

AN ASSESSMENT ON WATER QUALITY OF THE ICHAMATI RIVER AND ITS IMPACTS ON LIVELIHOOD OF PABNA CITY

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ABSTRACT

Ichamati is a unique river bounded by two major rivers Brahmaputra and Ganges. Though the river is interlinked with two major rivers, it is losing its environmental flow day by day. Change of Ganges river flow, Farakka Barrage, Pabna Irrigation Project and river land grabbing are responsible for present state of Ichamati river. The water quality of the river has also deteriorated due to the continuous disposal of waste water from industrial effluents, domestic wastes, agricultural wastes. For the study, some water samples of Ichamati river are collected from five major points of Pabna city : Ramchandrapur Regulator, Shadupara-SP Bungalow, Bridge-Kheyaghat, Meril-u/s and Meril-d/s. Different water quality parameters such as p^H, TDS, alkalinity, temperature, conductivity, DO of the sample water are determined and it is observed that some water quality parameters are not satisfactory. There have been huge influences on the ecology and environment, livelihood of people living surrounding the Ichamati river at Pabna city because of this waste water. This paper aims to present the recent scenario of Ichamati river water quality due to the disposal of waste water and the adaptation practises of local people through Driving Forces–Pressure–State–Impact–Response (DPSIR) framework analyses. The Driving-Forces–Pressure–State–Impact–Response (DPSIR) indicator framework is useful for identifying and developing indicators of sustainable development for water management of Ichamati river. From the field survey, driving forces have been identified as the population growth, their habitat pattern as well as the industrial development and economic activity of Pabna city. Pressures include the natural and anthropogenic demand and supply of water in agriculture, fisheries etc and water pollution of the river. State indicators can be split into those of the Ichamati water quantity and those of quality in different areas. Impacts include those that affect the ecosystems directly and livelihood pattern of the surrounding area. Response includes the regulation, law and activities taken by government, NGO and local stakeholders. In this study, the objective is extended to observe the complete assessment of present water quality scenario and a detailed perceptual study on its impact on ecosystem, socio-economic activities, livelihood on the Ichamati river.

Keywords: *Wastewater, Water quality parameter, DPSIR framework, Livelihood, Ecosystem.*

1. INTRODUCTION

Bangladesh is a riverine country. There are many rivers flowing through the North-West part of the country. Ichamati is one of them. Major part of the river flows over the district of Pabna and it is a unique river bounded by two major Rivers of Bangladesh: the Brahmaputra and the Ganges. The Ichamati river is passing through the middle of the Pabna Pourashava along the north-south direction. But presently this river is in dead condition. The Ichamati river is filled with water weeds and siltation. The river is lost her navigation during the long years. The downstream part of the river silted up by encroachment during the long ago. The Ichamati river has already been lost her natural levy in many years ago (Hasan et al. 2018). The reason behind it is some significant interventions constructed over it. Change of Ganges river flow, Farakka Barrage, Pabna Irrigation Project and river land grabbing were responsible for present condition of Ichamati river. A significant portion of Ichamati river has already dried up also the degrading water quality of the river water is also a huge matter of concern. Pabna has fledgeling knitted fabric and handloom related textile industries. There are also several consumer and pharmaceutical producing factories. Square (Bangladesh) is the largest pharmaceutical company in Bangladesh. Majority of its factories are situated near Jubilee Tank area of the town. One of the country's oldest pharmaceuticals Edrug has a plant at Ononto neighbourhood. Consumer food producer Universal Food Limited and POROB Foods are also situated there. Gas-based Al Amin Biscuit and Food Limited is the largest of its kind in Rajshahi Division. Waste material that includes these industrial liquid waste and sewage waste that is dumped in different points of the upstream urban area of the Ichamati river is the main cause behind the deterioration of water quality of Ichamati river. This pollution is propagated towards the rural downstream area and effects the fisheries and agriculture in a significant way.



Figure 1 : Ichamati river

In Bangladesh, total environment, as well as economic growth and developments, are all highly influenced by water. In terms of quality, the surface water of the country is unprotected from untreated industrial effluents and municipal waste water, runoff pollution from chemical fertilizers, vehicle emission pollutants, pesticides, etc. (Bhuiyan et al. 2011). Pabna is a town in Rajshahi Division of Bangladesh and the administrative capital of eponymous Pabna District. It is located on the north bank of Padma river and has a population of about 138,000 (Shaha, 2013). Major portion of the Ichamati river passes through it. So, the increasing pollution of the Ichamati river can affect the

ecology, environment, social pattern, economy, agriculture and overall livelihood pattern of Pabna district in a significant way. Thus, this study's objective is to assess the present water quality scenario and its impact on ecosystem, socio-economic activities, livelihood on the Ichamati river by DPSIR framework.

