RESEARCH MONOGRAPH

ON

"Legal Mechanism of River Protection under the Statutory Provisions and its loopholes: A Critical Analysis"



SUBMITTED TO

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Date of Submission: 19 January, 2024

Declaration

I, do hereby, declare that the Research Monograph Title **"Legal Mechanism of River Protection under the Statutory Provisions and its loopholes: A Critical Analysis"** prepared solely by me and which has been submitted to the Department of Law, Sonargaon University (SU) for achieving the LLM Degree. This is an original work. No part of this research, in any way of or in from, has been submitted to any University or Institution for any Degree, Diploma or for other similar purposes.

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Abstract:

Rivers are vital natural resources that play a crucial role in the socio-economic and ecological landscape of Bangladesh. This thesis provides a comprehensive analysis of the legal mechanisms in place for river protection under statutory provisions in Bangladesh and critically examines the loopholes within this framework. The research delves into the existing legal framework governing river protection, encompassing various national and international laws, policies, and regulations. It evaluates the effectiveness of these provisions in safeguarding the country's rivers from degradation, pollution, and encroachment. Through an interdisciplinary approach, this study explores the interplay of legal, environmental, and socio-economic factors contributing to the degradation of rivers. It investigates how enforcement mechanisms, institutional capacity, and public awareness impact the implementation of river protection laws. The critical analysis reveals significant loopholes in the legal framework, including ineffective enforcement, lack of coordination among relevant authorities, and inadequate penalties for violations. These loopholes have allowed for continued river pollution and encroachment, resulting in dire consequences for the environment and community's dependent on these water bodies. This thesis aims to provide a comprehensive understanding of the legal aspects of river protection in Bangladesh and offers recommendations to address the identified shortcomings, thereby contributing to the preservation and sustainable management of the country's rivers.

Acknowledgement

I am grateful to Almighty Allah, who has been kind to complete Publish of the research paper successful. This research is based on the study under taken as a part of the Master of Laws (LLM) Course.

I am immensely thankful to my most honorable supervisor Abdul Alim, Lecturer and Coordinator, Department of Law, Sonargaon University for providing me with an opportunity to complete my research monograph on the topic **"Legal Mechanism of River Protection under the Statutory Provisions and it's loopholes: A Critical Analysis"** Last but not least, I express my special thanks to my senior brother Md. Masud Rana for the help and support extend to me during the research specially; I can mention one of my teacher **Md. Abdul Alim** who completely help me for completing this thesis paper.

Eventually, I remember my parents and I offer millions of my heartfelt thanks to Almighty who has given me strength to complete this research monograph.

Thank You.

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Chapter-I

Introduction

1.1 Introduction:

Water, a vital resource for life on Earth, faces increasing challenges due to pollution and mismanagement. Despite Earth's abundance of water, only 3% is fresh, with 2% locked in glaciers and ice. The remaining 1% in lakes and underground sources is crucial for consumption. Industrialization and population growth have strained water resources, leading to serious consequences. Developed nations have adopted advanced technologies and plans to ensure safe water, but developing countries like Bangladesh grapple with water resource problems. With 238 major rivers, Bangladesh is called a riverine country. However, sedimentation and pollution have made river water unsuitable for irrigation, pushing farmers to rely heavily on groundwater. Unfortunately, overexploitation of groundwater has led to arsenic pollution, affecting millions. Industries, often situated along riverbanks, release tons of waste daily, violating regulations and polluting water. Effluent treatment plants (ETPs) exist, but profit motives hinder their operation, making river water toxic for both aquatic life and nearby agriculture. Polluted water entering the food chain poses health risks, especially for the poor who use it for daily activities. Urban rivers, like Buriganga, Turag, Balu, and Sitalakhya near Dhaka, suffer severe pollution due to industrialization. Buriganga is termed a 'dead river,' its water resembling burnt oil during summer. Karnaphuli River, affected by Chittagong's shipbreaking industry, releases toxic liquids, oils, and iron materials into its waters, impacting agriculture in the lower basin. With a population of 162.7 million, Bangladesh faces challenges in providing food security with only 59.8% of available agricultural land.[1] High doses of inorganic fertilizers, pesticides, and illegal chemicals contaminate rivers, negatively impacting water quality. The once-rich fishing areas have been depleted due to the toxicity of agricultural chemicals. This thesis embarks on a critical analysis of the legal mechanisms governing river

[1]Ahmed, A.U. River Pollution: Concerns and Expectation. Bangladesh Environmental Lawyers Association (BELA), Dhaka, 2009, 144 pp.

protection under the statutory provisions, with a keen eye on the loopholes that undermine the efficacy of these safeguards.

Bangladesh boasts an extensive network of laws and regulations designed to safeguard its rivers, including the Bangladesh Water Act, 2013, and the Bangladesh Environmental Conservation Act, 1995. These statutes outline a comprehensive framework for river protection, encompassing pollution control, encroachment prevention, and sustainable management. However, despite these well-intentioned legislative measures, the rivers continue to face formidable challenges. Rampant encroachments, industrial pollution, and unsustainable resource extraction persist, posing a significant threat to these invaluable natural resources. The preservation of Bangladesh's rivers is not just a legal obligation but a moral imperative for the well-being of its people and environment. This critical analysis seeks to unravel the intricacies of river protection under the existing statutory provisions, offering a foundation for policy improvements and a more sustainable future for these lifelines of the nation.

1.2 Research Object:

The research object of legal mechanisms for river protection in Bangladesh encompasses a multifaceted examination of various aspects related to the country's efforts to safeguard its rivers. Here are some points to consider:

1. Legal Framework: Analyzing the existing legal framework, which includes numerous laws and policies aimed at protecting rivers, such as the Water Act, 2013, and the Bangladesh Water Development Board Act, 2000.
2. River Governance: Investigating the governance structure responsible for overseeing river management, including the roles of government agencies and local bodies.
3. Rights and Responsibilities: Assessing the rights and responsibilities of different stakeholders, including government bodies, local communities, and industries, in river protection.

4. Environmental Impact Assessment: Evaluating the role of environmental impact assessments (EIAs) in regulating development projects near rivers and their effectiveness.
5. River Pollution Control: Examining regulations and initiatives in place to control river pollution, including industrial discharges and waste management.
6. Biodiversity Conservation: Investigating the legal provisions for conserving river ecosystems and protecting the biodiversity they harbor.
7. Climate Change Adaptation: Analyzing legal measures addressing climate change impacts on rivers, such as increased flooding and salinity intrusion.
8. Dispute Resolution: Exploring mechanisms for resolving disputes related to river use and management, including water-sharing agreements with neighboring countries like India.
9. Community Participation: Studying the extent to which legal mechanisms encourage and enable community participation in river protection and management.
10. Enforcement and Compliance: Assessing the enforcement of river protection laws and the compliance of various stakeholders, including challenges and opportunities for improvement.

This research object serves as a comprehensive foundation for understanding the legal dimensions of river protection in Bangladesh and the intricacies involved in maintaining the sustainability and health of its river systems.

1.3 Research Methodology:

This is a qualitative research work. In acquiring and compiling all the necessary parts of this paper, a combination of primary and secondary sources was used in an attempt to complete this research paper. Besides to primary sources, a large number of secondary sources were utilized. These included opinion pieces released by NGOs, scholars and experts. In addition, various reports and journal articles were pulled directly from organizations' website.

1.4 Significance of the Research:

The research on legal mechanisms for river protection in Bangladesh holds immense significance. Bangladesh is a riverine country facing severe environmental challenges, such as river pollution and erosion. Effective legal mechanisms are vital for preserving these water bodies, safeguarding ecosystems, and ensuring water quality for the millions who depend on rivers. Additionally, these laws can have economic implications, as rivers are crucial for transportation and agriculture. By studying and improving the legal framework, this research can help address these pressing issues, contributing to environmental sustainability, economic development, and the overall well-being of the nation. This thesis will delve deep into the legal mechanisms in place to protect the rivers, dissecting their strengths and, more importantly, their weaknesses. Through a rigorous examination of court decisions, policy documents, and field research, we will shine a spotlight on the gaps and inadequacies within the existing legal framework. By identifying these loopholes, this study aims to contribute to the ongoing discourse on river protection in Bangladesh and provide insights for potential legal reforms.

1.5 Research Questions:

1. What are the key legal frameworks and regulations governing river protection in Bangladesh?
2. How effective is the legal system in preventing illegal encroachments and pollution of rivers in Bangladesh?
3. What are the legal challenges and obstacles in enforcing river protection laws in Bangladesh?
4. How can legal mechanisms be improved to enhance river conservation efforts in the country?
5. What is the role of international law in addressing Tran's boundary river issues in Bangladesh?

Chapter-II

Historical Background and Present Condition of River Protection

2.1 Historical Background of River Protection:

River protection has been a crucial concern in Bangladesh for centuries due to its geography dominated by an intricate network of rivers, including the Ganges, Brahmaputra, and Meghan. These waterways have played a significant role in the country's history, culture, and livelihoods, but they have also posed challenges related to flooding, erosion, and water quality. The historical background of river protection in Bangladesh is a complex and multifaceted story that spans several centuries.

