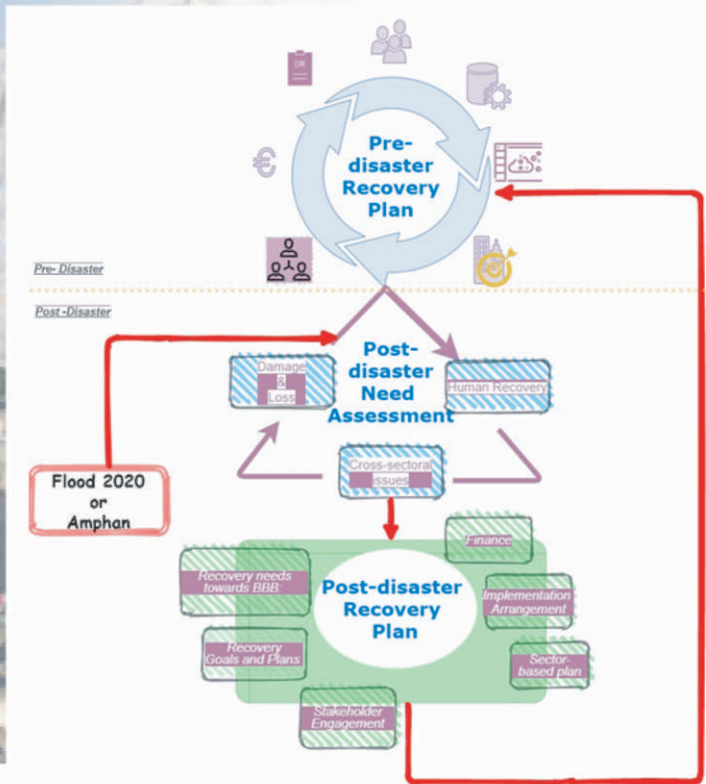




Proposed

# National Recovery Strategy

September 2021



National Resilience Programme (NRP)  
Department of Disaster Management  
Ministry of Disaster Management and Relief





# National Resilience Programme



## National Recovery Strategy and Plan for Cyclone Amphan and Flood 2020

Final Report  
IWFM, BUET  
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## Executive Summary

Living 2020s, in a superior knowledge and information-based human society than ever, we see the disaster risk is taking on new forms and dimensions with every passing year, and it is happening all over the world. An inadequate or failed disaster recovery may result in secondary disaster, derails development gains, increase vulnerability, and create chronic risk conditions in case of recurrent one. Though the global trend shows that in the short-term, disaster management agencies have succeeded in saving lives through better preparedness through dedicated staff and volunteers, the number of affected people (+32%) and economic loss show a sharp increase (+118%) (UNDRR 2020). A similar trend has also been observed in the case of Bangladesh, however still deep gender inequality becomes starkly obvious in disaster contexts. Where gender-disaggregated information is available, more women and girls die and suffer losses during disasters in Bangladesh. The country has ground-breaking success in managing the disaster, in particular, preparedness and humanitarian response for saving lives from recurrent disasters which are particularly true for disaster risk reduction efforts in the coastal area. However, while the loss of life has been reduced significantly, the economic loss and damage have increased manifolds over the decades, particularly because the rapid development activities and urbanization are falling under a new threat of damages and vulnerability under the amplified disaster events. Under this backdrop, UNDP through its National Resilience Programme has undertaken this initiative of a cutting-edge study of reviewing the current practices to devise a recovery strategy and action plan for the medium to mega-disasters coupling recovery and mainstream developments, regarding the recent Hydrological (for example, flood 2020) and Meteorological (for example, cyclone Amphan in 2020) disasters events.

The overall aim of this initiative is to formulate a risk-informed, gender and socially-inclusive, multi-sectoral coordinated disaster science-informed Disaster Recovery Strategy for Bangladesh. The study will review the current practices at different government institutions and identify the gaps and challenges for effective recovery interventions. As the study area, the flood 2020 affected area Kurigram-Jamalpur, as well as Koyra upazilas (affected by cyclone Amphan), are selected. The recovery strategy will be developed for agriculture, public infrastructure, and the socio-environmental sector.

As the first step of methodology, pre-disaster baseline data has been collected through secondary literature and field surveys. The study will perform Post Disaster Need Assessment (PDNA) guided by The Global Facility for Disaster Reduction and Recovery (GFDRR) and has been developed the Recovery Strategy by using science-based tools. The PDNA comprises of the assessment of disaster effects (Damage Assessment of infrastructure and physical assets, Disruption to the production of and access to goods and services, Governance and decision-making processes, Increased risks and vulnerabilities) and disaster impacts (macro-micro level economic impact and Human development impact). The flood 2020/cyclone Amphan effects and impacts has been assessed basically through the review of secondary literature, FGD, KII and Semi-structured survey in the study area. The sectoral needs and prioritization process have been facilitated by several science-based tools developed at IWFm, BUET. Through the development of recovery strategy for flood 2020/cyclone Amphan is aimed to address the future recovery issues and thus this study will develop a generic Pre-disaster Recovery Plan (PDRP) which is expected to guide future recovery efforts in different phases with improved recovery outcomes.

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## 1 Introduction

### 1.1 Background

Bangladesh has groundbreaking success in managing the disaster, in particular, preparedness and humanitarian response for saving lives from recurrent disasters. It has globally become a role model in reducing the loss of life due to disasters over the decades through strong institutional settings with capacity-building initiatives through developing policy, plan, manuals, guidelines, orders and acts. This has been particularly true for disaster risk reduction efforts in the coastal area, with the coastal Cyclone Preparedness Programme (CPP) being the best example. However, while the loss of life has been reduced significantly, the economic loss and damage have increased manifolds over the decades. One of the major reasons for this is limited, uncoordinated recovery efforts, in the absence of a comprehensive post-disaster recovery planning framework or strategy. Disaster recovery in Bangladesh is always handled in a scattered manner with inadequate attention. Recovery and reconstruction have not been effective because of the absence of an inclusive plan, inadequate implementation and long recovery time resulting from weak coordination, absence of proper failure analysis, ignoring the geophysical dynamic process and climatic influence on the disaster. Segmented sectoral recovery efforts without comprehensive (Gender-responsive and Risk-Informed) build back better approach is causing huge loss and damage every year by the recurrent disasters.