2. METHODOLOGY

The data collected for the study is both primary and secondary. A field survey was conducted for the study and five water samples were collected from five points of the Ichamati river for the assessment of water quality. Primary data are collected through the water quality testing report, field survey, direct observation, focus group discussion, stakeholder and community consultations and interviews of the field survey. Total 7 FGD are conducted and 89 people are interviewed at the field survey. They were asked questions about their impacts on livelihood, socio economic condition, environment pollution etc. Secondary data is collected from different sources including published and unpublished literature, different databases, newspapers and the World Wide Web. Secondary information, preliminary stakeholder discussions and field visits led to selection of preliminary study sites for detailed baseline study.

2.1 Water Quality Analysis

For checking the water quality, water samples of Ichamati river are collected from five major points of Pabna city: Ramchandrapur Regulator, Shadupara-SP Bungalow, Bridge-Kheyaghat, Meril-u/s and Meril-d/s. The five collection points are shown in Figure 2 and collection location of Shadupara-SP Bungalow is shown in Figure 3. Different water quality parameters such as pH, TDS, alkalinity, temperature, conductivity, DO of the sample water are estimated.



Figure 2: Five collection points of water of the Ichamati river



Figure 3: Water collection location Shadupara-SP Bunglow

2.2 Field survey and Focus Group Discussions

For this study, field surveys were conducted in Pabna at different points of the Ichamati river. Focus Group discussions were conducted and resources mapping were created at different locations. A sample resource mapping of Kheyaghat location is shown in Figure 4.



Figure 4: Resource Mapping of Kheyaghat location

Several interviews and Focus Group Discussions (FGD) were conducted in many places with different stakeholders like fishermen, farmers, local associations, marginalized group like women. The information collected from the different stakeholders were collected and various water conflicts were identified. A Focus Group discussion with farmers is shown in Figure 5.



Figure 5: FGD with farmers in study area

2.3 DPSIR framework analysis

The DPSIR framework was devised in the late 1990s as a tool for the reporting and analysis of environmental problems, ranging in scale from global systems to localized watersheds. Since then, international organizations have begun to apply this framework to the evaluation of sustainable development initiatives, to better understand and overcome barriers to sustainability (Carr et al., 2007). DPSIR framework means Driving-Forces–Pressure–State–Impact–Response (DPSIR) indicator framework where

- Driving forces are the human influences and activities that combine with environmental conditions and underpin environmental change;
- Pressure indicators measure the pressures that are exerted on resources and ecosystems from human activities (e.g., emissions, consumption, and utilization);
- State indicators assess the condition of the resource or ecosystem as a result of the pressures;
- Impacts, which are the results of pressures on the current state;
- Response indicators relate to the societal responses via policies, laws, programmes, research etc.

The Driving-Forces–Pressure–State–Impact–Response (DPSIR) indicator framework is useful for identifying and developing indicators of sustainable development for water management of Ichamati river. From the field survey, driving forces have been identified as the natural conditions occurring in the river and the level of industrial development and economic activity of Pabna city. Pressures include the natural and anthropogenic demand and supply of water in agriculture, fisheries etc and water pollution of the river. State indicators can be split into those of the Ichamati water quantity and those of quality in different areas. Impacts include those that affect the ecosystems directly and livelihood pattern of the surrounding area. Response includes the regulation, law and activities taken by government, NGO and local stakeholders.

3. RESULTS AND DISCUSSION

3.1 Water Quality parameters

The sample water of the Ichamati river which was collected from five different locations of Pabna city was tested and different water quality parameter is determined and compared with standard values. The values are shown in the table 1.