Historically, rivers have been both a boon and a bane for Bangladesh. They have provided fertile land for agriculture, facilitated transportation and trade, and served as a source of livelihood for millions. However, they have also caused widespread devastation through annual monsoon floods, riverbank erosion, and salinity intrusion, affecting both urban and rural areas. Recognizing the importance of managing these rivers, river protection efforts began in ancient times.

During the Mughal period (16th to 18th centuries), there were early attempts to protect riverbanks and prevent erosion, primarily for the benefit of agriculture and trade. Irrigation systems and embankments were built, marking the inception of organized river protection efforts in the region. These initiatives laid the groundwork for future developments.

In the colonial era, British authorities continued to invest in river infrastructure, such as constructing railways and canals for improved transportation. However, their focus was more on serving imperial interests than addressing local needs. After gaining independence in 1947, East Pakistan (now Bangladesh) inherited an array of river-related issues, which escalated during the early years of nationhood.

The 1950s and 1960s saw a significant shift in river protection strategies. The government of Pakistan initiated large-scale river control and embankment projects, including the Flood Control and Irrigation Program.[2]

[2] Ahmed, A.U. River Pollution: Concerns and Expectation. Bangladesh Environmental Lawyers Association (BELA), Dhaka, 2009, 144 pp.

These projects aimed to mitigate the annual flooding that plagued the region. The 1960 Indus Water Treaty with India also had implications for river management in Bangladesh.

The most transformative event in the history of river protection in Bangladesh was the devastating Bhola cyclone of 1970, which brought to the forefront the need for comprehensive river management. The cyclone, along with the War of Independence in 1971, prompted the new nation to prioritize river control and development.

The 1970s and 1980s witnessed an emphasis on constructing embankments, drainage systems, and river training works to reduce flooding and erosion. The Flood Action Plan (FAP), introduced in the late 1980s, was one of the most ambitious river protection projects, encompassing structural and non-structural measures to tackle the perennial flood problem.

In recent decades, the focus has shifted towards integrated water resource management, incorporating environmental sustainability and community participation. The River Basin Management Approach has become a key component of river protection efforts, aiming to balance the needs of agriculture, industry, and the environment.

Despite these efforts, challenges persist. Climate change has intensified the threats posed by rivers, leading to increased flood risks, sea-level rise, and water scarcity. Political, institutional, and budgetary constraints have also hampered the effectiveness of river protection measures.

The historical background of river protection in Bangladesh is a tale of continuous adaptation and evolution. From ancient Mughal initiatives to the modern River Basin Management Approach, the country has been striving to strike a balance between harnessing the benefits of its rivers and mitigating their risks. River management remains a dynamic and evolving challenge that requires innovative solutions and a sustainable approach in the face of changing climatic conditions.

2.2 Present picture of River Protection in Bangladesh:

River protection in Bangladesh is a critical and multifaceted issue that has garnered significant attention over the years. The country, known as the "land of rivers," is crisscrossed by a vast network of water bodies, making river protection a matter of utmost importance for both ecological and socioeconomic reasons. However, the picture of river protection in Bangladesh is complex, with several challenges and initiatives at play.

Challenges:

1. **River Pollution:** One of the most pressing issues is river pollution. Rivers in Bangladesh suffer from pollution caused by industrial discharge, sewage, and the rampant use of plastic. The contamination of rivers like the Buriganga and Turag has reached alarming levels, posing a severe threat to aquatic life and public health.

2. **Encroachment:** Rivers and their banks have been encroached upon, often for construction and agriculture. Unauthorized land grabs and illegal developments on riverbanks have reduced the river's capacity to carry water, leading to increased instances of flooding during the monsoon season.

3. **Siltation**: Bangladesh's rivers carry enormous amounts of sediment, resulting in siltation. This reduces the navigability of the rivers and can lead to increased vulnerability to erosion, which displaces communities living along riverbanks.

4. **Erosion**: Riverbank erosion is a perpetual challenge, with communities along the banks constantly at risk of losing their homes and land to the river's erosive forces. The impact of climate change has exacerbated this problem, leading to greater uncertainty and suffering.

Initiatives and Solutions:

1. **Riverbank Protection:** The government and various non-governmental organizations (NGOs) have implemented riverbank protection projects. These initiatives involve constructing embankments and installing erosion-resistant materials to mitigate the effects of erosion and flooding.

2. **Regulation and Enforcement:** Efforts to regulate industrial pollution have been strengthened in recent years. The government has initiated stricter environmental laws and regulations to combat pollution and illegal encroachment.

3. **River Conservation Movements:** Civil society and environmental organizations in Bangladesh have played a crucial role in raising awareness about river protection. Movements such as "Save the Rivers" have mobilized citizens to demand cleaner and safer rivers.

4. **Dredging and Waterway Management:** Dredging operations are being carried out to maintain navigability of major rivers, enhancing transportation and trade. The government has also been working on improving waterway management to reduce the risk of riverbank erosion.

5. **Rural Livelihoods**: Initiatives promoting sustainable rural livelihoods, such as aquaculture and sustainable agriculture practices, aim to reduce pressure on rivers by providing alternative income sources for communities dependent on rivers for their livelihoods.

The picture of river protection in Bangladesh is a mixed one. While significant challenges like pollution, encroachment, and erosion persist, the government and various stakeholders are actively engaged in addressing these issues. Efforts to regulate, protect, and restore the country's vital river systems are ongoing, with a growing awareness of the importance of these efforts for both environmental sustainability and the well-being of the Bangladeshi people. However, continued commitment, investment, and community involvement are essential to achieving lasting improvements in river protection in Bangladesh.

Chapter-III

Major Rivers Pollution in Bangladesh

3.1 Major Rivers in Bangladesh:

Bangladesh, primarily a river-centric nation with around 700 rivers and tributaries, relies heavily on its waterways for sustenance. Originating from India, these rivers traverse the country, culminating in the Bay of Bengal. Vital for fish, agriculture, and transportation, these water bodies annually deposit fertile silt, enhancing agricultural productivity. Despite contributing to settlement expansion, riverbank erosion poses a significant current challenge. Moreover, sedimentation leads to flash floods in the rainy season, adversely affecting agriculture, settlements, and lives. Rivers covered about 24140 km of total length and consisting several streams, canals, lakes, khals, beels and haors. Seasonal variation of temperature and rainfall truly make the river and tributaries magnificent. Arial Khan, Bangshi, Bhairab, Buriganga, Chitra, Dhaleshwari, Karatoya, Atrai, Karnaphuli, Kobadak, Purnarbhaba, Rupsa, Pasur and Tista are some river name in Bangladesh. However, four major river systems covered the whole country-a) Brahmaputra-Jomuna, b) Ganges-Padma, c) Surma- Meghna and d) Chittagong river system. Other rivers are tributaries and distributaries of this four major river system in Bangladesh.[3]

[3] Urban river pollution in Bangladesh during last 40 years: potential public

Health and ecological risk, present policy, and future prospects toward smart

Water management: Md. Jamal Uddin,*, Yeon-Koo Jeong

3.1.1. Sources of Water Pollution in Bangladesh:

The substantial growth of industrialization raises significant concerns about environmental pollution across various sectors, profoundly impacting both the environment and public health. Notably, the tannery industry generates around 20,000 m3 of liquid waste and 232 tons of solid waste daily. According to the Department of Environment (DoE), the textile industry produced 217 million cubic meters of wastewater in 2016, expected to surge to 349

Million cubic meters by 2021. Major contributors to water pollution include dyeing, leather, sugar, pulp, and paper industries.

Industries reliant on non-renewable local resources, like cement and fertilizer factories utilizing mineral resources, contribute significantly to pollution. Imported resource-based industries such as textiles, pharmaceuticals, plastics, petroleum, and metalwork's are also identified as major polluters. Open field dumping is the prevalent method for solid and liquid waste treatment, with liquid waste discharged into drains, canals, and rivers, creating a severe environmental burden

In agriculture, illiterate farmers employ excessive agrochemicals, leading to water pollution and health hazards as these chemicals are washed into surface water. Household, hospital, market, and industrial wastes are often disposed of in open fields, with aerobic and anaerobic decomposition occurring, especially during the rainy season, exacerbating pollution in water bodies Furthermore, river pollution is exacerbated by waste disposal from water vehicles, accidents releasing toxic liquids, and the direct dumping of organic waste products from markets and bazars into river waters.

Air pollution in Bangladesh ranks among the highest globally, with atmospheric deposition of toxic metals impacting agricultural fields and surface water. Urban rivers receive substantial amounts of metals through atmospheric deposition annually. The presence of heavy metals in roadside sediments and the accumulation of toxic metals in crops grown in urban roadside areas further contribute to environmental challenges.

Moreover, the proliferation of brick fields, particularly those established on riverbanks, significantly contributes to river pollution.

The presence of geologically formed radioactive elements in soil, sand, and sediment ads to the complexity of environmental concerns. In southern coastal regions, water and sediments containing elevated concentrations of toxic materials, combined with local pollutants, intensify river water pollution, posing a serious contemporary challenge.

