Proceedings of the 4th International Conference on Civil Engineering for Sustainable Development (ICCESD 2018), 9~11 February 2018, KUET, Khulna, Bangladesh (ISBN-978-984-34-3502-6)

IDENTIFYING THE IMPACTS ON RURAL LIVELIHOOD DUE TO SEASONAL VARIATION OF DAHUK RIVER DISCHARGE IN BANGLADESH

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ABSTRACT

This article explores the impacts of seasonal discharge fluctuation of Dahuk river on the livelihoods of the residents of 'Tetulia' Upazila under 'Panchagarh' district in Bangladesh. 75% of the respondents in the study area depend on Dahuk river for their livelihoods and sustenance where water scarcity in the non-monsoon period is a challenging issue. In the monsoon period, the discharge of Dahuk river was 48.6 m^3 per second while it was only 0.08 m^3 per second in the non-monsoon period. The study reflects on the significant impacts of this discharge variation on the natural, physical and financial resources. Moreover, a large number of farmers, fishermen and stone miners had to change their professions due to the adverse impacts of seasonal water scarcity. In the study, livelihoods diversification index is used for identifying the diversification of stakeholder's income in the monsoon and non-monsoon periods. Well-structured questionnaire survey, focus group discussion (FGD), participatory rural appraisal (PRA), and crosscheck interviews are performed for primary data collection. Finally, the study attempts to develop a sustainable rural livelihood framework to overcome the vulnerabilities of the stakeholder's livelihood in the study area approach in line with the United Nations Sustainable Development Goals. The implementation of sustainable livelihood framework in Dahuk River basin could reduce the repugnant consequences due to seasonal variation of Dahuk river's flow in the study area.

Keywords: *Dahuk river, livelihood, sustainable rural livelihood framework, sustainable development goals.*

1. INTRODUCTION

The availability of freshwater has major consequences over life and all social and economic processes. The system of fresh water is, therefore, a service of the ecosystem which, when interrupted, effects both the vitality of ecological systems as well as human well-being (Reid et al., 2005). The catastrophic changes of climate influence the Earth's ecosystem as well as people's livelihoods (Gain et al., 2012). As a major source of water, rivers are the crucial part of the ecosystem and play the vital role to the survival of civilization. Dahuk is a transboundary river, which originates from the marshlands Southwest of 'Jugibhita' within the 'Rajganj' block in the 'Jalpaiguri' district in India. It traverses the international border and crosses the 'Trinoihat' union at 'Tetulia' Upazila in 'Panchagarh' district of Bangladesh (BWDB, 2011; IUCN, 2014; Figure 1). Traveling to the South, Dahuk river flows through the western part of 'Tetulia' Upazila and, finally, it enters India (BWDB, 2011; IUCN, 2014). The main Dahuk stream is a major right-bank tributary of the 'Mahananda' (IUCN, 2014), but it has no branch river in Bangladesh (BWDB, 2011). Seasonal discharge variation of Dahuk river has caused severe impacts on natural, physical and financial resources, as well as on stakeholders' professions which is a serious challenge to achieve sustainable development goals (SDGs, 2017).

The total length of Dahuk river inside in Bangladesh is 14 km (BWDB, 2011). In Bangladesh, the river width varies in different locations, the lowest, highest and average width of the river is 20m, 139m, and 80m respectively. According to BWDB (2011), the river discharge was 1.43 m^3 per second in December 2010. Theoretically the river is perennial, however, the discharge is only 0.08 m^3 per second during the non-monsoon season more specifically in February – April (BWDB, 2011).