After disaster, most of the concerned government agencies take immediate initiatives to revive the system for making functionality with their regular maintenance fund, as normally there is no specific fund earmarked for addressing recovery. In most cases, it is done quickly without considering the risk dynamics. For major rehabilitation and reconstruction, new funding is allocated which lacks the build back better approach, founded on the consideration of climatic and environmental impacts, and rooted in gender-inclusive and people-centric system. Importantly, the recovery process lacks overall multi-sectoral coordination, which is very essential to synchronizing the activities across different sectors, reducing overlaps, and ensuring efficient use of resources.

It is widely recognized that recovery is complex, exhibiting multiple and diverse patterns of change, having no fixed endpoint, and no single agency or sector alone is responsible for it. Moreover, it takes place in a 'new normal': a context that is, to some extent, irreversibly altered by the disaster itself. As new insights into reconstruction and recovery processes are emerging, we need a comprehensive approach where human-centric system can be introduced, with the integration of traditional, often very effective community-based and indigenous practices.

Post-disaster recovery is often conceptualized and designed to return the community to the conditions of normal development it enjoyed before a disaster occurred, ie rebuilding pre-existing conditions of disaster risk, thus preparing the ground for future disaster. In most cases it is limited to the physical aspects and often overlooks pre-existing social, environmental, and financial dynamics of the affected population. The sectoral approach, in absence of a comprehensive and inclusive disaster recovery plan, strategy and design, falls short of addressing this dilemma. This results in gaps in coverage and slow pace of recovery. Risk reduction measures, while initially performing well in reducing risks, often fail to sustain their performance and contributes to

increased risks. For example, flood damage and loss in recent decades have been much higher compared to the extent of inundated area as embankments fail to provide protection in very severe flood events as well during small to medium flood events, causing inundation in areas which have undergone substantial changes in terms of infrastructural and economic development activities. Lack of coordinated effort and absence of good recovery plan has meant that assessment of loss and damage and recovery has not been a regular phenomenon; damage and loss assessments of only 7 major disasters have been carried out in the last 20 years, with amount valued at \$11.6 billion, while in reality the total loss would be much higher during the same period. In sum, the country is experiencing recovery gaps in terms of knowledge, practice, and resource.

First, the concept of recovery is not yet fully integrated into the policies and planning instruments of the Government. Second, recovery plans and efforts are not yet fully aligned with the long-term development agenda. Third, lack of a unified and coordinated sectoral recovery plan might be a gap in the context of recovery and Build Back Better approach. It is observed that international funding for emergency relief goes to its peak during any disaster and later it drops drastically which results in scarcity of resources for recovery. Despite increase in gross allocation in disaster preparedness (DP) and DRR by the government, funding are not often adequately available for recovery work linked to development. Moreover, due to lack of coordination, duplications of efforts - a waste of resources in other words – is also common. There is no system-wide approach to recovery, understood and accepted by all parties.

The recovery framework will be in alignment with the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW)<sup>1</sup>, a legally binding international treaty. CEDAW General Recommendation 37 (2018) on the gender-related dimensions of disaster risk reduction in the context of climate change<sup>2</sup> explicitly links disasters, pandemics, and women's rights in an actionable way taking into account the principles of substantive equality and non-discrimination, participation, and empowerment, accountability, and access to justice. The recovery plan should take into account the Ha Noi Recommendations for Action on Gender and DRR<sup>3</sup> for the achievement of SFDRR and [Yogyakarta Principles \(2007\) and Yogyakarta Principles + 10 \(2017\)](#) to ensure that people of diverse genders in policy and practice are entitled to the same human rights as all other persons. Thus, the actions for gender and social inclusion under the Amphan Recovery Framework will be reported in the Universal Periodic Review and the Review of Sendai Framework Asia Pacific Regional Action Plan.

Under this backdrop and realizing the appetite of GoB, UNDP through its National Resilience Programme, has undertaken the initiative of a cutting-edge study of reviewing the current practices

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<sup>1</sup> United Nations General Assembly (1979) Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW): <https://www.ohchr.org/Documents/ProfessionalInterest/cedaw.pdf>

<sup>2</sup> CEDAW (2018) CEDAW General recommendation No. 37 (2018) on the gender-related dimensions of disaster risk reduction in the context of climate change: <https://digitallibrary.un.org/record/1626306?ln=en#record-files-collapse-header>

<sup>3</sup> Asia Pacific DRR and Gender Stakeholders (2016) Ha Noi Recommendations for Action on Gender and DRR: [http://reliefweb.int/sites/reliefweb.int/files/resources/52737\\_hanoirecommendationfinal13julen.pdf](http://reliefweb.int/sites/reliefweb.int/files/resources/52737_hanoirecommendationfinal13julen.pdf)

to devise a recovery strategy and action plan for medium to mega-disasters, drawing experiences from the recent disaster events, cyclone Amphan and Monsoon Flood 2020. The timing of this initiative appears right as concerned ministries and agencies have gone past immediate response phases and are in the middle of or close to finishing assessment of sectoral damage and loss accrued in these two events. What makes the initiative even more important are the facts that the vulnerability and risk dynamics of cyclones and floods are different in several aspects, and the nature and extent of damage and economic loss associated with different components and hence the need for their recovery also differ prominently.

## 1.2 Defining Recovery

The definition of ‘recovery’ by provided by UNDRR ‘*The restoring or improving of livelihoods and health, as well as economic, physical, social, cultural and environmental assets, systems and activities, of a disaster-affected community or society, aligning with the principles of sustainable development and “build back better”, to avoid or reduce future disaster risk*’ is adopted in this study.