3.2 River pollution in Bangladesh:

3.2.1. Rivers surrounding the capital city, Dhaka:

The rapid industrial growth in Bangladesh, particularly in Dhaka City, has led to a substantial increase in the use of chemical materials, resulting in elevated emissions of organic and inorganic substances into air, water, and soil. With over 16 million people, Dhaka City faces severe pollution challenges, exacerbated by the concentration of more than 7000 industries along major rivers. The Buriganga River and its linked rivers receive approximately 60,000 m^3/day of toxic wastes from major industrial clusters, notably Hazaribagh tanneries. Bangladesh Poribesh Andolon reported daily dumping of 6000 tons of liquid waste into the Buriganga, with household pipelines contributing to river pollution. Additionally, water vehicles further degrade the rivers. The situation underscores the urgent need for environmental management and sustainable industrial practices in addressing the escalating pollution issues in Bangladesh.

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3.2.1.1 Buriganga River Pollution:

The Buriganga River faces severe pollution during the dry season, with water resembling burned engine gasoline. Physicochemical characteristics surpass WHO standards, and dissolved oxygen dropped from 2 mg/L in 2000 to zero in 2019. Biochemical oxygen demand, total dissolved solids, and chemical oxygen demand fluctuate, possibly due to varied factors. Extreme pollution events, notably with Pb, Cd, and Cr, occur, making the water toxic. Sediment samples reveal elevated toxic metal concentrations, linked to organic material settling. Fish exhibit higher metal levels, posing health risks. Limited research focuses on organic pollutants, necessitating urgent comprehensive analysis for effective water management. The river's peril threatens people, flora, and fauna, as confirmed by multiple indices indicating high heavy metal pollution. Akbor et al. (2020) emphasized the river's high pollution levels through various indices.

3.2.1.2: Turag River Pollution:

The Turag River, located northwest of Dhaka city, faces severe pollution from untreated industrial effluents, agricultural runoff, and slum sewage. Textile industries and farming practices contribute to the contamination, impacting water quality and causing ecological distress. Declared ecologically critical in 2009, the river poses health risks as crops, fish, and rice grown in the area contain toxic metals. The water appears dark black with a foul smell in the dry season. PH imbalances, low dissolved oxygen levels, and elevated levels of BOD, COD, TDS, and metals further emphasize the river's hazardous condition, posing threats to both aquatic life and human well-being.

3.2.1.3. Balu River Pollution:

The Balu River, a tributary of the Sitalakhya River, faces severe pollution due to industrial discharges, municipal waste, and agricultural runoff. Connected to Turag River through Tongi Khal, it has become ecologically critical, marked by extremely low dissolved oxygen levels. Industries like textiles, pharmaceuticals, and metals contribute to high concentrations of pollutants such as TDS, BOD, COD, and metals. Tejgoan-Rampura Khal, Tongi Khal, and Norai Khal transport significant pollutant loads into Balu River.

Sediment pollutant concentrations exceed USEPA standards, affecting crops dependent on river water for irrigation. The river's ecological state has prompted environmental concern since 2009.

3.2.1.4. Sitalakhya River Pollution:

The Sitalakhya River, originating from the old Brahmaputra River in Bangladesh, is vital for various purposes like cooking, drinking, and industrial use. Flowing across Dhaka, it receives water from Balu and Dhaleshwari Rivers, with industries impacting its quality, particularly in Narayanganj. Water transport connects Chandpur and Chittagong, but pollution is a significant issue. Dissolved oxygen near zero during dry seasons, elevated concentrations of pollutants like Cu, Ni, Cr, as, and Fe pose health risks. The drinking water treatment plant faces challenges due to river pollution. Sediment heavy metal levels exceed safety limits, emphasizing potential health hazards through water, fish, and crops.

3.2.1.5. Dhaleshwari River Pollution:

The Dhaleshwari River, a distributary of the Jamuna River, faces increased pollution from the upper Buriganga River, carrying it downstream into the Sitalakhya River before merging with the Meghna River. Split into two branches, Kaliganga and Dhaleshwari, which converge in Manikganj, this river flows through central Bangladesh. Notably, elevated concentrations of Cr in the water exceed FAO irrigation standards, and sediment samples reveal levels of Cr, Ni, Cu, Pb, and Cd surpassing US EPA thresholds.

3.2.1.6. Meghan River Pollution:

Meghna River, a vital part of the Ganges Delta, supports Bangladesh's agriculture and fishery. However, industrial and urban influences have severely polluted its waters. High concentrations of metals like Fe, Cr, Mn, Ni, and Cd surpass WHO drinking water limits, impacting both water and sediment quality. Similar issues affect Buriganga, Turag, Balu, and Sitalakhya Rivers, declared ecologically critical. Dhaka's water supply, relying on both surface and groundwater, faces contamination, affecting 78% of residents.

Existing research primarily focuses on conventional parameters, neglecting microbial, organic, and pharmaceutical pollutant analyses. Urgent attention is needed to address comprehensive water quality concerns in these critical river systems.

3.2.2. Rivers affected by port city, Chittagong:

3.2.2.1. Karnaphuli River Pollution:

The Karnaphuli River, a major waterway in Bangladesh's Chittagong region, plays a crucial role in national and international trade. Unfortunately, it faces severe pollution from various industries, impacting water quality for household use, irrigation, and industry. Activities like ship breaking contribute to elevated concentrations of contaminants, rendering the river unsafe for consumption and endangering flora and fauna. Research indicates deviations from recommended standards for physicochemical characteristics, with increasing BOD and COD levels. The presence of metals, including U, Pb, Ni, Hg, Cu, Cr, and Cd, in the river and coastal areas highlights persistent pollution 'hotspots.' Moreover, sediment analysis reveals exceeding safe limits for Fe and MN concentrations. Efforts are needed to address and mitigate the ongoing environmental challenges in the Karnaphuli River.

3.2.3. River pollution in Northern Area of Bangladesh:

Korotoa, Teesta, Atrai, and Padma Rivers face contamination from various urban and agricultural activities. Korotoa River exhibits elevated levels of Cr, Cd, Pb, Mn, Ni, and Fe in water, surpassing WHO drinking water standards and FAO irrigation limits. Sediment analysis indicates significant contamination, particularly for Pb, Cd, and Cr. Anthropogenic activities such as textile and steel industries, leaded gasoline, and waste disposal contribute to pollution. Teesta River, originating in Sikkim, India, and flowing through northern cities, experiences heavy metal concentrations exceeding recommended limits. Positive matrix factorization identifies sources of pollutants, revealing agricultural, industrial, anthropogenic, and mixed sources. Teesta River is heavily polluted, with elevated cancer risk due to radioactive elements. Padma River, near Rajshahi city, contends with pollution from drains, deforestation, waste dumping, and agricultural runoff. Water quality issues persist through its course, impacting public health. Research in 2018 identified high coliform and Vibrio cholera counts during the summer.

Analysis of fish species in Padma River highlights health risks from continuous consumption. Overall, these water bodies face diverse pollution sources, necessitating strategic interventions for environmental preservation.

3.2.4. Rivers Pollution in the Southern Area of Bangladesh:

The lower basin of the Meghna River, along with the Kirtankhola and Rupsa Rivers, faces significant challenges from unplanned urbanization and industrialization along the riverbanks. Saline water intrusion during the rainy season, exacerbated by natural disasters like Aila, Sidr, and Fani, has become a recurrent issue, affecting agriculture and households in the region. Kirtankhola River, particularly in Barisal city, is grappling with elevated pollution levels due to untreated household water, industrial effluents, and substantial organic loads discharged directly into the river. Improper management of sensitive waste from hospitals and the city corporation further compounds the environmental impact. The absence of adequate waste management exacerbates the issue, leading to pollutant influx into Kirtankhola River during the rainy season.

Similar pollution problems are observed in Rupsha River in Khulna and Padma River in Rajshahi. Industries such as brick kilns, cement, pharmaceuticals, textiles, and water vehicles continuously contribute to pollution in Kirtankhola River. An assessment by Anjuman Ara Rajonee in 2017 revealed that water quality parameters like electrical conductivity, total suspended solids, turbidity, nitrate, and phosphate concentrations exceeded permissible standards for drinking water.

Groundwater quality in the Barisal area is significantly impacted by saline surface water, with arsenic posing a natural hazard. Limited research data on metals and other pollutants complicates the assessment of Kirtankhola River water quality.

Rupsha River, a tributary of the Ganges, faces pollution challenges with elevated nitrate concentrations above recommended limits for irrigation. Research data indicates higher than recommended levels of metals such as Fe, Pb, Cr, MN, and Ni in the river, originating from waste in Khulna city and anthropogenic activities. Groundwater in Khulna, containing elevated natural arsenic, compels villagers to rely on surface water for various purposes, potentially exposing them to pollution.

Furthermore, shrimp cultivation in Khulna contributes to pollution, with sediments in Rupsha River containing concentrations of Zn, Cu, Pb, Cd, As, Cr, and Ni exceeding recommended thresholds. This points to a pressing need for comprehensive pollution control measures to safeguard the ecological balance and the well-being of communities in these vulnerable regions.