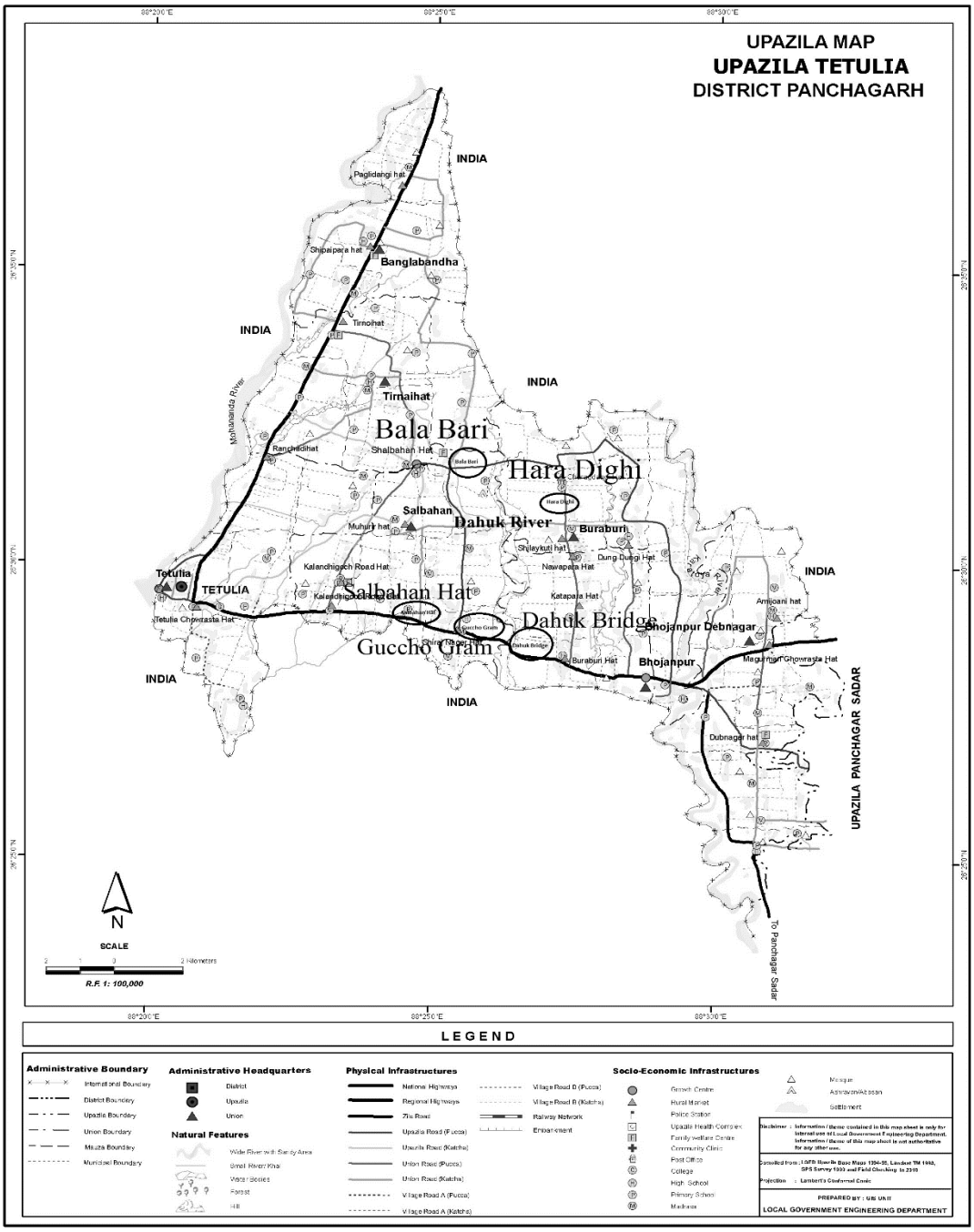

Figure 1: Tetulia Upazila of Panchagarh district.
Source: LGED (2016)

In the monsoon season, particularly during July to September, the discharge is about 48.6 m^3 per second (BWDB, 2011; IUCN, 2014). For years, the crucial roles of the Dahuk river basin wetland ecosystem inside Bangladesh include groundwater recharge, irrigation, sediment trapping, soil fertilization, food chains maintenance, crop production, livestock

grazing, fisheries production, source of stone and sand, essential minerals and other nutrients provision, wildlife habitat provision and aesthetic beautification.