Sometimes the term ‘recovery’ is mixed with rehabilitation (*the restoration of basic services and facilities for the functioning of a community or a society affected by a disaster*) or reconstruction (*the medium- and long-term rebuilding and sustainable restoration of resilient critical infrastructures, services, housing, facilities and livelihoods required for the full functioning of a community or a society affected by a disaster, aligning with the principles of sustainable development and “build back better”, to avoid or reduce future disaster risk*). The recovery process involves both activities that were planned before disaster and those that were improvised after the disaster is needed to view as an integrated process, inseparable from preparedness, response and mitigation (Dorman 2013). and integrated with development.

## 1.3 Experiences with past recovery efforts SIDR

The cyclone SIDR hit the south-east coast of Bangladesh on 15 November 2007. It caused partial/severe damage to over 1.5 million households, prompting arguably the largest ever housing recovery in the country’s disaster history. Based on assessments by the government, the Shelter Coordination Group (SCG) and the United Nations Development Program (UNDP), it was estimated that out of 1.5 million affected households, 66 percent were fully damaged of which approximately 200,000 households (later revised to 300,000) required external assistance to repair and reconstruct their houses. As an immediate follow-up measure, cash support of BDT 10,000 and BDT 5,000 for housing repairs was provided by the GoB to all affected households totaling US \$27 million. Besides, shelter materials such as CGI sheets, bamboo, tents, polythene sheets, and toolboxes were provided by the GoB, NGOs, and the government of Japan and Saudi Arabia.

In absence of a recovery policy in Bangladesh’s disaster response system, the post-disaster recovery effort to SIDR was largely driven by practice. In fact, the roles of different ministries in



housing recovery are not specified in the country's main legal framework for disaster management, rather coordination was based on the Standing order on disasters (GOB, 1999) which has a minimum focus on recovery efforts. In the post-SIDR period, the Ministry of Disaster Management and Relief (MoDMR) and its associate departments such as the Disaster Management Bureau (DMB) and the Department of Relief and Rehabilitation (DRR) took the lead in coordinating the housing recovery process (GFDRR, 2004). The execution of shelter strategy was monitored by the Shelter Working Group (SWG), under the aegis of the GoB.

Till 2007, post-disaster recovery efforts were focused on agriculture, infrastructure, water resources, food security, and studying the implications of disasters for macro-economic indicators. The concept of housing recovery never received adequate attention. Rather, the government was of the assumption that, if recovery of public infrastructure (i.e., highways, rural roads, rail systems, river terminals, jetties) was ensured, it would enable housing recovery as well. This philosophy sidetracked the housing recovery effort as a whole. Even, international agencies such as the World Bank and Asian Development Bank continued to provide post-disaster support to critical infrastructure, ignoring housing recovery without any rationale (Bake, 2005). NGOs' support to housing recovery during the floods of 1988 and 1998 and the cyclone of 1991 were fraught with issues of problematic targeting, geographical overlapping, lack of coordination, wide cost variations, and non-participatory and inappropriate design (Bake, 2005). In essence, the lack of governmental mandate resulted in an absence of a structured system through which people affected by disasters can find a designated place in recovery efforts. Rather, the whole post-disaster housing recovery scenario following SIDR was dependent on the inclination and policy of the recovery agencies.

Prior to Cyclone SIDR, Bangladesh did not have a definitive national design standard, only a building code for the construction of concrete buildings in urban areas. But it did not cover post-disaster recovery/reconstruction. Besides, due to the uncertainties of resource mobilization for housing recovery, SWG found it difficult to agree on minimum standards and designs that could be universally followed. On the other hand, humanitarian agencies applied their own set of design standards based on their availability of funds and philosophical approach to housing recovery. This generated a wide spectrum of variability in housing unit cost and structural design. So, the GoB and the SWG, based on the principle of Build Back Better (BBB) settled on a minimum structural design standard which was validated through expert consultation. But its implementation was not such a straightforward task either for the government or independent humanitarian agencies. The primary setback came from the major dilemma to balance the huge unmet need for shelter and the high unit cost for resilient housing. Besides, some of the donors did not agree with the adopted design regulations. Eventually, several construction practices emerged with some features of resilient design. Nonetheless, the housing recovery operation made a substantial impact on the overall post-disaster scenario. It reduced the number of beneficiaries living outside a protected environment by 30 percent, from 37 percent to 7 percent (GFDRR, 2004).

Agriculture was one of the most hard-hit sectors during SIDR. The farmers incurred an estimated loss of 800,000 - 1.3 million MTs of cultivable paddy, fisheries, livestock totaling to a US\$ 437.6 million production loss. It was further amplified by salinity intrusion in the coastal belt, over-

topping of polders, and scarcity of ground water. Major initiative by the government included advance provision of credit in form of cash grant up to Tk. 5000 per acre (Hossain and Deb 2008). Other recovery initiatives included agricultural aid such as seeds, fertilizer, cultivation machines from the Ministry of Agriculture. As per governmental records, 60 power tillers, 130 power pumps and spray machines were distributed among local farmer groups to stimulate post-SIDR yield (World Vision 2008). Whereas water infrastructure support (i.e., dams, irrigation canals) was given by the Local Government Engineering Division (LGED). Farmers were also trained in crop diversification and technical knowledge to cultivate hybrid and high yield rice, maize, lentil varieties as an alternative to traditional paddy in high salinity environments. Unfortunately, these initiatives by GoB and NGOs were inadequate compared to the scale of agricultural devastation. Although appreciable, the unstructured nature of these recovery efforts failed to have a major positive impact on the overall post-disaster recovery scenario.