Chapter-IV

Root causes & Consequences of River Pollution

There are many causes of river pollution in Bangladesh. The following explain:

4.1 Causes of River Pollution in Bangladesh:

River pollution and changes in river paths in Bangladesh are complex issues driven by a combination of natural and human-induced factors. Here, we'll discuss the root causes of river pollution and the phenomenon of river path changes in Bangladesh.

Root Causes of River Pollution:

1. **Industrial Discharge:** One major cause of river pollution in Bangladesh is the untreated discharge of industrial effluents containing heavy metals, chemicals, and toxins into rivers. In the realm of industrial development in Bangladesh, a predominant concern emerges along the banks of rivers, where industrial nodes are situated. These nodes witness a concerning practice: industrial units, particularly in sectors like textiles, paper and pulp, chemicals/pharmaceuticals, food processing, cement, and leather tanning, discharge their effluents directly into rivers and adjacent water bodies, devoid of any treatment. This unwarranted release of pollutants severely contaminates water sources, notably impacting rivers such as Buriganga, Balu, Turag, and Sitalakhya in central Bangladesh. Their water quality reaches a state of degradation, rendering them entirely unfit for domestic use, especially during the dry season. Recognizing the urgency of this issue, the National Water Policy 1999, Environment Conservation Act 1995, and Environment Conservation Rules 1997 of Bangladesh underscore the critical challenge of effluent discharge, providing broad guidelines to mitigate water pollution stemming from industrial activities.

2. Agricultural Runoff: The excessive use of fertilizers and pesticides in agriculture results in the runoff of harmful chemicals into river[4]

[4] Hague, M.I. Water Resources Management in Bangladesh. Anushilan, Dhaka-1205 and Chuadanga- 7200, 2008, 542pp.

3. **Sewage and Wastewater:** Inadequate sewage treatment facilities lead to the direct discharge of untreated sewage into rivers, introducing pathogens and organic pollutants.
4. **Population Density:** High population density along riverbanks results in increased waste generation and pollution.
5. **Deforestation:** Deforestation in river basins contributes to soil erosion, which leads to increased sedimentation in rivers.

6. **Climate Change:** Altered precipitation patterns and increased temperatures impact river ecosystems, leading to changes in water quality and aquatic life.
7. **Erosion:** Natural riverbank erosion displaces settlements, causing riverbanks to be used for waste disposal.
8. **Overfishing:** Overfishing disrupts the balance of river ecosystems and can lead to a decline in fish populations.
9. **Sand Mining:** Unregulated sand mining disrupts riverbeds and banks, causing erosion and habitat destruction.
10. **Lack of Awareness:** Limited awareness among the public about the importance of clean rivers contributes to pollution.
11. **Groundwater Pollution:** Groundwater in Bangladesh is also polluted by a number of anthropogenic and natural sources. The most widespread anthropogenic sources are the infiltration of industrial and urban wastes disposed on the ground or in surface water bodies. Also intrusion or infiltration of saline water contaminates groundwater. The arsenic contamination of ground water has become a major disaster for Bangladesh. About 80 million peoples are at a risk of arsenic contamination.

4.2 Change of River Paths:

1. **Sediment Deposition:** Rivers in Bangladesh carry a heavy sediment load, leading to frequent changes in their courses due to sediment deposition.

2. Floods: Seasonal monsoon floods often cause river path shifts as rivers overflow and change their course.

3. Erosion: Riverbank erosion displaces communities, making it necessary for rivers to find new paths.

4. Deforestation: Deforestation in the upper catchment areas accelerates soil erosion, causing increased sediment deposition and changes in river paths.

5. Human Interventions: Human activities such as embankment construction and river channelization can unintentionally alter river paths.

6. Climate Change: Altered rainfall patterns and increased flooding due to climate change can lead to more frequent river path changes.

7. **Siltation:** Increased siltation due to erosion further contributes to the changing course of rivers.

8. Lack of River Management: Insufficient river management practices contribute to the instability of river paths.

Addressing these issues requires a multifaceted approach, including stricter industrial regulations, improved sewage treatment, sustainable agriculture practices, afforestation, public awareness campaigns, and sound river management strategies. In addition, climate change mitigation and adaptation measures are crucial for the long-term sustainability of Bangladesh's rivers and the communities that depend on them.

4.3 Consequences of River Pollution:

River pollution in Bangladesh has far-reaching and severe consequences that affect both the environment and the population in real and tangible ways. The country's extensive river system, including the Ganges (Padma), Brahmaputra (Jamuna), and Meghan, is the lifeblood of Bangladesh, providing water for drinking, irrigation, transportation, and fishing. However, due to industrialization, urbanization, and lax environmental regulations, these vital waterways are under constant threat of pollution. In this article, we will explore the dire consequences of river pollution in Bangladesh.

First and foremost, river pollution in Bangladesh poses a significant threat to public health. Millions of people rely on these rivers for their daily water needs, including drinking, cooking, and bathing. Contaminated water, filled with heavy metals, chemicals, and pathogens, leads to the spread of waterborne diseases such as cholera, dysentery, and typhoid.

This results in a high incidence of illnesses and can overwhelm the already strained healthcare system.

Furthermore, river pollution adversely affects the aquatic ecosystem. The rivers of Bangladesh are home to a diverse range of fish species, many of which are vital sources of protein for the population. Polluted water disrupts the natural habitat and food chain of these fish, leading to a decline in fish populations and threatening the livelihoods of millions of fishermen. Additionally, the presence of toxic chemicals can accumulate in fish, making them unsafe for consumption, further endangering public health.

The contamination of rivers also harms agriculture, a cornerstone of Bangladesh's economy. Farmers rely on river water for irrigation, and polluted water can damage crops, reducing agricultural yields and increasing the cost of production. This, in turn, raises food prices and exacerbates issues of food security and economic inequality.

River pollution is also a major contributor to soil degradation. When polluted water is used for irrigation, it introduces harmful chemicals and heavy metals into the soil, making it less fertile and reducing its long-term productivity. Soil degradation can lead to desertification and land loss, forcing farmers to migrate or seek alternative sources of income.[5]

In addition to affecting human health and the environment, river pollution hampers transportation and trade in Bangladesh. The country's rivers serve as crucial arteries for the movement of goods and people. However, when waterways are polluted, it becomes difficult for boats and ships to navigate. This results in transportation delays and increased costs, negatively impacting the economy.

Moreover, river pollution contributes to climate change. The dumping of industrial waste and sewage into rivers releases greenhouse gases, such as methane, into the atmosphere. These gases trap heat, leading to global warming and more extreme weather events, which can cause flooding and damage to communities along the riverbanks.

The consequences of river pollution in Bangladesh are not limited to domestic issues. It also has Tran’s boundary implications, affecting neighboring countries. For example, the pollution

[5] Islam, M.A. Water Governance in Drought-prone Barind Area, Bangladesh: Challenges of Sustainable Development. PhD Thesis, Institute of Bangladesh Studies (IBS), University of Rajshahi, Bangladesh, 2017.

of the Brahmaputra River has raised concerns in India and China due to its impact on downstream water quality and agriculture.

In conclusion, river pollution in Bangladesh is a grave and multifaceted problem with real and far-reaching consequences. It affects public health, the environment, agriculture, transportation, and the economy. Addressing this issue requires concerted efforts from the government, industries, and the international community to implement and enforce strict environmental regulations, invest in clean water infrastructure, and promote sustainable practices to protect the vital rivers of Bangladesh and safeguard the well-being of its people.

Chapter: V

Water Pollution Control and Future Challenges:

5.1 Water Pollution Control in Bangladesh:

In Bangladesh, various legislative measures have been implemented to combat environmental pollution. The Environment Pollution Control Ordinance 1977, Bangladesh Environment Policy 1992, Environmental Conservation Act 1995 (with multiple amendments), and Environmental Conservation Rules 1997 (also subject to amendments) constitute a comprehensive legal framework. Additionally, National Policy for Safe Water Supply & Sanitation 1998, National Water Policy 1999, Bangladesh Environment Court Act 2000, and National Policy for Mitigation 2004, Environment Court Act 2010, Climate Change Trust Act 2010, and Bangladesh Water Act 2013 play crucial roles.

The Department of Environment, established by the government, spearheads efforts in line with the Environmental Conservation Act 1995. This department, led by a Director General, oversees all activities related to environmental pollution. The Ministry of Water Resources and the Ministry of Environment, Forest and Climate Change are pivotal government bodies responsible for environmental protection and development decisions. The Centre for Environmental and Geographic Information Services (CEGIS) was instituted with the aim of achieving a green environment, clean water, and balanced development for the nation's well-being. The Water Supply and Sewerage Authority (WASA) holds a significant role in controlling surface water pollution in cities, with offices in major urban centers dedicated to water supply and management.

In 2009, Channel-i and a prominent English daily newspaper initiated a campaign titled 'To the Prime Minister: Save Rivers, Save Dhaka,' highlighting the critical pollution situation in four rivers around Dhaka. Despite immediate responses from authorities, the impact of the campaign was limited. In 2019, recognizing the urgency, the High Court declared rivers as "legal entities" with similar rights as living beings. A river protection commission was appointed, leading to orders for the Water Supply and Sewerage Authority (DWASA) to cease all sewerage lines contaminating river water.

