1) stated that to build dams/barrages on rivers in upstream areas necessitates permission from downstream countries (ILC 1974). The environmental impacts of such projects are recognized in comparatively recent reports and documents. The report of World Commission on Dams of 2000 noted that large dams and diversion projects can led to the loss of forests and wildlife habitat, aquatic biodiversity and can affect downstream floodplains, wetlands, reveries', estuarine and adjacent marine ecosystem (World Commission on Dams. 2000).

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Whereas, according to international laws, without the consent of the downstream river nation and causing environmental damage no one country can control the multi-nation rivers alone. Previously, India has built Farakka Barrage which is known as "Barrage of death'' for Bangladesh. Similarly, the proposed project of Tipaimukh dam will emerge as an another Farakka. Because, when Bangladesh needs water for cultivation and fisheries, the dam will hold 27% more water in June, 16% in July, 14% in August and 4% in September than an average monsoon year (Rashid 2011).

If India constructs the Tipaimukh Dam like Farakka, it will be staggeringly devastating and damaging the following terrible adverse impact on the North-East part of Bangladesh. Environmental degradation, economic crisis and hydrological drought will cause irreversible damage. Suddenly, the free flowing Surma-Kushyara rivers will turn dry up remain so far a major portion of the year (Nov-May) disrupting irrigation, agriculture, drinking water supply, navigation etc. Six to seventh month's dry conditions will stop lesson recharge of ground water which over the years will lower the ground water level, affecting all dug wells, shallow tubewells, as it happened in north western region of Bangladesh as a result of drastic withdrawal of the Ganges water at Farakka. Agriculture of North Eastern region of Bangladesh will be affected seriously because of this Dam as it is hampared in North Western region by Farakka Barrage . The overall objective of this study is to find out the loss and damage might be happen in Bangladesh due to construction of Tipaimukh dam thru conducting a projected EIA. The specific objectives of this study are to assess the plausible impacts of Tipaimukh Dam on the environment and socio-economic conditions of the people of Bangladesh thru pre EIA ; to depict a real pcture of post dam construction in North Eastern region of Bangladesh and to provide recommendations and remedial measures to minimize the negative impacts of Tipaimukh Dam.

Methodology

The Study area covers a gross extent of 335,600 ha between latitude 24°56' to 24° 15' N and longitude 92°05' to 90°55'E. It extends over the districts of Sylhet, Sunamganj, Moulavibazar, Habiganj and Kishoreganj in Bangladesh. The study area is bounded by the Kushiyara-Bijna-Ratna-Sutang River system on the south, the old Surma-Dahuka River system and Jagannathpur-Sylliet road on the north, old Surma-Baulai River system on the west, and the Sylhet-Kaktai village road on the east. The area generally experiences the sub-tropical monsoon climate due to variation of its location and topography. The mean annual highest temperature is 23 °C (Aug–Oct) and average lowest temperature of 7 °C (Jan). Nearly 80% of the annual average rainfall of 3,334 mm occurs between May and September (Bennett et al., 1995).

Figure 1: Meandering flow pattern of Borak River in India

The land in the study area is generally low-lying and of low relief. The lands have formed as a result of alluvial sediment deposition on a slowly subsiding tectonic basin. Consequently, most of the area is underlain by Holocene-age alluvial, estuarine and lacustrine deposits. The study area is comprised of three main physiographic units: uplands, lowlands floodplain and flood basins (Rashid 1991). Flood basins cover about 65% of the study area. This physiographic unit is characterized by large, saucer-shaped depressions known as *haors*. The study area is dominant in haor.

Source river of Tipaimukh Dam: As the Tipaimukh dam will be built on Barak River, it is therefore rational to be acquainted with the characteristics of Barak River. The Borak is an international river that flowed over India, Myanmar and Bangladesh with a drains area is 41,723 sq. km. From its source in the Manipur Hills of India, Liyai Village of Poumai Naga tribe, the river is known as the Barak River. It flows west through Manipur State, then southwest leaving Manipur and entering Mizoram State. It enters Bangladesh and at its mouth divides into the Surma River and the Kushiyara River and passes 669 km within Bangladesh and fall to the Bay of Bengal.