Bangladesh is the downstream country of the Dahuk river basin. The freshwater availability depends on water diverted from upstream India (cf. BWDB, 2011). Also, the transboundary water sharing between India and Bangladesh, especially in the dry season, is long-term unsolved problem (Bhaduri & Barbier, 2008; Rahaman, 2009; Rahaman & Varis, 2009; Rahman & Rahaman, 2017). Besides, constructing dams and other developing projects in the upstream is an obstacle of free flow of sediment that is adversely affecting the flora and fauna in the study area. For ensuring the vitality of ecosystem and livelihood of the local people along the Dahuk river basin, transboundary water resources management is vital (cf. Jagerskog & Zeitoun, 2009).

Nations, like India and Bangladesh, that share water bodies should be cooperating to explore the opportunity for effective development of transboundary river basin (Jagerskog & Zeitoun, 2009). In many rivers basins around the world, transboundary water sharing mechanisms exist (for details see: Rahaman, 2015). Integrated Water Resources Management approach could be the best way to reach the sustainable development goals along the international rivers basins (SDGs, 2017) because it springs a negotiation among different water users, permits for a more comprehensive, fair and sustainable utilization of water resources (Peña, 2011; Rahaman and Varis, 2005).

The seasonal variation of discharge in the Dahuk river inside Bangladesh has a major impact on natural, physical and economic resources, as well as on stakeholders' profession, which poses a serious challenge to achieve the sustainable development goals (SDGs, 2017).. Many farmers, fishers, and stone miners have changed their walks of life with the variety of Dahuk's discharge. Furthermore, 75% respondents in the study area depend on Dahuk River for their livelihoods. Besides, with the growth of inhabitant and increasing the need for water, maintaining water resources in Dahuk basin is a prominent challenge.

Overall, the study provides the foundation for understanding the impacts of seasonal variation of Dahuk River discharge on the rural livelihood of villagers in “Tetulia Upazila” of Panchagarh district in Bangladesh. Additionally, it stresses the need to develop a sustainable rural livelihood framework approach intended to overcome the vulnerability of stakeholder's living. Finally, the study attempts to develop a sustainable rural livelihood framework approach to overcome the vulnerability of stakeholder's livelihood in the study area in line with United Nations Sustainable Development Goals (SDGs, 2017). Implementation of the proposed sustainable livelihood framework in Dahuk River basin could diminish the negative impacts on the rural livelihood in the study area due to seasonal variation of Dahuk river discharge.

2. METHODOLOGY

The research was carried in Dahuk river basin inside Bangladesh. In this study, a questionnaire survey is used to collect primary data. The survey is conducted in four villages namely 'Guccha Gram', 'Haradhighi', 'Balabari' and 'Shalbahan Bazar' in 'Tetulia' Upazila of 'Panchagarh' district of Bangladesh. In the questionnaire survey, a total of 100 people are interviewed. All respondents were chosen randomly from different villages located in Dahuk River basin area of Bangladesh. The focus of the survey is to ascertain how the seasonal variation of the Dahuk river discharge influences the livelihoods of the stakeholders, crop production, fisheries, and emigration. Besides, the crosscheck interviews (Afroze, 2014) were also done to justify the primary data by Upazila Nirbahi Officer (UNO) and Upazila Agricultural Officer (UAO) of Tetulia Upazila. Additionally, Focus Group Discussion (FGD) is performed in the study area. The Participatory Rural Appraisal (PRA) tool is also used in

FGD that represents the information about the living status, recent changes in lifestyles, and stakeholder's interest level to be involved in the addressing land and water resources management (cf. Allan & Curtis, 2002).

3. DATA ANALYSIS AND RESULTS

3.1 Overview of the stakeholder's livelihoods of Dahuk river

47% of respondents of the study area are women. Most of them enthusiastically participated in the interviews as well as in the group discussions. However, the respondents are classified into three groups based on their age. 31% of respondents are middle-aged (34±3 years) and more active. Stakeholders, who are 41-50 years old, make more capital. Additionally,