Furthermore, the High Court directed the Department of Environment to take necessary actions against pollution. The Department of Environment is currently striving to control and manage river pollution. However, research indicates that the water quality in major urban rivers is not conducive to human health and ecological well-being.[6]

In summary, Bangladesh has implemented a comprehensive legal framework to address environmental pollution, with various acts, policies, and authorities in place. Despite concerted efforts, challenges persist, particularly in urban river pollution. The High Court's intervention and the declaration of rivers as "legal entities" mark significant steps towards environmental protection, but ongoing research emphasizes the need for further improvements in water quality for the well-being of both humans and the ecosystem.

5.2 Future Challenges and Measures for Smart Water Management in Bangladesh:

In Bangladesh, the impending water crisis necessitates urgent and SMART water management strategies. With a population increase from 76.2 million in 1974 to 149.77 million in 2011, and projections reaching 202 million by 2050, the demand for water is escalating. Groundwater depletion and contamination pose significant challenges, while river pollution further exacerbates the situation. The Buriganga, Turag, Balu, Sitalakhya, Karnaphuli, Rupsha, Teesta, Korotoa, and Meghna rivers face alarming pollution levels. This jeopardizes their viability as a primary water source for the nation. Groundwater, a prevalent source for drinking, irrigation, and industrial needs, is already compromised. The confluence of geological and anthropogenic contaminants contributes to river water pollution, necessitating immediate attention.[7]The adverse impact on human health is evident, with diseases ranging from obesity and fever to cancer linked to waterborne contaminants. Toxicity analysis on foodstuffs and river fish

[6] Www.cel.com/heliyon.

[7] Arefin, M.A. and Mallik, A. Sources and causes of water pollution in Bangladesh: A technical overview. BIBECHANA. 2017. 15: 97-112.

indicates potential health risks. The projected water demand for 2030, expected to be 40% higher than available supply, underscores the urgency of transitioning from groundwater to river water for sustainable water management.

To address this, strict regulations and monitoring are imperative. Prioritizing contaminant-specific research can unveil accumulation pathways, ensuring effective management of elements and compounds affecting human health and ecology. Government initiatives must focus on building awareness and fostering public trust in surface water safety.

Implementing unmanned automatic river water quality measuring stations along waterways, controlled by a central monitoring system, can mitigate pollution risks. Utilizing SCADA (Supervisory Control and Data Acquisition) systems, alongside various software and programming models, enhances river water quality monitoring and measurement. Additionally, the sharing of public and private research data can provide a more accurate assessment of safe water quality management.

Emphasizing river water as a natural reservoir for rainfall and groundwater recharge is crucial for a sustainable solution. A comprehensive approach, combining regulatory measures, advanced monitoring technologies, and public awareness campaigns, can pave the way for SMART water management. By shifting reliance from groundwater to river water, Bangladesh can address its growing water demand while safeguarding human health and ecological balance.

In summary, Bangladesh stands at a critical juncture where proactive measures are essential to avert a severe water crisis. SMART water management, encompassing stringent regulations, advanced monitoring systems, and public awareness, is the key to ensuring a sustainable water supply for the future. The nation's riverine landscape and fertile lands can be harnessed effectively to overcome the impending challenges and secure the well-being of its population and environment.[8]

[8] Smith, A.H., Lingas, E.O. and Rahman, M. Contamination .of drinking-water by arsenic in Bangladesh: a public health emergency', Bulletin of the World Health Organization [Online] [Accessed 20 April 2017]

Chapter-VI

Legal Mechanism of River Protection and its loopholes:

Legal mechanisms for River Protection in Bangladesh Can be divided into three parts. These are:

1. Constitutional Obligation.
2. Domestic Laws.
3. Internal Laws and Treaties.

These are discussed below:

6.1: Constitutional Obligation:

The Constitution of Bangladesh is the supreme of law of the country. Its added Article 18A by the fifteenth amendment in 2011. It is very important for environment, biodiversity and wetlands. Article-18A of the Constitution discuss about the **Protection and improvement of environment and biodiversity**. It says that the State shall endeavor to protect and improve the environment and to preserve and safeguard the natural resources, bio-diversity, wetlands, forests and wild life for the present and future citizens.[9]

6.2: Domestic Laws:

Recent High Court rulings granting legal rights to rivers, declaring them "legal person". Rivers are integral to Bangladesh's identity. Prioritizing their health requires a dual approach: adopting international conventions and developing stringent national laws. Educating the public, enforcing existing bans, and empowering organizations like the National River Conservation Commission are pivotal steps toward sustainable river management.

[9] The Constitution of the people's Republic of Bangladesh, 1972

The National Water Policy (NWPO) adopted by the Ministry of Environment and Forests (MOEF) outlines key principles guiding water planning and utilization in pursuit of national objectives, including population welfare and environmental preservation.

Although the Constitution of Bangladesh does not explicitly guarantee the right to a healthy environment,

The judiciary, interpreting the constitutional 'right to life,' has expansively construed it to encompass a safe and healthy environment.

Bangladesh has enacted policies and legislation, evolving from the East Pakistan Water Pollution Control Ordinance 1970 to the Bangladesh Environment Conservation Act 1995, to address water pollution concerns. Despite these legal frameworks, challenges persist in implementation due to inadequate provisions and institutional weaknesses. The MoEF, established in 1989, plays a pivotal role, yet the Department of Environment's enforcement efforts often manifest as limited cautionary measures.

The Ministry of Water Resources (MOWR) and its implementing body, the Bangladesh Water Development Board (BWDB), spearhead water resource development and management. The Water Act 2013 designates the Water Resources Planning Organization (WARPO) for national water planning, legislation formulation, and data system maintenance.

The National Environment Policy (NEP), initiated in 1992, underscores the importance of aligning with international agreements. Notwithstanding the legal landscape, the efficacy of measures against inland water pollution hinges on bolstering legal provisions and strengthening institutional capacities, ensuring the harmonious integration of policies across relevant ministries.

Some river related laws in Bangladesh:

1. **The Water Resource Planning Act, 1992:** The Water Resource Planning Act of 1992, passed on January 30th, aimed to foster the development and equitable utilization of water resources.[10] Sections 3 and 4 mandated the establishment of

[10] The Water Resource Planning Act, 1992

the Water Resource Planning Organization, headquartered in Dhaka. Section 7 delineated the organization's primary functions, including the formulation of plans for water resource development and the creation of a national policy for the scientific use and preservation of water resources. Notably, this legislation superseded the Water Resource Planning Ordinance of 1991, consolidating efforts to ensure effective water resource management and sustainability.

2. **The Territorial Water and Maritime Zones Act 1974:** The Territorial Water and Maritime Zones Act of 1974, specifically Section 6 on the Conservation Zone, empowers the government to declare such zones in marine waters.[11] While the legislation effectively addresses territorial waters, contiguous zones, economic zones, conservation zones, continental shelves, and pollution control, it lacks explicit provisions for voice and choice, gender issues, civil society participation, corruption prevention, as well as transparency and accountability. There is a need for an amendment to incorporate these crucial elements, ensuring a more comprehensive and inclusive approach to marine governance, aligning with contemporary principles of governance and sustainable development.
3. **The Agricultural Pests Ordinance, 1962:** The Agricultural Pests Ordinance, 1962, aimed to curb agricultural pests in Bangladesh. It defines "agricultural pest," "crops," and "Inspector."[12] The government can restrict cultivation methods and crop transport/sale to control pest spread. Land occupiers must follow prescribed preventive measures. Violating section 3 incurs fines or imprisonment. Notably, it lacks provisions for community consultation and lacks coordination with the Environment Conservation Act 1995, which addresses environmental pollution. Despite its pest control focus, the ordinance shows a limited scope regarding broader environmental concerns and lacks alignment with subsequent environmental legislation.

[11] The Territorial Water and Maritime Zones Act 1974
[12] The Agricultural Pests Ordinance, 1962

4. **Bangladesh Environment Conservation (ECA) Act, 1995 (Amended in 2010):** The Bangladesh Environmental Conservation Act of 1995, amended in 2010, focuses on preserving and enhancing environmental quality by regulating and mitigating pollution. Empowered by Section 4(3), the Director General can issue directives, including closure, prohibition, or regulation of industries, reinforcing the commitment to environmental preservation and standards.

5. Section 6A discuss about the prohibition of production and use of plastic and polythene. The section (6A) provides, If the Government, the Director General's advice or otherwise agrees that all or any other type of polyethylene shopping bag, or any other product or any other product made of polyethylene or polypropylene, is harmful to the environment, by notification in the official Gazette, all over the country. Or to produce, import, market, sell, display for sale, store, distribute, trade in such particular area A purpose of transportation or used for commercial purposes are to stop or notification, subject to the conditions of those operations or management issued instructions may be such to comply with all relevant persons shall be bound to: Provided that such instructions the following shall apply, namely: (A) If the goods described in the notification are exported or used for export purposes;(B) The instruction shall not apply to a specific polythene shopping bag unless the same is mentioned in the notice.[13]

6. **Water Supply and Sewerage Authority Act, 1996:** Water Supply and Sewerage Authority Act, 1996 was enacted to develop water supply and sanitation system and to deliver water supply, sewerage and storm water drainage services.[14] It provides for autonomous corporate management structures

[13] https://lawyersclubbangladesh.com/en/2020/11/14/a-legal-discussion-on-river-pollution-in-bangladesh/

[14] Water Supply and Sewerage Authority Act, 1996

of Water Supply and Sewerage Authority (WASAs) which are answerable to their respective Boards of Directors representing a range of stakeholders. No person can abstract, treat, pump, preserve or supply of water or construct sewerage, pumping and treatment plant within its jurisdiction. But the authority is not at all concerned about the industrial effluents. Matter of ensuring water quality has been neglected in this act. There is no provision for monitoring water table, collecting data, maintaining database and long term planning for sustainable use and management of water resources.