Bangladesh's extensive polder system is viewed as the first line of defense for coastal communities against tidal surge and salinity intrusion. SIDR did extensive damage to this earthen embankment enclosed system jeopardizing livelihood of millions around the coastal belt. This category 4 cyclone was accompanied by tidal waves up to 5 meters high, with storm surges which rose to 6 meter in some areas. These surges over-topped polders and breached critical embankment infrastructure around protected low-lying coastal regions. Besides the high wind and associated flooding caused damage to railroad, bridge and utility service infrastructures. In response the government took medium to long term recovery initiatives based on the concept of 'Reconstruct Better'. Recovery projects aimed to upgrade transportation network of bridges, roads, highways, reconstruct damaged schools to schools-cum-shelter, upgrade and reconstruct damaged embankments, repair electricity and water supply services. Although these recovery schemes help to gain stability in SIDR hit areas, most of these projects are plagued by insufficient resources, unavailability of funds, mismanagement, and improper planning. Access to resource proved to be the most significant determinates that worked as a catalyst in Bangladesh's post-disaster infrastructure recovery schemes. Study suggests, currently 44 of Bangladesh's 123 coastal polders run risk of overtopping if a severe cyclone hit. While by the year 2050, 59 coastal polders could be overtopped because of inadequate mangrove forests and mean higher-velocity storm surges owing to shift in climate pattern in the coming decades (Dasgupta et al. 2014). So, we are yet to fully recover let alone evolve from the damaged inflicted by cyclone SIDR.

## Flood 1998

The 1998 floods were undoubtedly the worst of the century especially for an under-developed country like Bangladesh. It was qualitatively different from major floods in the previous 20 years because of the length of the flood period, which lasted about 10 weeks from early July to September 7th. The damage was severe. Approximately 30 million people and 68 percent of the country were affected, as opposed to about 30 percent in a typical flood year.

The Ministry of Food and Disaster Management (MFDM) took the lead in relief and recovery following the 1998 devastating floods. The Ministry was tasked to supply information to the National Disaster Management Council, the apex government organization headed by the Prime Minister, and to the Inter-Ministerial Disaster Coordination Committee, which coordinates the implementation of disaster management decisions of the government and assists them in taking decisions. The action protocol and inter-ministerial coordination efforts were set forth by the Disaster Management Bureau's (DMB) Standing Orders on Disasters (GOB 1999) guideline. It outlined the detailed role of government agencies, ministries, and the Bangladesh Red Crescent Society during normal times, the alert, warning, disaster, and rehabilitation phases. Unfortunately, it did not have concrete guidelines on post-disaster recovery management efforts.

Although DMB was envisaged to perform specialist functions, in close collaboration with root level administration and concerned line ministries, no significant role of DMB could be found either in the relief or recovery process, excepting that it acted as a repository of information. (WB, 2004). Instead, the ministries including agriculture, fisheries, and livestock were the main players in the recovery process and were coordinated by the planning ministry. They based their actions on sectoral recovery plan, while securing funding from both internal and external sources (Alam 2002).

In response to the devastation left by the 1998 floods, the majority of recovery funds was directed towards infrastructure and food security. The World Bank's allocation of \$149 million to recovery was used to finance the repair of damaged highways, rural roads, pontoons, jetties, river terminals, embankments, and marketplaces. The Asian Development Bank (ADB) allocated a total of \$104 million for the repair and construction of roads, bridges, rural infrastructure, railways, water resources, education, and urban development. USAID provided around 300,000 metric tons of wheat to Bangladesh to replenish the country's food stocks and assist destitute families. JICA funded recovery projects of \$15.6 million to reconstruct small and medium bridges on the Dhaka-Chattogram Highways (WB, 2004). The World Food Program (WFP) launched a US\$ 26.9 million intervention plan to be part of a Bangladesh Integrated Food-Assisted Rehabilitation project, with the objective to assist flood-affected, food-insecure populations in the recovery of their prior nutritional and health status, and the reconstruction of household assets. In essence, the majority of the recovery funds were targeted towards infrastructure development and food aids.

A major fault of 1998 flood recovery plan was its inattention to the revival of livelihood and housing of flood hit communities. In terms of livelihood recovery measures, steps taken by the GoB or independent humanitarian actors were either minimal or obsolete. There was no significant attempt to replenish the asset base of affected households (i.e., chicken, ducks, goats, sheep,

fisheries) on which they could rebuilt their economic independence. Households most vulnerable to floods, specifically those in the char area did not have any provision for low-interest or non-exploitive credits. Housing recovery initiatives were the least successful right after the 1998 floods, primarily due to the absence of a concrete guideline. Major recovery projects did not include housing rehabilitation, rather their sole focus was on the repair and restoration of public infrastructure. Housing does not appear as a significant expenditure, despite the extent of the loss (US \$249 million as per GoB/UNDP). Although many NGOs worked on interim housing recovery projects, the overall number of the affected population covered was relatively small compared to the fund allocated for larger infrastructure projects.

One successful area of government recovery response to the 1998 floods was the fiscal measures related to agricultural recovery. Exemption of duty on power tillers was approved in September 1998, leading to an increase in imports from 6,299 units between mid-September 1998 and March 1999 to 17,500 units over the corresponding period in 1997-98. In addition, TSP fertilizer was made completely duty free (Benson and Clay, 2001). Besides in order to ensure food security, GoB promoted private sector imports through the removal of the 2.5 percent development surcharge on rice imports and instructed customs officers to expedite clearance of rice imports. During the 1998 floods, some 300,000 MTs of aus (summer) crop were destroyed, and the flooding caused extensive damage to seedbeds and transplanted seedlings for the aman (fall) crop, and there was a projected shortfall of 2.2 million MT. Between July 1998 and April 1999, the private sector imports equaled 2.42 million MTs, and government imports 399,000 MT. (WB, 2004)

In conclusion, due to the recovery efforts of the 1998 Bangladesh floods, it had a considerably lower impact on the affected population than the 1988 floods, even though the 1998 floods were of a considerably longer duration. Considering, the low level of international support and new external resources that flowed into Bangladesh, the level of recovery was is all the more impressive. Notably, the contribution from NGOs as both direct providers of resources and advocates for a more open society, economic growth of 5%, poverty reduction, and prior investment in emergency preparedness all fed into an improved recovery outcome.