Table 1: Water Quality parameter of different points of the Ichamati river

Parameter	Unit	Location of water sample collection point					ECR'97 (Inland Surface Water)
		Ramchandrapur Regulator	Shadupara- SP Bungalow	Bridge- Kheyaghat	Meril- u/s	Meril- d/s	
Temp.	°C	28.6	28.2	29.4	28.8	30.8	≤40
pH		6.14	6.33	6.36	6.58	6.45	6.0-9.0
EC	μS/cm	710	1188	774	858	840	≤1200
TDS	mg/L	317	540	339	380	367	≤2100
DO	mg/L	0.36	3.52	0.98	1.25	0.83	4.5-8.0
Turbidity	NTU	17.2	49.4	59.7	13.36	19.4	---
Color	Pt-Co	71	65	153	45	62	---
Suspended Solids	mg/L	47	42	51	38	39	≤150
Alkalinity (Total)	mg/L	255	315	270	325	290	---
Iron	mg/L	1.03	0.22	0.31	0.09	0.13	2
Ammonia- Nitrogen (NH ₃ -N)	mg/L	4.7	10.4	10.15	5.15	8.65	5
Nitrate-N	mg/L	0.2	2.8	0.2	0.7	1.2	10
Phosphate	mg/L	6.6	5.5	8.1	4.7	4.6	
Sulfide	mg/L	4	10	7	2	9	1
Chloride	mg/L	70	70	70	10	50	≤600

It is clearly observed that dissolved oxygen of all the points of Ichamati river is very low which indicates the increasing pollution of the Ichamati river. Now-a-days, the DO is too low to survive for aquatic lives as all the samples are below the standard DO limit 4.5-8.0mg/L. From the interviews of nearby resident and specially FGD with fishermen at Shreepur, it was mentioned that now-a-days, they are having loss in fishery business because in the degrading water quality the fishes and aquatic lives can't survive properly. But before some years, they used to have really good profit from the fishery business. But now people living downstream of the Ichamati river are suffering this socio-economic problem. They mentioned the prime reason is the wastes released from Square industries from upstream. However, from Table 1, it is also seen that there is high iron in "Ramchandrapur Regulator" compared to other points. The probable cause that was understood from the field survey was the released industrial wastes from the nearby industries where metal wastes are also released without proper monitoring and there is significant amount of iron and other metals. Thus, the presence of metal wastes may increase the iron content. Apart from that, the value of Ammonia-Nitrogen (NH₃-N) was quite high in "Shadupara-SP Bungalow" and "Bridge-Kheyaghat" point. The reason was in that location, there is an outlet of several domestic sewer lines or drains where human wastes and other household wastes are dumped. During the field survey our team collected the water sample from that outlet point. From the information of the local residents, the practise is quite old, the human wastes from surrounding locality are passed by the several drains and the connecting outlet is at the point beside SP Bungalow. So, as expected we found high amount of Ammonia-Nitrogen (NH₃-N) due to the organic waste.

The comparison of dissolved oxygen in various locations of the Ichamati river is shown in Figure 6. It is clearly evident that due to the extreme disposal of industrial wastes the dissolved oxygen in Meril bypass area is very low. From the site visit, it was observed that due to the untreated wastes released from the Meril soap industry located at that point, the colour of the river water becomes darker and there was odour problems due to the wastes. From the visual condition, it was assumed that the water may have low amount of DO which was confirmed after tests.

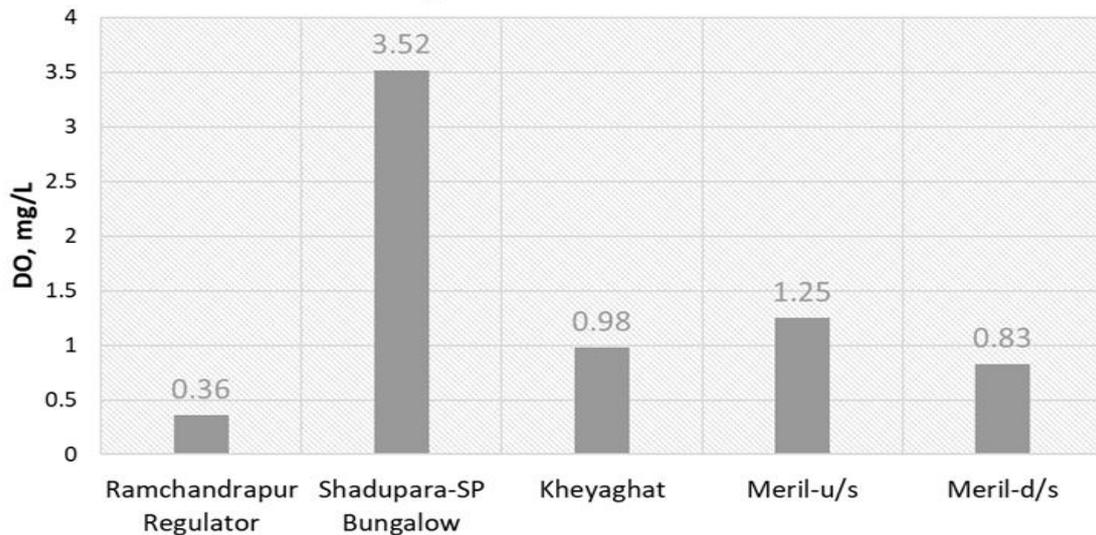


Figure 6: Variation of DO in different locations of the Ichamati river.