Figure 2: The riparian country Bangladesh shows the falling point of Indian rivers

Tipaimukh Dam

Tipaimukh Dam is a proposed hydroelectric project, to be built on the river Barak in Manipur state India. The project has sparked off controversy as India has unilaterally planned to build the dam just 100 km off the Bangladesh border and is likely to affect two major rivers of Bangladesh, namely the Surma and the Kushiara and another 60000 Manipuri people who depend on the river for livelihood and other activities. In spite of enormous remonostration, Indian government unilaterally signed an agreement with the Indian national hydro-electric companies NHPC (National Hydroelectric Power Corporation Limited), and SJVN (Satluj Jal Vidyut Nigam Limited-SJVNL) and the Manipur State government On October 22, 2011. The government of Bangladesh was either uninformed or unaware of this massive project occurring at the world's 6th most earthquake-prone area in India directly following California, Japan, Taiwan, Mexico, and Turkey.

Technical Features

The dam envisions a 390m long and 162.8m high, across the Barak River, 500 m downstream of the confluence of the Tuivai and the Barak on the Manipur-Mizoram border. The dam will be at an altitude of about 180 m. above mean sea level with a maximum reservoir level of 178 m. this giant like dam would cost about Rs 6351 crore to biuld[7]. The dam was originally designed to contain flood waters in the lower Barak valley but hydro power generation was later incorporated into the project. The project will have an installation capacity of 1500 MW power for the national grid and a firm generation of 412 MW. The dam will permanently submerge an area of 275.50 square kilometres. The exact location of the dam is 24°1"N and 93° 1"E.

Figure 3: Location map of Tipaimukh Dam

In addition, India has a plan to constitute an even larger barrage at the Fulertal area, downstream of the dam site. The main purpose of the dam and barrages is to divert two-thirds of the water flow from the Barak River to neighboring Indian states, Assam and Kasur, for irrigation purposes. As a result, only 50 bcm of water will be available at the Meghna Basin inside Bangladesh. Bangladesh has the right to have 800 bcm of water from rivers originated in India and flowing through Bangladesh (Alam 2012).

Effects on Bangladesh

The impact due to the construction of the Tipaimukh dam is going to be multi-dimensional. If the Tipaimukh dam is put into operation, the whole North Eastern Bangladesh, especially Sylhet, Sunamganj, Moulavibazar, Habiganj, Brahmanbaria, Kishoreganj, Netrokona, Norshingdi and Narayanganj districts will have to suffer severe environmental consequences, and the people would be put to reduced circumstances. It would endanger wildlife, agriculture and freshwater fisheries in a vast area of land which would be alternately affected by worse droughts and floods in lean and wet seasons. The daily life of a vast number of people of the Meghna basin who live by fishing would be put at risk. The Geographic ecosystems will be affected if decreasing in the amount of ground water, and Sylhet forests will be severely damaged, declining production of the tea garden due to Tipaimukh dam. Therefore, 16 districts of Bangladesh to the river riparian will be desertification and 40 million people in 16 districts of the life and livelihood will break (Ahmed 2010).

Tipaimukh's Potential ecological cost on Bangladesh

If India is construct the Tipaimukh Dam, it will kill Meghna and all common rivers; will dry up Surma and Kushiara rivers in winter season; will disrupt irrigation, agriculture, drinking water supply, navigation etc.; six to seven months dry conditions will stop/lessen recharge of ground water; will destroy fisheries wildlife innumerous haors and low lying areas in the entire Sylhet division; intrusion of saline water into crop lands (Ahmed 2010); about 27,242 hectares of cultivable land will be lost (Hossain 2010); more than, 40, 00 people will be rendered landless (Kibria 2005); decline in the natural productivity of the two most abundant resources of Bangladesh – land and water (Singh 2005); dams higher than 150 m. usually have a 30% Reservoir Induced Seismicity RIS factor (Ahmed 2010); the project will totally affect 311sq area and same will be happen in downstream region like Bangladesh (Ibotombi 2005).

Environmental Impact Assessment (EIA)

To review the probable losses and damages an EIA has been conducted based on parameters which may affect due to construction of Tipaimukh dam. Among the three methods of EIA, the Batelle method has been applied in this study as it gives fruitful result for large project like dams.