Considering the previous experiences, it can be summarized that

- There were no pre-disaster recovery plan (documented)
- Gaps existed in recovery needs assessment through a formal need assessment process.
- The overall recovery process appeared ad hoc basis and not based on an overarching recovery and priorities.
- Recovery was not reinforced by proper financial resources. The aid was typically provided as immediate humanitarian relief with few resources for longer-term recovery needs.
- Recovery suffered rebuilding infrastructure with proper BBB vision.
- Inappropriately addressed community participation and ownership.

#### 1.4 New Recovery challenges including pandemic

The principal challenge would be to access past recovery efforts, policies, programs, and practices to pinpoint the major gaps, bottlenecks in administrative coordination and decision-making. Besides, a comprehensive recovery plan should be put into place that ensures proactive partnership between local, national, and international stakeholders. Past efforts should be studied to revise recovery policy while considering the strength of past experiences. The challenge would be to combine both aspects of the bottom-up and top-down approach which has been missing in Bangladesh's disaster-recovery approach.

In case of designing an advance and adaptive disaster recovery policy, it would be effective to establish a seasonal hazard (i.e., drought, heavy rainfall, cyclone and storm surges, floods, river-bank erosion) calendar based on out geography. Local communities should be trained to adapt to these recurrent disasters with advance and indigenous methods alike. Besides, based on previous experience of the affected region permeant infrastructure development plan (i.e., polder, seawall, dam, shelter house, embankments, irrigation projects. river protection schemes.) should be put into place to simulate future recovery effort keeping in sync with the hazard calendar. The major challenges to overcome with such comprehensive planning would be lack of inter-ministerial administrative coordination, expertise on recovery policy protocols, unstable security situation, and constant influx of financial resource.

The local social network is largely overlooked in Bangladesh's disaster recovery policy formulation. The recovery scheme is governed by governmental bureaucrats, policymakers, international humanitarian actors, bi and multi-lateral donors, and so-called community experts. In most cases, there is virtually no involvement of grass root level stakeholders (i.e., local community representatives, disaster-affected people). An integrated approach would enable locals to voice their demands. Without bridge this gap, it would indeed be a challenge to design an effective recovery strategy and to execute a successful recovery program.

In the coming decades, we must face corruption head-on to establish an effective and efficient implementation of recovery management policies at the grassroots level. It is unequivocally a major barrier to development and recovery efforts. The policy-implementing authorities (e.g., ministries, departments, local governments, and NGOs) are often involved in corruption, which leads to mismanagement, disproportionate allocation of funds, and even blunt fund theft (Islam et al, 2015) Local NGOs and local governments are caught up in post-disaster corruption through favoring their microcredit borrowers and political party men, respectively, as well as taking bribes and misusing relief goods during the distribution of recovery support (Khan and Rahman, 2007). Ultimately, these inconsistencies trickle down to form an ineffective recovery program causing a nation-wide crisis.

Economic stability and disaster risk reduction are interlinked. The government challenges would be to bridge both entities by ensuring a stable economic base for people of disaster-prone areas. A self-sustained household will be more responsive to the recovery effort. The GoB should work on creating an alternative earning source by the implementation of rural employment programs, diversifying crops, and establishing a well-structured micro-loan system to simulate the rural household economy.

Women's role in post-disaster recovery efforts has long been sidelined by our existing system . Active participation and leadership of women and girls should be one of the cornerstones of future recovery policy. A two-part strategy might be followed where we develop new technologies to reduce the gender digital divide and support women's role in our current social arrangement or to alter the very fabric of social prejudice to accommodate women's role with existing technologies (Alam and Rahman, 2019).

The post-disaster recovery scheme should be based on academic research, statistics, social experiment, and hard evidence. To have a head start, our age-old perception of post-disaster recovery should be substituted by the core concept of Built Back Better (BBB). Correlation between disaster and development should be recognized. The challenge would be to develop a total response system to assist a pool of well-informed, educated advisor panel. They would aid in times of disaster in decision making with the capacity to improvise immediate action plans to tackle unknown situations in the post-disaster recovery period.

### 1.5 Objectives of the study

The overall objective of the study is to formulate of a joint Strategy and Recovery plan focusing cyclone Amphan and floods 2020 ensuring the engagement of key ministries, departments, private sectors and development partners including UN agencies.

The specific objectives are

- (1) Review the current practices at different government institutions and identify the gaps and challenges for effective recovery interventions
- (2) Synthesize the reasons for failure in reducing loss and damage during recurrent disasters
- (3) Review and modify loss and damage and need assessment methodology
- (4) Developing protocol for prioritization of recovery needs
- (5) Strategizing incorporation of Build Back Better approach, and implementation of timely recovery for medium to long term, mainstreaming with development initiatives.

### 1.6 Scope of the work

1. Review the present practices and institutional arrangement of recovery, categorize the exiting gaps, challenges and required measures.
2. Develop a participatory, multi-sectoral loss and damage assessment methodology in collaboration with relevant Government agencies and actors at the UN and I/NGOs.
3. Identify the vulnerable sectors due to cyclone Amphan and the monsoon flood in line of people's and Govt. viewpoint and developed a prioritization methodology considering the specific recovery needs of women; persons with disabilities, children, elderly persons, and diverse groups across all sectors.

4. Identify the sectoral needs to achieve a risk informed, gender inclusive and sustainable recovery strategy.

5. Develop a full recovery strategy- pre- and post-disaster period incorporating 'build back better' principle, gender and social equity, and a joint implementation, monitoring and evaluation system.

6. Prepare training module on recovery for national and local level administrators and organizations

## 2 Methods and Materials

### 2.1 Approach of the study

After consultation of the past disaster experience, this study aims to generate a complete disaster recovery plan for Bangladesh focusing the disaster of flood 2020 and cyclone Amphan including implementation strategy. The study will be mainly based on secondary data. Fig. 1 shows a summarized outline of the study. Following the red arrows, this study will firstly analyze the Post-Disaster Need Assessment (PDNA) due to flood 2020 and Cyclone Amphan. Then based on the PDNA Post-Disaster Recovery Strategy (PDRS) will be initiated. Based on the PDNA and PDRS the Pre-Disaster Recovery Plan (PDRP) for the next flood or cyclone will be developed. Thus, a complete recovery strategy for flood and cyclone is aimed to develop through this study.