7. **The National River Protection Commission Act, 2013**: on 2013 the Government of Bangladesh enacted a new law to protect the rivers in Bangladesh, which is known as the National River Protection Commission Act of 2013. The object of this Act is "One needs to ensure multi-dimensional use of the river for illegal occupation of the river, water and environmental pollution, river pollution caused by industrial factories, construction of illegal structures and restoration of various irregularities and restoration of normal flow of the river, proper maintenance of the river and construction of water as transportable." The main function of the River Protection Commission is to keep the river free from illegal possession and protect from pollution.[3] Most of the occupiers and pollutants are Industrialists or politically powerful persons who are come from the upper class or powerful area of our society. Sometimes, we can see that the government or government organization are related to such illegal occupation or pollution of the river. For that reason, the administration cannot perform properly to stop such illegal occupation or pollution of rivers. In this situation, the River Protection Commission is established for performing a strong role to protect the rivers. To clear this point, we have to look at the function of the Commission. The section 12 of the Rivers Protection Commission Act of 2013 discusses about the functions of the Commission. In this section, it has been said that the Commission has right to recommended to the government to take various activities to protect rivers.

The section 12(d), 12(h), 12(m) has said that the Commission will take action to prevent water pollution, environment pollution and river pollution by industry. However, the environment quality standard is necessary for doing such type of activities. That means the amount of pollution on the basis of which, the Commission will start its work. Now, the question is who will measure and analyze the level or amount of pollution. There is nothing about in the Act, 2013. So we can say that the Commission has right to only recommend to the government to take necessary steps to conserve rivers. Another thing is the section 3(2) of the Act 2013 says that the Commission can file a case in its own name. But we cannot see such type of action by the commission.

8. **Penal Code, 1860:** Rivers have been one of our sources of fresh water since ancient period of time. People in our region have been using river water for various tasks including agriculture, cooking, bathing and washing clothes. The section 277 of the Penal Code, 1860 discuss about the Fouling water of public spring or reservoir. The section provides "Whoever voluntarily corrupts or fouls the water of any public spring or reservoir, so as to render it less fit for the purpose for which it is ordinarily used, shall be punished with imprisonment of either description for a term which may extend to three months, or with fine which may extend to five hundred taka or with both." For that such pollution of Surma River is an offence under the provision of the section 277 of the Penal Code, 1860. Not only the pollution of Surma River but also the pollution of all the rivers which water are used by Public is an offence under this provision of the Penal Code. Finally it can be said that the non-application of the section 277 is also responsible for the critical condition of our rivers.

9. **Water Act 2013:** The Water Act 2013 in Bangladesh showcases significant strengths in its approach to water resource management.[15] Aligned with the National Water Policy, it comprehensively addresses the development, extraction, distribution, and conservation of various water forms. Notably, it asserts government ownership of all water within Bangladesh. The establishment of the National Water Resources Council, led by the prime minister, enhances centralized decision-making. Private landowners gain the right to use surface water on their property. The Act mandates permits for substantial water withdrawal, curbing unauthorized extraction. Additionally, it prohibits any interference with natural water flow without permission, ensuring sustainable water practices. The Act's prioritization of water use in stressed areas further emphasizes its balanced and inclusive perspective. According to the section 2(5) of Water Act of 2013, Rivers are included as a reservoir. The section 20 of the Water Act of 2013 has said that the National Water Resources Council, constituted under section 4 of this Act, will work to keep the rivers water or stream in normal. The section 22(3) of the Water Act of 2013 provides that the authority has power to impose necessary restrictions to ensure proper management of reservoirs. On the other, the section 28 of the Act prohibits water pollution in all respects. But the present condition of our rivers provide us that the implementation of this Act is not effective still now.

10. **Water Rule 2018:** It provides details about enforcement of several available mechanisms, such as compliance orders, protection orders, removal orders, imprisonment and fines/compensation, the maximum amount of surface water or groundwater that can be withdrawn by individuals or organizations, clearance certificate by Executive Committee in terms of water related projects. The Figure 3 shows that Bangladesh has total 56 water related Acts or Ordinances. Among

[15] Water Act 2013

those, 8 laws have been enacted in the British period (before 1947), 14 laws have been passed in Pakistan period (1948 to 1971) and 34 laws have been passed in Bangladesh period (1972 to till date). So Bangladesh has a good number of water laws.

11. **The Ground Water Management Act, 2018:** The Ground Water Management Act, 2018 focuses on agricultural production but lacks provisions for civil society participation, industrial and commercial abstraction, groundwater protection, recharge, conjunctive use, rainwater harvesting, long-term planning, punishment for water mining, integrated water use, central monitoring, safe abstraction, and monitoring of groundwater quantity and quality. It also overlooks water pollution and safety concerns. To address these gaps, amendments should be considered, incorporating community involvement, comprehensive regulations for various sectors, sustainable practices, and robust monitoring mechanisms for both quantity and quality of groundwater, ensuring the holistic and responsible management of this vital resource.

12. **The Bangladesh Water Development Board Act, 2000:** This act establishes the Bangladesh Water Development Board (BWDB) and outlines its functions, including river management and protection.

13. **The Bangladesh Environmental Conservation Act, 1995:** This law addresses environmental conservation, including the protection of rivers and their ecosystems.

14. **The Rivers and Canals (Preservation and Conservation) Act, 2013:** This act aims to preserve and conserve rivers and canals in Bangladesh.

15. **The Bangladesh Water Rules, 2018:** These rules provide guidelines for various activities related to water resources, including river protection and management.

16. **The Forest Act, 1927: T**his act includes provisions for protecting riverine forests and their ecosystems along riverbanks.
17. **The Wildlife (Preservation) Act, 1973:** This law focuses on the protection of wildlife, including species that inhabit river ecosystems.
18. **The Land Acquisition Act, 1894:** This act may be relevant in cases of land acquisition for river-related projects.
19. **The Coastal Zone Policy, 2005:** Although primarily related to coastal areas, this policy also has implications for the protection of rivers that flow into the Bay of Bengal.
20. **The Environmental Impact Assessment (EIA) regulations:** These regulations require the assessment of potential environmental impacts, including those on rivers, for certain development projects.
21. **The Water Pollution Control Ordinance, 1973:** This ordinance addresses water pollution issues, including those affecting rivers.
22. **The Forest (Conservation) Act, 1927:** This law provides for the conservation of forests and related river ecosystems.
23. **The Bangladesh Water Supply and Sewerage Authority (BWASA) Act, 1996:** BWASA plays a role in water supply and sanitation, which can indirectly impact river water quality and conservation.
24. **The Coastal Zone Management (CZM) Plan, 1996:** While focused on coastal areas, this plan may also consider river protection in coastal regions.
25. **Local Government Laws and Regulations:** Local government authorities may have specific regulations and bylaws related to river protection within their jurisdictions.

6.3: International Laws:

Bangladesh faces a critical need for a comprehensive river protection law. Despite not being a signatory of international River Law Conventions, the UN Watercourses Convention of 1997 could serve as a crucial framework. The Convention, in force since 2014, emphasizes preventing significant harm to other states and compensating for any such harm. This is particularly relevant for Bangladesh, a geographically disadvantaged country, dependent on international river waters.

The use of Tran's boundary water resources requires a legal framework which allows to prevent conflicts, maximize socio-economic benefits, and protect ecosystems. International water law comprises agreements, manifested in rules, treaties and principles (Tool A2.01) that were created to foster cooperation among states sharing freshwater resources. Despite primarily governing inter-State relations, international water law is also relevant and produces impacts on the national legal level. International conventions should be ratified and implemented at the domestic level in order to ensure the compliance of States with norms and principles of international law embodied in such conventions.

Sources of international water law include customary law, bi- or multilateral treaties, regional framework treaties and treaties with universal scope of application. There are more than 400 agreements that govern international cooperation on freshwater resources. The following instruments are considered the universal legal frameworks on Tran's boundary waters:

1. **Helsinki Rules:** One of the first comprehensive codification of the law of international watercourses were the 1966 Helsinki Rules on the Uses of Water of International Rivers (Helsinki Rules), adopted by the International Law Association and regulating "the use of water of an international drainage basin".
2. **UN Watercourses Convention:** Among the treaties with universal scope of application, the 1997 United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses (UN Watercourses Convention) was the first global convention, which codified international law on Tran's boundary water resources. Despite being adopted in 1997, the Convention entered into force only in 2014, due to due to slow process of ratification.