The Batelle method

Batelle method was first designed for water resource development. The principle lies in splitting the environmental impacts in three major categories: ecology, physio chemical and human interest. These categories are divided into thematic data as shown:

The method follows three steps:

- First step: at this stage, the environmental indicators has been transformed into environmental quality. The notation table defines a number from 0 to 5 (0 for no change of quality and 5 for severe positive or negative). Thus it is possible to quantify evolution both in the environmental deterioration or improvement.
- Second step : a total of a 10 points (or Parameter Importance Units : PIU) are shared among the indicators by the authors of the EIA. They reflect the relative importance of each parameter.
- Third step : the comparison between the situation with and without the project is done in Environmental Impact Units (EIU). It can even reflect benefits or losses in terms of environmental conditions following the given equation.

$$EIU = \sum_{i=1}^{n} (V_i)_1 W_i - (Vi)_2 Wi$$

Where :
$(Vi)_1$ environmental quality for indicator "i" in the project conditions,
$(Vi)_2$ environmental quality for indicator "i" without the project,
w_i relative weight of the indicator "i" (PIU),
n total number of indicators.
Methods of Assessment: Changes of environmental parameters

- Severe (+5 or -5)
- Higher (+4 or -4)
- Moderate (+3 or -3)
- Low (+2 or -2)
- Very Low (+1 or -1)
- No change (0)

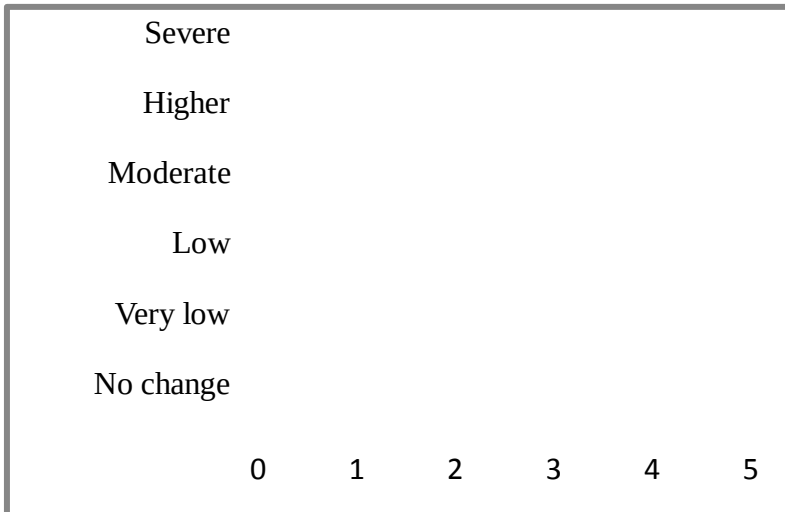

Figure 4: EIA index on proposed Tipaimukh dam

Relative importance of Environmental Parameters

- All parameters are not equal importance or weight.
- It varies from country to country

In study area: lessen river flow, loss of biodiversity, Wetland Ecosystem, agricultural production disruption, flood, earthquake risk, settlement displacement, fish production, water table declination, desertification, massive siltation, and intrusion of saline water carry more importance.

EIA Procedure
1. **Preparatory Works** – study report
2. **Data collection** – from all sources, survey
3. **Data Analysis** – convert to change scale
4. **Impact Evaluation** – relative weight
5. **Mitigation and Monitoring Plan-** to address the probable disaster (Islam 2003)

Table 1: Parameter used in EIA with importance and impact values

Environmental Parameters	Relative Importance Value	Degree of Impact	EIV
Ecological			**-21**
Biodiversity hammering	8	-3	
Wetland ecosystem	5	-3	
Fish and other aquatic lives	4	-1	
Medicinal plants	4	-1	
Vegetation	3	-1	
Avian species	2	-1	
II. **Physio-chemical**			
River flow	5	-2	
Flood frequency	5	-1	
Siltation	4	-1	
Saline intrusion	3	-1	**+16**
Regional water table down	2	-1	
Drainage Congestion	1	-1	
III. **Human Interest**			
Power generation	8	+6	
Irrigation	6	+4	
Settlement displacement	5	-1	**-5**
Earthquake risk	4	-1	
Loss of agricultural lands	4	-1	
Employment opportunities	5	+4	
Desertification	5	-1	
Landscape	2	0	
Total Environmental Impact Value			

Source: Field survey 2014 and Islam, S. EIA+LGED, IWFM, BUET, 2003

1. Ecological Loss

Action

- Loss of floral and faunal species and hampered breading, nursery and feeding of lives.
- Scarcity of water to keep reasonable wetland ecosystem.
- Reduced habitat and free movement milieu for avian species.
- Loss of environment to survive medicinal plants.
- Threat on fish culture.

Impact

- As the Tipaimukh area lays in an ecologically sensitive and topographically fragile region this dam worsen the environmental situation.
- Reduction in fish protein consumption.
- Unemployment of fisherman.
- Deteriorate socio economic status.
- Extinction of species of fish, birds, amphibians etc.