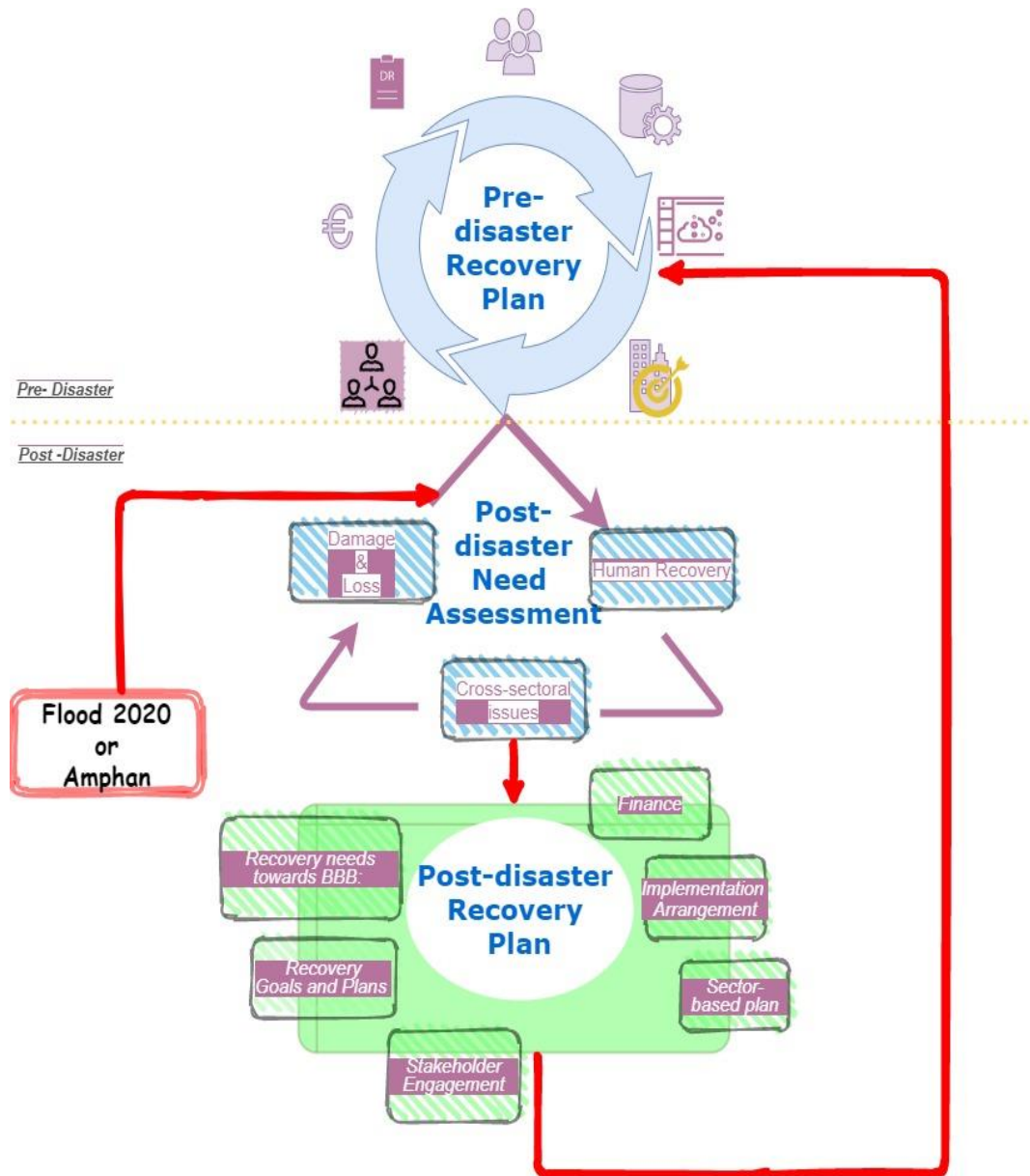


Fig. 1: Outline of Recovery Strategy



## 2.2 Core vision and guiding principles

Reinforce community resilience to flood and cyclone while fostering a risk-informed, gender-inclusive, multi-sectoral, human centric reconstruction that builds back better in a timely manner. The recovery strategy will ensure the engagement of key government ministries, departments, CSOs, and development partners including UN agencies holistically and comprehensively. At the same time, it can be adapted and replicated by all parties in such future disasters with the aid of science backed assessment tools.

This study identifies nine core principles that, when put into practice, maximize the opportunity for achieving recovery success.

1. Individual and community empowerment and resilience;
2. Eco-centric solutions towards a Build back better future;
3. Pre-Disaster Recovery Planning with the aid of science backed assessment tools;
4. Timeliness and Flexibility of recovery work;
5. Ensuring resilient recovery of citizens which is the basic human right recognized as an essential foundation for effective recovery;
6. Ensuring People-centric and socially inclusive recovery which will identify the needs and priorities of affected and vulnerable populations with special attention to women, elderly, children and disable by creating participatory processes that involve communities themselves in decision-making, service delivery and recovery;
7. Inclusion of Traditional/ indigenous approaches;
8. Women led and gender inclusive recovery which will be pro-poor/ livelihood focused;
9. Efficient use of resources to avoid sectoral overlaps in a coordinated manner.