The comparison of EC in various locations of the Ichamati river is shown in Figure 7. EC mainly indicates the amount of ionic content in a solution. From Figure 7, it is seen that all the sample water has shown $EC < 1200 \mu S/cm$. It indicates the ionic content or salt content is in the permissible state.

The comparison of p^H , alkalinity, sulfide in various locations of the Ichamati river is shown in Figure 8. The p^H of all the samples are within 6.1-6.6 which indicates slightly acidic nature of the water. The alkalinity content is overall is in the normal limit. But the sulphide level is a bit higher at the Shadupara-SP Bungalow due to the direct release of wastewater from households and Meril d/s due to the direct release of industrial wastewater from Meril industry.

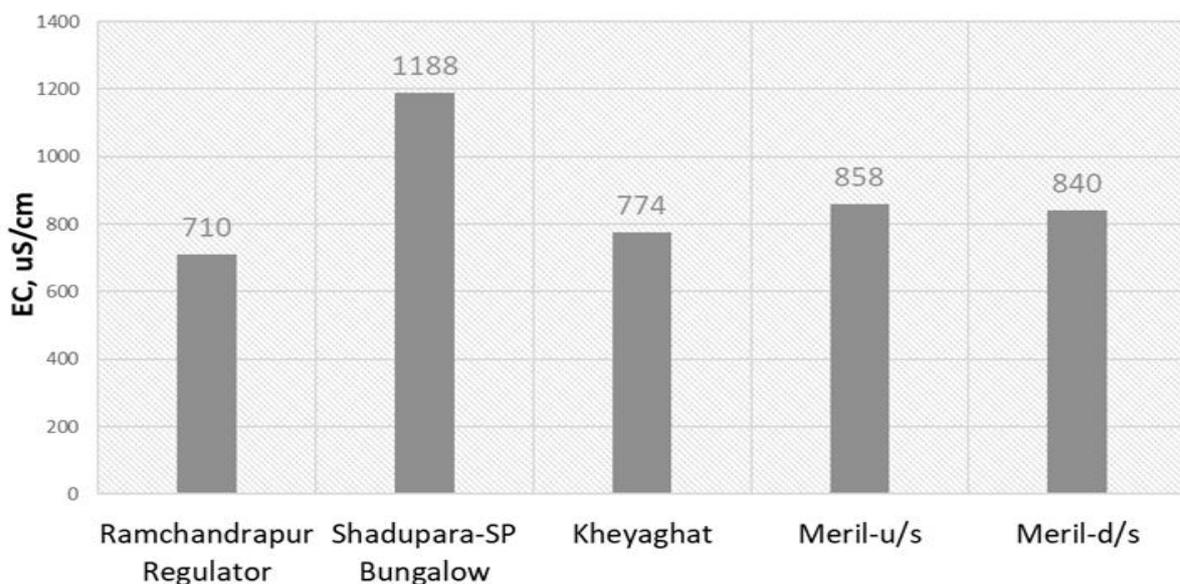


Figure 7: Variation of EC in different locations of the Ichamati river.