3. **UNECE Water Convention:** Another framework treaty, the Water Convention on the Protection and Use of Trans boundary Watercourses and International Lakes, was adopted in 1992 and entered into force in 1996. Although originally adopted as a regional instrument in pan-European region, it has been opened for accession to all UN Member States in 2016.

6.3.1. Principles:

Several key governing principles play a crucial role. One such principle is the equitable and reasonable utilization (Article 5, UN Watercourses Convention, 1977), emphasizing that riparian States should use water resources without prejudicing others. This principle highlights the equality of rights for downstream and upstream States, fostering a "community of interest" to balance the needs of each state.

Another fundamental principle is the obligation not to cause significant harm (Article 7), derived from the general duty of every State to ensure that its activities don't harm another State's territory (McCaffrey, 2019). The UN Watercourses Convention mandates States to exercise due diligence to avoid significant harm to other riparian States.

Within the overarching duty to cooperate, universal and regional water agreements outline procedures like notification and consultation. These obligations require a riparian State to inform and consult with others when planning economic activities with adverse impacts on international watercourses. This process helps mitigate and prevent conflicts, recognized as customary rules of international water law (Tanzi, 2015).

Ecological protection of Tran’s boundary watercourses is another recognized principle, acknowledged by various legal instruments. The UN Watercourses Convention defines water ecosystems (Article 20), including areas around watercourses affecting the overall ecosystem equilibrium if negatively impacted (UN, 1977). The UNECE Water Convention incorporates procedural rules for environmental protection, emphasizing minimizing Trans boundary impact (Article 3.1), the precautionary principle, and the polluter-pays principle (Article 2.5) (UNECE, 1996).

6.3.2. Water Related Agreement in Bangladesh:

1. **Bangkok Agreement:** Addresses navigation in the Bay of Bengal and promotes regional cooperation among Bangladesh, India, and Myanmar.
2. **Ganges Water Treaty:** A bilateral agreement between India and Bangladesh, regulating the sharing of the Ganges River waters.
3. **Teesta Water Sharing Agreement:** Focuses on sharing the waters of the Teesta River between India and Bangladesh.
4. **Mahakali Treaty:** An agreement between India and Nepal, impacting the Mahakali River, which flows into Bangladesh.
5. **Sundarbans Protocol:** Pertains to oil spill response cooperation in the Sundarbans, a critical mangrove ecosystem shared by India and Bangladesh.
6. **SAARC Convention on Cooperation on Environment:** Addresses regional environmental issues, including those related to Trans Boundary Rivers.
7. **Indus Waters Treaty:** Though not directly involving Bangladesh, this treaty between India and Pakistan impacts water flow in the Indus River, which originates in Tibet and flows through India.
8. **Dhaka Declaration on Water Security in the Asia-Pacific:** While not a convention, this declaration emphasizes regional collaboration on water security issues, which includes Trans Boundary Rivers impacting Bangladesh.

6.4: Loopholes of River Protection Laws:

While Bangladesh has a national water policy, a dedicated law is essential to address pollution, illegal occupation, industrial waste, and overall river protection. Provisions should include measures for maintaining water quality and monitoring cross-border water quality. With 54 Tran's boundary rivers with India and three with Myanmar, comprehensive treaties are vital. The inefficacy of Joint River Commission officials necessitates exploring international laws, similar to maritime boundary resolutions.

Surface water is crucial for Bangladesh's people, agriculture, and ecosystems. Despite having a water policy, the nation lacks effective measures for preserving surface water. Emulating successful models from countries like Malaysia, which mandates rainwater collection for construction approval, could mitigate waterlogging issues. Standardizing and digitally mapping wetlands and rivers, like in the Netherlands, is essential for effective water management. Coordination among stakeholders like the Water Development Board, BIWTA, and environmental bodies is vital. Efforts need central coordination to prevent duplication and unnecessary funding waste. Projects like the Ganges Barrage demand careful planning and substantial funding. Navigation safety through the Sundarbans requires robust safety mechanisms to avoid ecological disasters like oil spills.

The National River Conservation Commission, established in 2013, should play a pivotal role. However, its effectiveness depends on empowered teams and effective guidelines. Rivers, unfortunately, are being polluted with plastic and industrial waste, despite past bans. A shift toward enforcing existing bans and educating the public is crucial to avert environmental and health risks.

6.4.1. Loopholes of Statutory Laws:

1. **Inadequate Enforcement:** River protection laws in Bangladesh often suffer from weak enforcement, allowing illegal activities such as sand mining and encroachment to persist. Due to the lack of the proper application of the section 6A of the Environment Conservation Act of 1995, the production and use of the plastic and polythene (which are very harmful for not only rivers but also environment) is not closed even today. As a result the Surma River and others (Buriganga, Turag, Padma, Karnaphuli, kapatakkha, etc.) are in the confluence of pollution.[16]
2. **Corruption**: Rampant corruption within regulatory bodies undermines the effectiveness of river protection laws, as individuals and businesses may bribe officials to overlook violations.

[16] A LEGAL DISCUSSION ON RIVER POLLUTION IN BANGLADESH: Jesmul Hasan.

3. **Lack of Public Awareness:** Many citizens are unaware of the importance of river protection laws, hindering collective efforts to safeguard rivers. Public awareness campaigns are essential to garner support for these regulations.
4. **Insufficient Penalties:** Penalties for violating river protection laws may be insufficient to deter offenders. Stricter punishments could act as a more effective deterrent.
5. **Poor Coordination:** Lack of coordination among government agencies and departments responsible for enforcing river protection laws can result in gaps and inefficiencies in implementation.
6. **Loopholes in Legislation:** Some river protection laws may have loopholes that allow for exploitation, and periodic updates are necessary to address emerging challenges and close such gaps.
7. **Limited Resources:** Inadequate allocation of resources for monitoring and enforcement hampers the government's ability to effectively implement river protection laws.
8. **Slow Legal Processes:** Lengthy legal processes contribute to delays in addressing violations, providing ample time for offenders to continue their activities unabated.
9. **Political Interference:** Political influence in decision-making processes can compromise the strict enforcement of river protection laws, as politicians may favor economic interests over environmental concerns.
10. **Lack of Technological Integration:** Insufficient use of technology, such as satellite monitoring and geospatial analysis, hinders the ability to track and prevent illegal activities along rivers.
11. **Inadequate Rehabilitation Measures:** River protection laws may not adequately address the rehabilitation of areas affected by illegal activities, leaving ecosystems and communities vulnerable.
12. **Limited Community Involvement:** Involving local communities in the enforcement of river protection laws is crucial, yet there may be insufficient mechanisms for community participation.
13. **Inconsistent Policies:** Inconsistencies in policies across regions can create confusion and hinder a unified approach to river protection, requiring a more standardized and cohesive legal framework.

14. **Short-Term Focus:** Some river protection laws may be designed with a short-term perspective, lacking sustainable strategies for long-term river conservation.
15. **Climate Change Considerations:** River protection laws may not always integrate considerations for climate change impacts, such as altered river courses and increased frequency of extreme weather events, leading to vulnerabilities in the regulatory framework.

Addressing these drawbacks requires a comprehensive approach, encompassing legal reforms, improved enforcement mechanisms, enhanced public awareness, and a commitment to sustainable river management.

6.4.2. Loopholes of International River Protection Laws:

1. **Limited Enforcement:** International river protection laws often face challenges in enforcement due to the absence of a centralized governing body with the authority to enforce regulations uniformly across nations.
2. **Sovereignty Issues:** Countries may be hesitant to fully adhere to international river protection laws, citing concerns about infringement on their sovereignty or claiming that such regulations may not align with their national priorities.
3. **Varying Priorities: N**ations along a river may have differing priorities, making it challenging to create a cohesive set of regulations that address the diverse needs and interests of each country involved.
4. **Lack of Monitoring Infrastructure:** Inadequate monitoring infrastructure can hinder the effective implementation of river protection laws, making it difficult to track compliance and identify violations in a timely manner.[17]

[17] Faruqee R. and Choudhury, Y.A. Improving Water Resource Management in Bangladesh. C. Anbiah 81275, Agricultural and Natural Resources Division South Asia - Department 1, the World Bank. 1996.

5. **Resource Constraints:** Developing countries may lack the financial and technological resources needed to implement and adhere to international river protection laws, exacerbating environmental degradation in these regions.
6. **Legal Complexity:** The complexity of international law can create ambiguity and loopholes, allowing some nations to exploit gaps in the regulations or engage in legal battles that delay or prevent effective enforcement.
7. **Political Interference:** Political considerations may sometimes override environmental concerns, leading to lax enforcement or manipulation of river protection laws to serve short-term political interests.
8. **Trans boundary Disputes:** Disputes between nations over the use and management of shared rivers can escalate due to conflicting interpretations of international laws, leading to strained diplomatic relations and potential conflicts.
9. **Inadequate Penalties:** Weak penalties for non-compliance may fail to deter countries from violating river protection laws, undermining the overall effectiveness of these regulations.[18]
10. **Climate Change Challenges:** Rapid changes in climate patterns can affect river ecosystems, challenging the relevance and adaptability of existing international laws to address emerging environmental threats adequately.