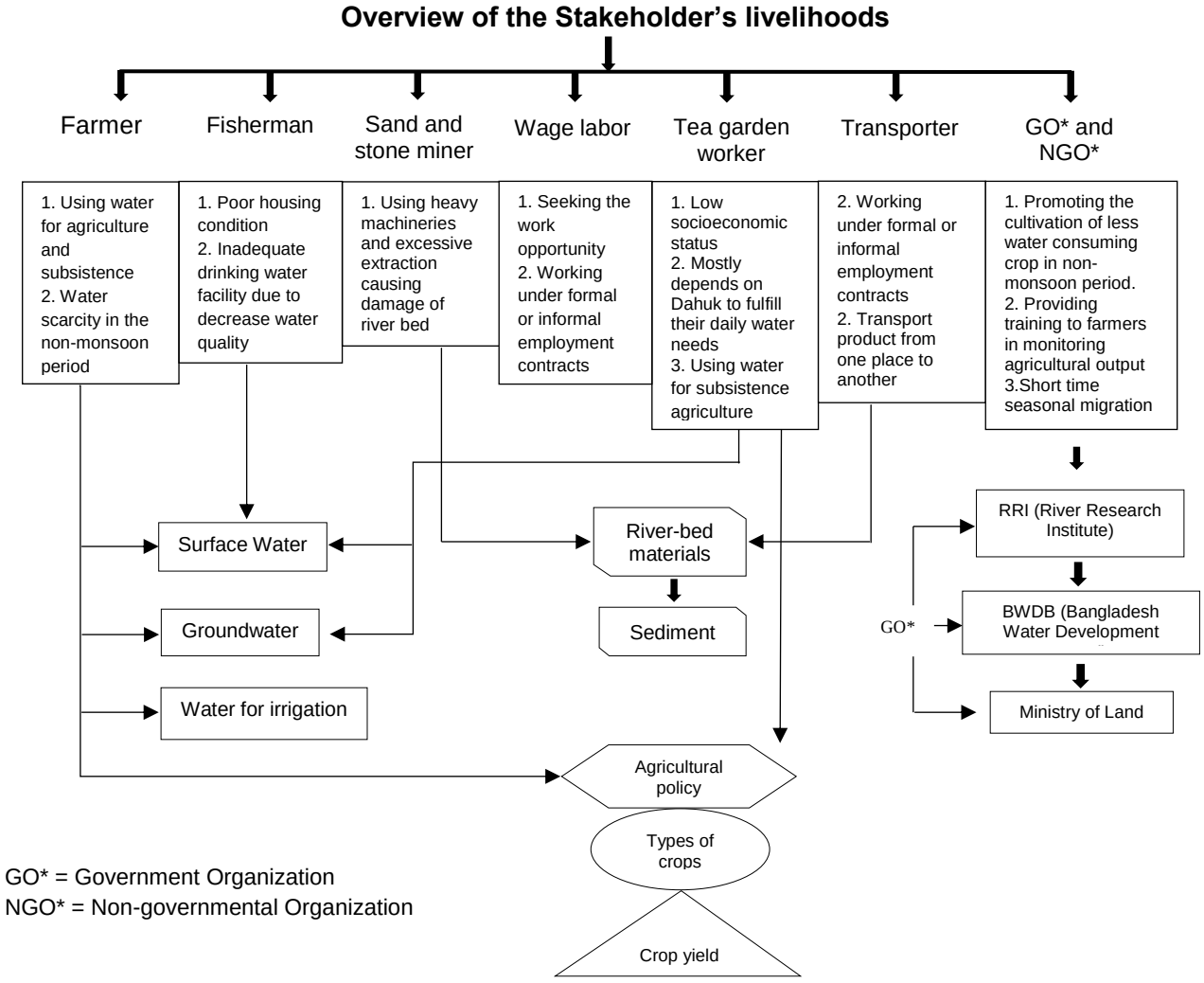

Figure *2*: Overview of the Stakeholder's livelihoods of Dahuk river basin area.
Source: Field Survey (2016)

25% of the respondents are young (20-30 years) and 13% people are in the age group of above 50 years. 38% of the families in the study area are nuclear family. Members of the ordinary families are seen to be tea garden workers and farmers. A very small portion of families consists of members who are working in business and service sectors.