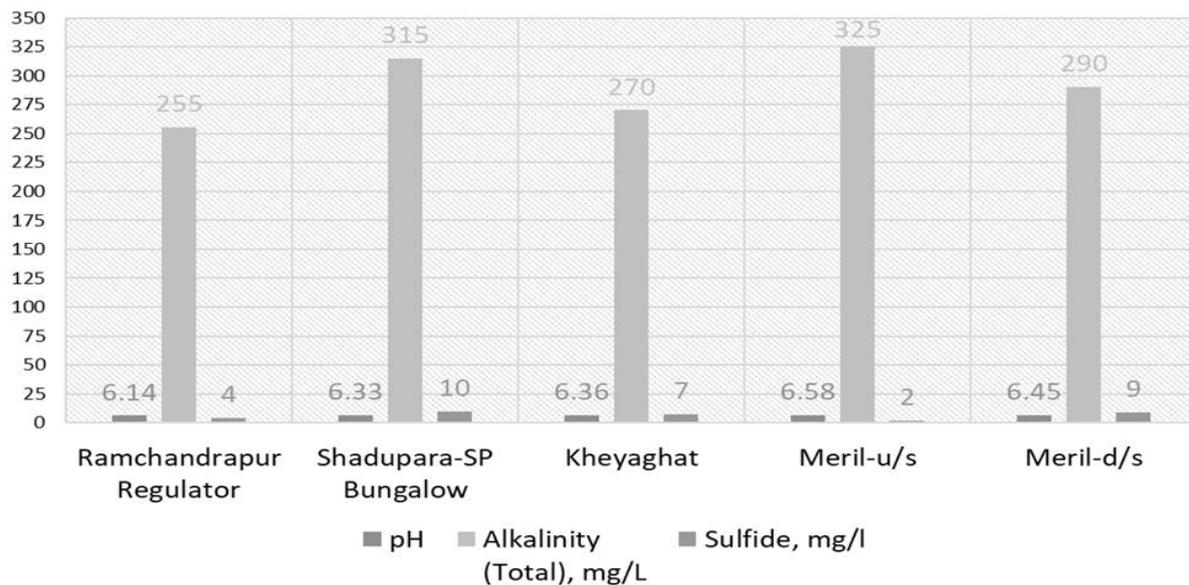


Figure 8: Variation of p^H , alkalinity, sulfide in different locations of the Ichamati river.

3.2 DPSIR framework analysis

From the collected data, driving forces have been identified as the level of industrial development and economic activity of Pabna city with the increasing population growth. The Meril industrial area is one of the main industrial zones of it from where the industrial wastes release. Due to the population growth, there is unplanned habitat pattern in the city. Some poor people has started living in the parts of river that has dried up and silted. Some of the household wastes are released on an outlet connected to the river. The population growth, their habitat pattern as well as economic and industrial development is identified as the driving forces here towards the whole scenario.

Pressures include the natural and anthropogenic demand and supply of water in agriculture, fisheries etc and water pollution of the river. At the downstream peri urban area, the fisheries and agricultural sector needs vast amount of water. But due to the low flow of water and degrading water quality in the river there is a huge impact on the agricultural and fisheries sector. The fishermen group near the Shreepur area has mentioned huge loss in fisheries for consecutive 3 years due to the pollution coming from the industries. Though the farmers are using the groundwater instead of surface water for irrigation purpose, but it is lowering the groundwater table each year. As the Ichamati river is dried up, the groundwater recharge is also not too high.

State indicators can be split into those of the Ichamati water quantity and those of quality in different areas. The Ichamati river is almost a dead river now. The natural flow of the river is too low to meet the environmental flow. The water quality parameters are listed before which shows that the dissolved oxygen is very low due to the excessive disposal of wastes which indicates an unfavourable condition for aquatic life. Thus, the biodiversity and habitat diversity is decreasing.

Impacts include those that affect the ecosystems directly and livelihood pattern of the surrounding area. The excessive dumping of industrial waste has already polluted the river to a great extent. The main adverse ecological impact was on aquatic flora and fauna of the Ichamati river. From the FGD of several farmer groups and experts, it is found that several fish types that used to be found naturally at the rainy season when there is water isn't found for last two years. The pollution also propagated to the downstream rural area of the Ichamati river which affected the fishery sector a lot. Many fishermen have shifted their profession and become day labourers or farmers. The groundwater is being used extensively as surface water of the river is not available in many points due to lack of flow of the Ichamati. Thus, the groundwater table is also degrading. The ecosystem is also hampered

significantly. As the dissolved oxygen is very low, its hard for the aquatic lives to survive in the river water. Thus, the biodiversity is degrading due to the pollution.

Response includes the regulations, law taken by government, NGO and local stakeholders. Bangladesh Water Development Board (BWDB) has undertaken a project of “Re-excavation of the Ichamati river” under the “Bangladesh Delta Plan 2100” to revive the river.

The DPSIR framework is shown in Figure 9.