## 2.3 Delineating the levels of risk and resilience

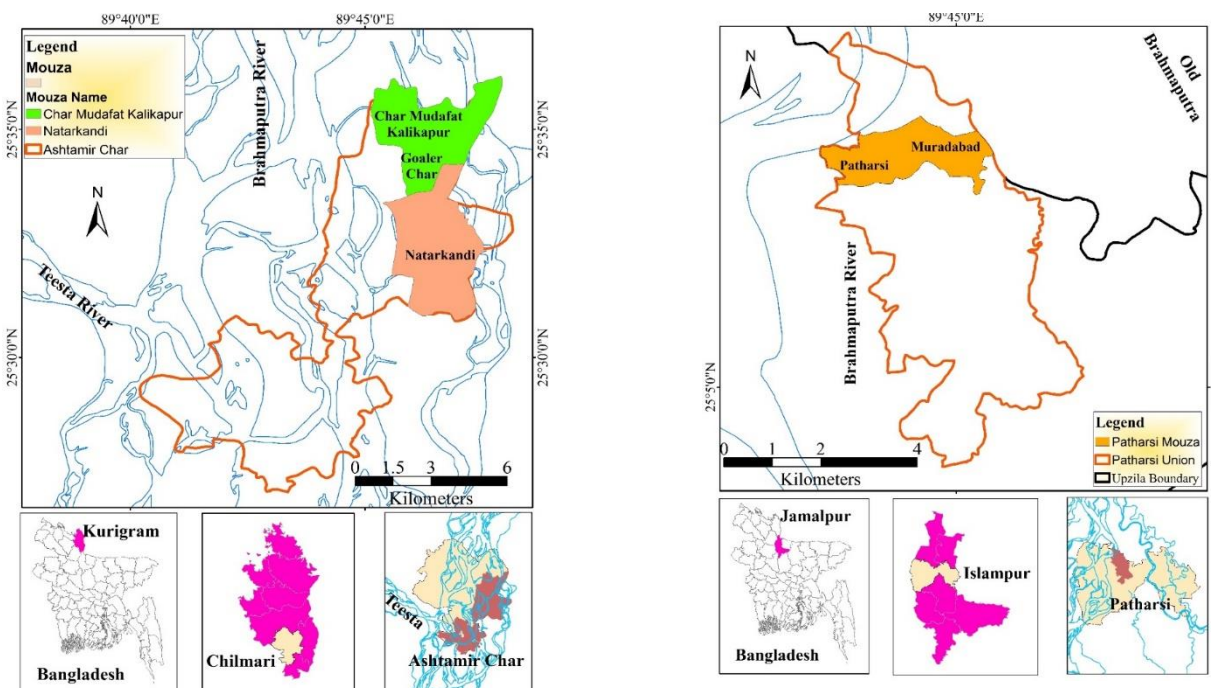
The 2020 monsoon flood affected on the Northern, North Eastern and South Eastern region of Bangladesh around 30 districts with moderate to severe impact on 15 Districts (NAWG 2020a). Total 1022 unions from 158 upazilas have been inundated by floodwater, affecting 5.4 million people and leaving 1,059,295 families waterlogged. On the other hand, Super Cyclonic Storm Amphan threatens to inflict a devastating blow on one of the most vulnerable places on Earth for tropical weather systems: the mouth of the Bay of Bengal, including parts of India, low-lying Bangladesh and Myanmar. Tropical cyclone Amphan intensified rapidly in the Bay of Bengal to become a “Super Cyclonic Storm” – the equivalent of a strong Category 4/weak Category 5 on the Saffir Simpson scale. It is expected to make landfall on Wednesday 20 May, 2020 as an Extremely severe cyclonic storm (strong Category 3 equivalent), bringing dangerous winds, storm surge and flooding to coastal areas of West Bengal in India and Bangladesh.<sup>4</sup>In these circumstances, this study considers Kurigram and Jamalpur area for flood recovery and Koyra for cyclone Amphan recovery sites. Fig. 2 shows the map of the flood affected study area.

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<sup>4</sup> <https://www.washingtonpost.com/weather/2020/05/18/category-5-cyclone-amphan-takes-aim-northeastern-india-bangladesh-with-life-threatening-storm-surge/>

### 2.3.1 Study area and recent disaster in line with Covid-19 Kurigram

The study considers one of the villages of Kurigram district under Rangpur division which is in the northern part of Bangladesh along the border of India. There are 9 upazillas in Kurigram district. Chilmari upazila of this district is situated in between 25°26' and 25°40' North latitude and between 89°38' and 89°48' East longitude and is highly vulnerable to upstream floods and riverbank erosion. It is located by the Indo-Bangladesh frontier. Chilmari upazila is bounded by Ulipur upazila on the north, Char Rajibpur and Sundarganj upazilas on the south, Raumari and Char Rajibpur upazila on the east, Ulipur and Sundarganj upazilas on the west. It has 6 unions, 58 mouzas and 144 villages. Among the six unions, Ashtamirchar union is the most flood vulnerable union (Roy, 2015) as it is intersected by the mighty Brahmaputra river. There are 23 Mouzas (the smallest identical unit in Bangladesh which has a specific and fixed boundary) under Ashtamirchar union where total population is 17701 with 23.5% literacy rate. Char Mudafat Kalikapur Village of Char Mudafat Kalikapur mouza of this union is found out as the most flood prone area. And that's why it has been selected as study area. The number of households of Char Mudafat Kalikapur Mouza is 715. According to BBS 2011, Total population is 2963 which is 16.74% of Astamirchar



union. Literacy rate is 21.9% which is lower than literacy rate of Union and much lower than the national average of 51.8% (BBS, 2015).

Most of the people of char Mudafat Kalikapur are involved in Agriculture related work. Fisheries, small business, daily labor etc. are the other income sources of the inhabitants. Due to recurrent flood they faced several changes in their livelihood. Moreover, Covid-19 increase their loss and

Fig. 2: Study area map considered for flood 2020

damages with disaster During Covid-19 they locked down their char area. As a result, people cannot to go anywhere to find new work or collect necessary item. Labor price became high then which create negative impact on agriculture and others sectors as well. With the help of some NGOs, they were acknowledged about the precautions system.