Agriculture assigns about 50% of total labour potential in Bangladesh and contributes about 10% to the GDP (Roy et al., 2014; Rahaman & Shehab, 2017). Similarly, a majority of the residents of the study area mainly depends on agriculture as a source of income for the subsistence. Among the 100 people who were interviewed, 34% of the respondents were farmer. 20% female respondents were tea garden worker. Furthermore, 19% people had been surviving by doing labour work on daily basis. With the seasonal variation, some possibilities of employment are created. A large number of fishermen work in the industry or the agricultural field in the non-monsoon period for their survival when the lack of water in Dahuk river hinders their livelihood based on fishing. In the study area, it is seen that 35% of the people are uneducated. Only 31% and 11% of the respondents have the primary and secondary level of education respectively. Most of the people who are working in the agricultural sector, tea garden, and as day labourer, have no education.

According to the survey, 75% stockholders depend on Dahuk river for their livelihood. People who are working as service holders are more economically solvent. Tea harvesting becomes more challenging due to the low level of water in non-monsoon season resulting in lower wages of tea garden workers (Table 1). In this period, some of them work as a day labor under an informal employment agreement. Moreover, the earnings of farmers rise in the non-monsoon season (Table 1). Farmers mainly depend on river bed area for rice cultivation in the non-monsoon season. Although rice is a high water consuming crop (Rahaman et al., 2016; Rahaman & Shehab, 2017), farmers are more involved in rice harvesting because cultivation of rice is more beneficial compared to other crops. Besides, sand and stone miner's wages is comparatively high in the non-monsoon season (Table 1). Due to the less river water flow in the non-monsoon season, the uprooting of river bed elements is relatively simple for then. In the monsoon period the income of fisherman is quite satisfying compared to the non-monsoon season (Table 1).

The stockholders of Dahuk river basin depend on groundwater to meet their farming and drinking water demands due to seasonal variation of discharge in Dahuk river. For drinking water, 95% people rely on tube well. The surface water is not adequate in the non-monsoon period that increases the dependency on groundwater. More usage of tube well water contributed to decline of the groundwater table day by day. Dahuk river provides 48% of agricultural water requirement and 41% of industrial water requirement. Besides, for the municipal purpose, 32% of stakeholders depend on Dahuk's water. However, the water usability of Dahuk river is declining in current years. Only 22% people use toilets,in the study area. Most of the toilets are located nearby the Dahuk river without proper disposal systems and, consequently, pollute river water, soil, and air. More importantly, bacteria or other contaminants are propagating through infiltration that reduces the groundwater quality. (Ahmed & Rahman, 2000).

3.2 Agriculture practices of Dahuk basin area in Bangladesh

Most of the farmers of Dahuk basin area in Bangladesh are highly involved with rice production. Although Bangladesh has the highest yield of rice production in South Asia (FAOSTAT, 2017; Rahaman & Shehab, 2017), according to the local farmbers, the productivity of rice production is declining in recent year . The lack water availability in Dahuk river and temperature increase could be the reasons for this situation. According to the survey, 75% of the area enclosing the Dahuk river is used for rice cultivation. Farmers have grown rice in the low land area, jute and rice in the medium high land area and various types of daal (lentil) and vegetables in the high land area. As irrigation has an immediate connection to the crop yield, farmers have to supply water to the cultivated land with an interim of five to six days to get a favourable production. However, the unequal discharge of Dahuk river and decline of groundwater table caused to raise the expense of irrigation.

3.3 The discharge variation in Dahuk river

Dahuk is an international cross-border river. The fluctuation of Dahuk river's discharge is significant with the seasonal change. Data from two gauge stations located in Bangladesh (SW 57-Buribari (NTWL) and SW 57-Buribari (NTQ)) have shown a remarkable seasonal discharge variation of water in the Dahuk river over a year (BWDB, 2011). In the monsoon season, more specifically in July to September, the flow of Dahuk river was 48.6 m^3 per second (BWDB, 2011). Furthermore, the river flow was much low during the non-monsoon period particularly in February to April, which was only 0.08 m^3 per second (BWDB, 2011). Hence, the unexpected changes of climate, construction of dams and reservoirs, and other development projects in the upstream could be the cause for the variations of Dahuk river discharge in Bangladesh.