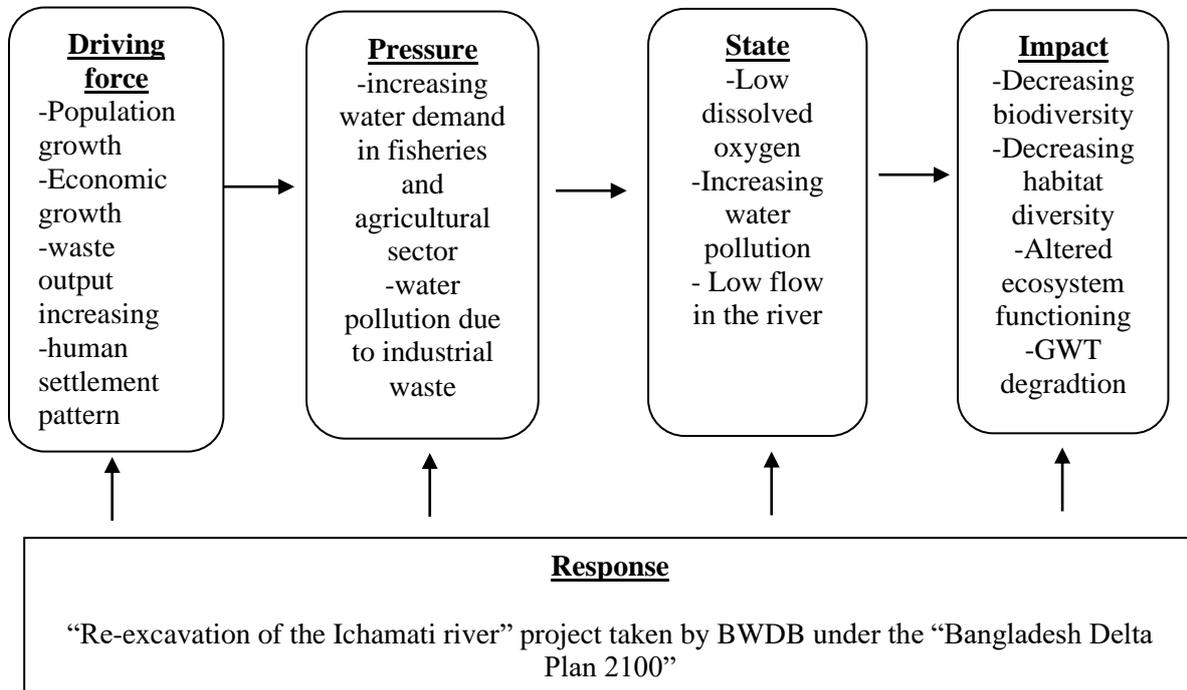


Figure 9: DPSIR framework on the Ichamati River

4. CONCLUSIONS

The Ichamati river is almost a dead river now. Apart from losing its environmental flow, the water quality of the river has also deteriorated due to the continuous disposal of waste water from industrial effluents, domestic wastes, agricultural wastes. To assess the water quality of the Ichamati river, five samples were collected from five different points of the river and different water quality parameters of the Ichamati river such as pH, TDS, alkalinity, temperature, conductivity, DO of the sample water are determined and it is observed that the amount of dissolved oxygen is not enough to maintain the aquatic life. The impact of the wastewater is significant on the surrounding ecosystem and livelihood of Pabna city which is shown through the DPSIR framework. From this study, it can be concluded that the degrading water quality of the Ichamati river is a great concern for the ecosystem, socio economic aspect and overall livelihood of Pabna city. Its recommended to take necessary steps to reduce pollution and restore the flow of the Ichamati with the integrated participation of concerned stakeholders.

REFERENCES

Bhuiyan, M.A.H., Rakib, M.A., Dampare, S.B., Ganyaglo, S., & Suzuki, S. (2011). Surface water quality assessment in the central part of Bangladesh using multivariate analysis. *KSCE Journal of Civil Engineering* 15(6), 995–1003.

- Carr, E.R., Wingard, P.M., Yorty, S.C., Thompson, M.C., Jensen, N.K., & Roberson, J. (2007). Applying DPSIR to sustainable development. *International Journal of Sustainable Development & World Ecology* 14 (2007), 543–555.
- Hasan, S. R., Hossain, M.T., Khan, L.A., & Afrin, S. (2018). Seasonal water logging problem in an urban area of Bangladesh: a study on Pabna Pourashava. Paper Presented in 1st National Conference on Water Resources Engineering (NCWRE 2018), 21-22 March 2018, CUET, Chittagong, Bangladesh.
- Saha, A.K. (2013). Environmental aspects of solid waste management: a case study of Pabna city in Bangladesh. *IJASET* 2(2), Vol. 02. Issue 02. Article No. 01, 1-8.