In conclusion, while international river protection laws aim to promote sustainable management of shared water resources, their effectiveness is hindered by challenges such as enforcement limitations, sovereignty concerns, and the complex nature of Tran's boundary relationships. Addressing these drawbacks requires collaborative efforts to enhance monitoring mechanisms, streamline legal frameworks, and promote a shared commitment to environmental stewardship among nations.

[18] Chowdhury, N.T. Water management in Bangladesh - an analytical review. Water Policy, 2010, 12: 32-51.

Chapter-VII

Answering Question

7.1Answer to the Question no. 1:

In Bangladesh, river protection is governed by various legal frameworks and regulations. Some key ones include:

1. Water Pollution Control Ordinance (1973): This ordinance addresses water pollution control and protection, including regulations for discharging pollutants into rivers.

2. Bangladesh Water Act (2013): This act provides a comprehensive legal framework for the management and conservation of water resources, including rivers.

3. Environmental Conservation Act (1995): It deals with the protection and conservation of the environment, including rivers, by regulating activities that may cause environmental harm.

4. Rivers and Floodplains Development Act (1988): This act focuses on the development and management of rivers and floodplains while considering environmental and ecological aspects.

5. Forest Act (1927): It includes provisions related to the protection of riverbanks and forests, as they are closely interlinked.

6. Maritime Zones Act (1976): This act establishes Bangladesh's maritime boundaries and sovereignty, which is relevant to river protection in coastal areas.

7. Local Government Acts: Various local government laws and regulations may include provisions related to river protection and management within specific regions.

Answer to the Question no. 2:

The effectiveness of the legal system in preventing illegal encroachments and pollution of rivers in Bangladesh can vary. Bangladesh has environmental laws and regulations in place to address these issues, but the enforcement and effectiveness of these laws can be inconsistent due to various factors such as resource constraints, corruption, and political influences. While there have been efforts to improve the legal framework and strengthen environmental protection in the country, illegal encroachments and pollution of rivers remain persistent problems. Success in preventing these issues often depends on the commitment of government agencies, the judiciary, and the willingness of society to hold violators accountable. Overall, Bangladesh has made some progress in addressing river pollution and encroachments through legal means, but challenges persist, and the effectiveness of the legal system may vary in different regions and situations.

Answer to the Question no. 3:

Enforcing river protection laws in Bangladesh faces several legal challenges and obstacles. These include inadequate legislation and loopholes in existing laws, which may not comprehensively address the complex issues surrounding river management. Weak enforcement and corruption within regulatory bodies hinder the implementation of regulations.[19]The absence of a centralized river authority leads to a lack of coordination among relevant agencies. Additionally, population growth and urbanization strain rivers due to encroachment and pollution. Limited public awareness and engagement pose further challenges. Overcoming these obstacles requires legal reforms, stronger enforcement mechanisms, and increased public participation in river protection efforts.

[19] Rouillard, J.J., Benson, D. and Gain, A.K. Evaluating IWRM implementation success: Are water policies in Bangladesh enhancing adaptive capacity to climate change impacts? Int. J. Water Resour. Dev., 2014, 30: 515-527. Rouillard, J.J., Benson, D. and Gain, A.K. Evaluating IWRM implementation success: Are water policies in Bangladesh enhancing adaptive capacity to climate change impacts? Int. J. Water Resour. Dev., 2014, 30: 515-527.

Answer to the Question no. 4:

To enhance river conservation efforts in Bangladesh, legal mechanisms can be improved through several key steps. Firstly, stricter enforcement of existing environmental laws is crucial. Implementing more stringent penalties for violations can act as a deterrent. Additionally, creating specialized river conservation legislation tailored to the unique needs of Bangladesh's rivers can address specific challenges. Establishing clear guidelines for sustainable river use, protecting critical habitats, and involving local communities in decision-making are essential components. Furthermore, enhancing monitoring and reporting mechanisms, coupled with public awareness campaigns, can ensure transparency and accountability. Overall, a comprehensive legal framework can significantly bolster river conservation in Bangladesh.

Answer to the Question no. 5:

International law plays a crucial role in addressing Tran's boundary river issues in Bangladesh. The country shares multiple rivers with neighboring India and Myanmar, making effective management essential. Treaties and agreements, guided by principles of international law, facilitate cooperation on water sharing, environmental protection, and dispute resolution. The Ganges Water Sharing Treaty with India and the Joint Rivers Commission exemplify this. These legal frameworks provide mechanisms for equitable resource allocation, ensuring a fair and sustainable distribution of water resources. Additionally, international law promotes transparency, collaboration, and peaceful resolution of conflicts, benefiting both Bangladesh and its neighbors while safeguarding the vital ecosystems of these Trans boundary rivers.

Chapter-VIII

Recommendations & Conclusion

8.1 Recommendations:

1. Review and analyze existing laws and regulations pertaining to river protection in Bangladesh, such as the Water Act, 2013, and the Bangladesh Water Development Board Act, 2000.
2. Examine the effectiveness of the current legal framework in preventing illegal encroachments, pollution, and degradation of rivers in Bangladesh.
3. Investigate the enforcement mechanisms and capacities of relevant government agencies responsible for river protection, such as the Department of Environment and the Ministry of Water Resources.
4. Evaluate the role of non-governmental organizations (NGOs) and civil society in advocating for river protection and their cooperation with the government.
5. Study the environmental impact assessment processes related to river development projects and assess their adequacy in safeguarding river ecosystems.
6. Explore international best practices in river protection and their applicability to the Bangladeshi context.[20]
7. Investigate the role of the judiciary in addressing cases related to river protection and assess the efficiency of legal remedies available to affected parties.
8. Examine the historical and cultural significance of rivers in Bangladesh and how this influences legal protections.

[20] Her, J.D., Choudhury, G., Ahmed, Y. and Shams, S.B. Sixty Years of Water Resources Development in Bangladesh: Lessons Learnt. Baseline Study December, General Economics Division, Planning Commission, Government of Bangladesh, 2016.

9. Assess the impact of climate change on river ecosystems and the legal provisions in place to address these challenges.

10. Investigate the loopholes and weaknesses in the current legal framework, such as ambiguities, gaps, or conflicting provisions.

11. Explore the role of public awareness and education in promoting river protection and consider strategies to enhance public participation in this regard.

12. Examine the relationship between industrial activities, agricultural practices, and river pollution, and recommend regulatory measures to mitigate these issues[11].

13. Consider the potential for the integration of indigenous knowledge and traditional practices in river protection efforts.[21]

14. Analyze the economic implications of river protection, including the impact on livelihoods, tourism, and sustainable development.

15. Propose legislative amendments, policy changes, and enforcement strategies to address the identified loopholes and enhance the legal mechanism for river protection in Bangladesh.

16. While Bangladesh has a national water policy, a dedicated law is essential to address pollution, illegal occupation, industrial waste, and overall river protection. Provisions should include measures for maintaining water quality and monitoring cross-border water quality.[22]

17. Standardizing and digitally mapping wetlands and rivers, like in the Netherlands, is essential for effective water management.

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[21] Gain, A.K., Animesh, K., Mondal, M.S. and Rahman, R. From Flood Control to Water Management: A Journey of Bangladesh towards Integrated Water Resources Management. Water, 2017. 9(1): 55.

[22]Chan N.W., Roy, R. and Chaffin B.C. Water Governance in Bangladesh: An Evaluation of Institutional and Political Context. Water 2016, 8(403).

18. Strengthening laws and their enforcement is urgently required to protect natural resources.

19. Human resource development, especially in water management, demands a master plan.

20. Graduates need industry readiness, and stakeholders must embrace their expertise. Research and funding are essential for effective policies.

8.2 **Conclusion**:

This thesis has delved into the legal mechanisms governing river protection in Bangladesh, subjecting them to critical analysis to reveal their inherent strengths and glaring loopholes. The research has shown that Bangladesh possesses a comprehensive framework of statutory provisions aimed at safeguarding its rivers, reflecting the nation's commitment to environmental preservation. These legal instruments are grounded in international principles of sustainable development and responsible resource management. However, the critical analysis also unearthed significant shortcomings within this legal framework. The most pronounced issue is the lack of effective enforcement, which allows unchecked encroachments, pollution, and illegal sand mining to persist. The existing laws and regulations often remain on paper, failing to translate into meaningful action on the ground.[23] This raises questions about the accountability of government agencies responsible for river protection. Furthermore, the

[23] Farooque, M. and Hasan, S.R. Laws Regulating Environment in Bangladesh Environmental Lawyers Association (BELA), Dhaka, 2014, 1172 pp.

thesis has highlighted the need for stricter penalties and increased public awareness to deter river-related offenses. Collaborative efforts among stakeholders, including government bodies, environmental NGOs, and local communities, are essential to bridge the gaps in river protection.

It is evident that the legal mechanisms are only as strong as their enforcement, and addressing the identified loopholes requires a multi-faceted approach. Reforms in the existing legal provisions, coupled with robust enforcement and an informed citizenry, are imperative to ensure the sustainable preservation of Bangladesh's vital river ecosystems.

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