3.4 Possible impacts on the livelihoods

Livelihoods diversification index is used to find out stakeholders income diversification and vulnerability. There are various livelihoods diversification indexes such as Composite Entropy Index, Entropy Index, Modified Entropy Index, Simpson Index, Shannon Wiener Index (Shiyani and Pandya, 1998). In this study, Simpson and Shannon Index are used for recognizing the diversification of earnings in the monsoon and non-monsoon period. The Shannon Index (H) and Simpson Index (D) is represented by**:**

H=-$\sum_{i=1}^{S} \frac{n_i}{N} ln \frac{n_i}{N}$, D= 1-$\frac{\sum_{i=1}^{S} n_i(n_i-1)}{N(N-1)}$; Where N is total number of income, $\boldsymbol{n_i}$ is the individual income ofstakeholders.

Shannon Wiener Index (H) in non-monsoon season is higher than monsoon period, which indicates that the stakeholder's income is more diversified in the non-monsoon season.

Stakeholders	Non-monsoon period (November - May)			Monsoon period (June - October)		
	Income (Current US$)	Shannon wiener Index	Simpson index	Income (Current US$)	Shannon wiener Index	Simpson index
Farmer	1355	-0.35	0.068	409	-0.27	0.02
Fisherman	313	-0.36	0.003	1024	-0.36	0.12
Stone/sand miner	1251	-0.34	0.05	341	-0.25	0.01
Wage labor	651	-0.26	0.01	391	-0.27	0.01
Tea garden labor	782	-0.28	0.02	279	-0.22	0.009
Transporter	810	-0.29	0.02	428	-0.28	0.02
Total	5162	H= 1.89	D= 0.8	2872	H= 1.67	D= 0.78

Source: Data collected from Field Survey (2016)

Based on the standard (no diversification, D<=0.01); low level of diversification, D=0.01-0.25; medium level of diversification, D =0.26-0.50; high level of diversification, D=0.51-0.75; very high level of diversification, D=>0.75) (Ahmed et al., 2015) livelihoods diversification is much higher in the Dahuk basin area (Table 1).

The inadequacy of water is a public concern in Dahuk basin area. During non-monsoon season (November-May), the scarcity of water is extremely high. More importantly, to meet the agricultural water requirement, most of the poor farmers of Dahuk basin area rely on river water. During monsoon season (June to October), Dahuk river fulfils the stakeholder's demand for agricultural, domestic and industrial water requirements but, when water

becomes infrequent in the non-monsoon season, around 33% of people forcefully rely on groundwater for irrigation, thus, creating significant stress on groundwater. Besides, the lack of water availability in Dahuk river in non-monsoon period threaten the ecosystem stability and livelihoods of people that depend on the river.

Drought is another problem in the study area. Around 28% respondents have suffered drought in Dahuk River basin area (Field survey, 2016). In addition, 37% respondents said that extreme sand and stone mining are continually killing the riverbed of the Dahuk river. Setting up grinding stone machine near the river and inappropriate sand and stone mining could be a vital reason for river erosion. 21% respondents are affected directly by the river erosion. In addition, air pollution is a remarkable problem in the study area where emission of CO_2 and CO from several brickfields is a great threat for the vitality of ecological stability. Moreover, Dahuk river has been changed its course with 15 degrees inclined from east to west at "Guccha gram" area (Field survey, 2016). In addition, bad odour is found in river water which is increased in monsoon period though the water level is high at this time. Wetting jute, dumping human and industrial wastes are the main reasons to spread bad odour, and watercolour becomes blackish. 70% respondents are not using river water for drinking and domestic purposes as water is unsafe.

3.5 Sustainable rural livelihoods framework

Livelihoods of rural Bangladesh is dependent on both agricultural and non-agricultural businesses (Ahmed et al., 2015). As an agrarian country, agriculture is the root of the rural livelihoods in Bangladesh. However, a livelihood is sustainable when it can cope with and retrieve from stresses and shocks, keep up or ameliorate its capabilities and assets, while not damaging the natural resources (Smyth & Vanclay, 2017). The study starts with an analysis of people's livelihoods and how these have been changing over time. Social progress like basic human needs, the foundation of well-being and opportunities can contribute to achieve the Sustainable Development Goals related to water (SDGs, 2016). Table 2 has demonstrated the relationship between sustainable goals with the analysis of the research.