Mitigation Measures

- Law application
- Awareness building
- Monitoring enhancement
- Negotiation with stakeholder
- Searching alternative options

2. Physio chemical

Action

- Restriction of river water flow by the dam will disrupt the seasonal rhythm of the river.
- Sudden flow of water bring flood.
- Irregular pattern of water flow lead saline intrusion.
- Water table decline during lean period.
- Subsequent siltation in downstream including river bed.

Impact

- Desertification in surrounding region.
- Obstruction to navigation and plying of boat.
- Salinity hamper agricultural production.
- Sudden flood lead uncertainty of life and huge damages.
- Siltation causes vast area to barren.

Mitigation Measures

- Ensure river flow whole the year round
- Domestic law application
- Application of International protocol, convention, declaration and treaty
- Awareness build up
- Bilateral discussion and negotiation

3. Human Interests

Action

- Dam, embankments cause loss of agricultural land
- Assurance to power generation.
- Diversion of river water for irrigation purpose.
- Stored water for long time lead earthquake risk as the Tipaimukh area falls under one of the most seismically volatile regions on the planet.
- Uncertainty of flood occurrence and change of living means cause displacement of human settlement.
- Diversification in agriculture helps employment generation.

Impact

- Disparity of income among people.
- Changes of local cultural diversity and tradition.
- Increases turbidity of water.
- Risk of life increase due to natural hazard.
- Difficulty arise in agriculture farming

Mitigation Measures

- Select appropriate soils for road and embankment construction.
- Provide adequate opening for discharge of flood and accumulated rain water.

Mitigation Measures

- Plan the project to avoid fertile agricultural land.
- Rehabilitate the affected farmer and fishermen.
- Generate employment opportunities in other activities
- Provide compensation to the affected people
- Maintain equity in opening sluice gate of barrage

Prospective Estimation

It is estimated by many experts and studies that India want to build the Tipaimukh dam to hold water at large scale to will be used to generate power. In order to do this they will have to fill up the reservoir that holds 15 BCM of water, out of which about 8 BCM will be dead storage (i.e. will remain behind the dam permanently

to maintain needed pressure to run turbines). If this 8 BCM water is released over 365 days in a year then it amounts to about 17,000 cusec, which is a huge amount for the Surma-Kushiyara-Meghna rivers in dry season (Khalequzzaman 2012). As result of the dam, the flow characteristics and water release schedule will be different as compared to the flow that existed before the dam was built. No one in really knows how much water will have to be released on a daily basis for proper operation of the hydroelectric project. While the past record shows the high risk of earthquake in the surrounding area of Tipaimukh as recorded at least two major earthquakes measuring 8+ on the Richter scale in the past 50 years (Ibotombi 2005).

Conclusion

Water is the ambient natural resource that neither knows nor respects human boundaries. India unilaterally constructed the Farakka Dam and Barrages on the Western side, the Tista Dam and Barrages on the River Tista flowing into Northern part of Bangladesh, and finally, it is going to construct the giant Tipaimukh Dam and its Barrages on the rivers that flow in rest of the eastern side of Bangladesh. If India constructs this dam, it will affect the riparian country Bangladesh in many ways. It will affect the traditional life style of North-eastern Bangladeshi people as the life, livelihood, and ecosystems in haor region have established equilibrium with the natural flow of the rivers, and the farmers prepare their field in harmony with this natural flow regime. According to the 1996 Ganges Act, Article 9, unilateral use of water from joint river is prohibited, but India is not complying with this Act of Equity, Fairness, and No Harm. Also, India is not discussing the plan of the dam, exchanging scientific information and making a bilateral agreement with Bangladesh. India is contractually bound to abide by this treaty until 2026. As per the 1992 Biodiversity Convention, 1972 World Heritage Convention, and 1971 Wetland Convention, India has no right to unilateral implementation of this giant Tipaimukh Dam. No activity is legally allowed in upstream areas that causes harm to the people of downstream areas. No attempts or activities could be done that cause change or destroy climatic conditions, either in the upstream or downstream areas. The Tipaimukh Dam Project is a clear violation of the Joint River Commission between India and Bangladesh, as per international river commission acts. Now, if this natural flow regime is altered then farmers will not be able to prepare their land for boro cultivation on time, and the whole agricultural production may be jeopardised. On the other hand, if India releases way too much water in the dry season then farmers will not have access to their land since these lands will be under unusual amount of water which has been emerged in present EIA.

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