Table 2: An approach to change: enhanced capabilities and social life

Sustainable Livelihood Framework				
SDGs Goal No & Name	Goal's targets	The research findings	Possible ways to meet the SDGs	Recommendations
1. End poverty in all its forms everywhere.	1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including	Monthly household's income indicates that there has had a higher number of poor compared to per capita income (FAO, 2017).	In the study area, creating equal opportunities could minimize the vulnerable condition (Gerard et al., 2012). Social life and environment could be enriched by enhancing the quality education, health, and other social services (Ali & Zhuang, 2007). Besides, higher agricultural productivity could play a vital role to established	The local and international NGOs and the government should work together for poverty mitigation. Besides, giving microcredit with low-interest rate could be more efficient.

	microfinance.		Sustainable livelihoods framework (Ali & Zhuang, 2007). Activities of the social entrepreneur like the Institute of OneWorld Health (USA) and Sekem (Egypt) could enrich the social structure (Christian & Johanna, 2004).	
2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture.	2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round.	Water scarcity is a significant constraint for adequate food production. Transboundary river conflict is a challenging issue for Bangladesh. Agricultural water demand in the downstream area is affected when the water body is controlled by upstream county (Strasser el al., 2016). Morevoer, farmers claimed that the productivity of rice production is decreasing in recent past (Field survey, 2016).	Rain-fed agriculture and conjunctive use of water could reduce the pressure on groundwater (Rahaman & Shehab, 2017). The rain-fed agricultural practice is more beneficial for poor farmers as it is areound two times more effecient than irrigated agriculture (Seckler, & Amarasinghe, 2000). Besides, high yield varieties crops are grown in rain-fed agriculture, which positively effects food security. Food should be stored in monsoon season for using during drought.	Need to prioritize in some factors for the improvement of food security that includes, implementation of high yield verities crop, reducing yield gap, improvement of irrigation efficiency and ensuring adequate storage facilities for the crop as well as water resources.
3. Ensure healthy lives and promote well-being for at all ages	3.8 Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all.	Health facilities are inadequate in study area. In particular, high population growth rate, increasing water demand, and contamination form unplanned waste disposal system have adverse impacts on human health.	Increase investment in the health sector, and the recruitment, development, training, and retention of the health workforce should be encouraged to ensure health amenities.	Usually, rural people live in fresh and contamination free environment but, nowadays, they have affected by several diseases (Saadat, 2010). Health system should improve by investing cost-effective primary health care services including care centers provided by the government and non-government organization.
4. Ensure inclusive and qual¬ity education for all and	4.1 By 2030, ensure that all girls and boys complete free,	Educational qualification among the stakeholders is	The government should take urgent steps for providing primary and secondary education	Providing primary education was the earlier objective of Millennium

promote lifelong learning.	equitable and quality primary and secondary education leading to relevant and effective learning outcomes. 4.3 By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship	quite low in Dahuk basin area. Most importantly, farmers have no education and, thus, not able to adopt advanced agricultural technology.	efficiently among all the stakeholders. Moreover, they need to encourage the private sectors for more investment for the development of educational tools, policy, and practice.	Development Goals (MDGs) but providing secondary education and promote lifelong learning is the new target of SDGs which is very aspirational for developing countries to come out from poverty. Without quality education, no sustainable development goal (SDGs, 2017) can be achieved.
6. Ensure availability and sustainable management of water and sanitation for all	6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all. 6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations. 6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.	Water scarcity is a common issue in Dahuk river basin area. Decline of groundwater table is caused by the unsustainable extraction of groundwater to fulfill the agricultural demand. Poor sanitation facilities and unplanned waste disposal in Dahuk river have adverse impacts on drinking water. Most of the toilets are built near the riverside and poor operation and maintenance of sanitation results to rapid deterioration of river water (cf. Brikke and Bredero, 2003; Field Survey, 2016). Moreover, function and maintenance of water supply and sanitation system are	Freshwater is a vulnerable and essential resource and should be managed in an integrated manner (Rahaman & Varis, 2005). Water development and management mainly depend on the approach involving users, planners, and policymakers. A nationwide program known as Water Sanitation, and Hygiene (WASH), developed by BRAC aims to enhance the health situation of the poor (Nowreen et al., 2011). It will accommodate safe drinking water for 8.5 million people and sanitation facilities for 17.5 million people in 150 Upazila around the country (Nowreen et al., 2011). Village-level Operation and Maintenance (VOLM) is known as a sustainable technology for operation and maintenance at the community level to ensure long-term	Practices of harvesting less water consuming crops in dry season could reduce the stress on groundwater. The government should establish a proper monitoring system and legislation for using groundwater. Besides non-government organization and the citizens need more closely involved to improve the overall scenario. Most importantly, negotiation needs to be made with the upstream country to solve the transboundary river issues and meet the SDGs.

		neglected by communities as well as the government. However, transboundary river conflict is one of the challenging issues in Bangladesh. Controlling the river body by upstream county results to increase the water insufficiency due to the inadequate flow of surface water during the non-monsoon season.	benefits (Brikke and Bredero, 2003). The following policies stated by EC (2000) and Hall (1998) could be the sustainable approaches for mitigating the adverse impact. • Expanding the scope of water protection. • A strong commitment to pollution prevention by set up a deadline. • A requirement to amplify the advanced technology for waste treatment and disposal. • Need to established guideline of emission and environment-friendly legislation for sustainable development. Increasing the availability of surface water for irrigation during non-monsoon months should be ensured through transboundary water cooperation. Besides, reducing the use of groundwater and increasing irrigation efficiencies should be encouraged. Promoting the conjunctive use of surface and groundwater for irrigation should be promoted (cf. Rahaman & Shehab, 2017).	

4. CONCLUSIONS

This study examines the impacts on the livelihoods of residents due to the variation of Dahuk river's discharge in 'Tetulia' Upazila of 'Panchagarh' district in Bangladesh. In the survey, approximately 100 stakeholders were randomly selected to collect primary data to identify the impacts of the temporal variation of Dahuk river discharge on the livelihoods of the people living in Dahuk river basin area inside Bangladesh. These impacts are summarized below.

45% of the respondents are farmers and majority of them fully depend on Dahuk river's water to fulfil their agricultural water demand. Water scarcity in non-monsoon period is the most concerning issue in the study area. During non-monsoon period (February –April), the discharge of Dahuk river was only 0.08 m^3 per second , and during the monsoon season

(July-September) the discharge increased to 48.6 m^3 per second. Besides, transboundary river conflict is one of the challenging issues in Bangladesh. Controlling the river body by upstream country could results in further increase of the water scarcity due to the inadequate flow of water in Dahuk river during the non-monsoon period. Therefore, the propensity of unsustainable use of groundwater is increasing day by day.

Approximately, 75% respondents directly depend on the Dahuk River for their livelihoods. In terms of economic stability of farmers and fishermen, monsoon season brings more economic benefits for the fisherman in comparison to farmers. Likewise, the monsoon season is also suitable for tea gardening, as it needs much water for cultivation. On the other hand, the non-monsoon season is beneficial for the sand miner, as it is easier to collect stone from the Dahuk River without excavation. However, income and livelihoods diversification index (see Table 1) indicates that the stakeholder's income is more diversified in the non-monsoon season. Many farmers, fishermen, and stone miners have to forcefully change their professions with the seasonal variation of Dahuk's discharge. The river water plays a vital role to fulfil the agricultural, drinking, and industrial water demand. However, unsustainable sanitation practices, lack of industrial waste disposal system, wetting of jute in Dahuk river are the main reasons of decreasing water usability day by day. Already 70% respondents are not using river water for drinking and domestic purposes as water is unsafe.

As the seasonal change of Dahuk river discharge have adverse impacts on agriculture, livelihoods, and well-being of the stakeholders in the study area, a holistic policy approach, presented in table 2, should be considered to enhance the adaptability of local people, minimize the vulnerability and established a sustainable livelihood framework in Dahuk river basin area of Bangladesh in line with the United Nations Sustainable Development Goals.

ACKNOWLEDGEMENTS

The excellent support from the Department of Civil Engineering, University of Asia Pacific, and its staff is greatly appreciated. Thanks to Rony Ahammed and Anamul Karim for their participation during the field study.

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