### Jamalpur

Bangladesh’s administration is divided into numbers of division, district, upazila, and mouzas and villages. Islampur upazila has 12 unions, 89 mouzas and 169 villages. Among them Patharshi village of Patharshi mouza under Patharshi union was considered to accomplish the study. Islampur upazila of the Jamalpur district under Mymensingh Division located in located in the north-central part of the country. This upazila is situated in between 24°57' and 25°10' North latitudes and in between 89°38' and 89°56' East longitudes. It is bounded by Dewanganj and Bakshiganj upazilas on the north, Madarganj and Melandaha upazilas on the south, Sherpur Sadar and Sreebardi upazilas on the east, Saghatta , Fulchhari and Sarikandi upazilas on the west. As Jamalpur district is bordered by Brahmaputra, Padma, Meghna, Old Brahmaputra and Lakhya rivers, the entire area is prone to floods. Among twelve union of Islampur Upazila of this district Patharshi union is one of the flood vulnerable union as itt is closer to Brahmaputra river than other unions. Every year Monsoon flood inundates this union and cause damages to people. There are 12 mouzas and 11 villages in Patharshi union where total population is 28009 with literacy rate 38.7%. According to BBS 2011, Total population of Patharshi mouza is 7023 with 1755 households.

The majority of the people are involved with agriculture with some seasonal and short-term small business. Amon is the main crops produce in the area. In low land with Aman IRRI is cultivated. The land where paddy production is not so feasible in economic consideration those are used in sugarcane production all over the year. These sugarcanes are supplied in the ‘Jil-Bangla sugar mill, Dewanganj.’ In high agricultural land, Robi crops and banana and other vegetables are produced. These lands provide three times crops in a year.

### 2.3.2 Flood 2020

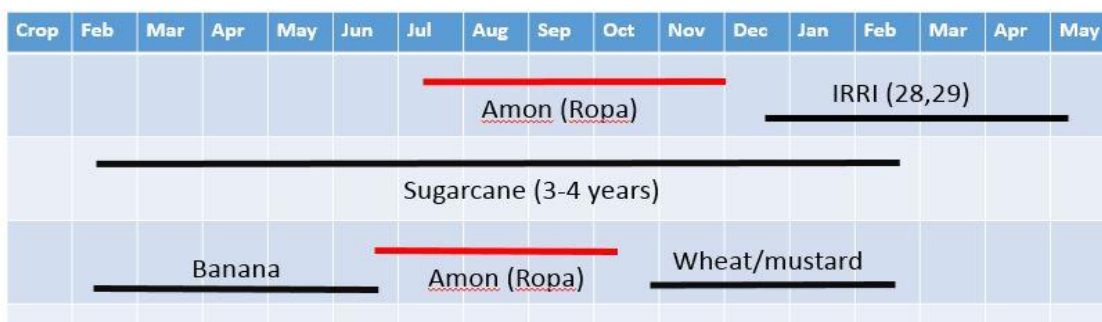


Fig. 3: Red colored crops are highly damaged in Flood 2020

#### a) Agricultural sector

This year people of Char Mudafat Kalikapur have faced flood of a unique characteristics. Flood occurred recurrently four times in a year which brought devastating damage in agricultural sector. As most of the people of this area directly and indirectly depend on agriculture, the loss affected their livelihood and socio-economic condition. After first flood, they lost about 70%-85% of their crops and other agricultural product. They took several initiatives to recover themselves. Such as, they prepared seed bed for seedlings of Ropa Aman. Unfortunately, after one month of first flood they faced second flood which damage almost 100% of their crops. All the seedlings are rotten due to flood. Jute, Onion, Vegetables production and other seeds have totally damaged. Moreover, due to transportation and communication problem they couldn't sell any products. Flood also damaged their irrigation equipment such as sediment and debris filled the boring. Flood waters have brought in excess garbage and sand in some places which reduced soil fertility. Recurrent and longtime flood created acute shortage of food and also raised the price of food for livestock which forced them to sell their livestock in cheap price. In some cases, they used them for their own feeding to survive. In addition, about 30-35% livestock died due to inundation of places, snake bite and various unknown diseases.

In general, there are two times flood affected every year in Jamalpur in the left bank of Jamuna. Flood duration is less with a loss of agricultural damage and a little damage of household. But in 2020 the flood has occurred recurrently four times and stayed 7-10 days that causes a huge damage of agriculture, public infrastructures and other livelihoods which weakens the socio-economic condition of the people of affected areas. The Amon production has severely damaged in Islampur, Jamalpur. Farmers has tried to plant seeds three times but in every time the seeds are rotten due to flood water.

Due to four times flood the livestock food price raised at a high level that many people have forced to sell their livestock that they could not manage money for buying foods. On the other hand, the damage of seeds created an extra burden on economic condition. So, some people have sold their livestock to bear their family cost during recurrent flood 2020.

#### *b) Public Infrastructure Sector*

There is no pucca road or embankment in Char Mudafat Kalikapur. But flood damaged existing kutchra road and creates severe problem in communication. The primary school which could be used as flood shelter was completely submerged.

In Jamalpur, due to 2-3 months long time submerge of road in water, all pucca roads are highly damaged. Kutchra and muddy roads are washed out in water flow. About 80% of total roads of the village are damaged. Drains, culverts and canals are broken down which was not previously damaged in such extent. Other public infrastructures like govt. school, community center, bazar place etc. are not damaged as located in a high place.

#### *c) Socio-Environmental Sector*

Flood water has brought garbage and sand in some places which reduced the fertility of soil. Water sources submerged into water and created water scarcity. 10-15 families had to dependent on a tube well. Water borne diseases caused health damage. Women had to work by standing in water which resulted in different diseases in lower portion of body. Sanitation systems were completely damaged.

In mainland, during 1<sup>st</sup> flood of the year there are huge dirty water submerged within the areas as all dust, plastic and organic and inorganic materials are floating in water. It creates the water polluted and odor. The crops are highly damaged for dirty and dust water. The sanitation toilet is submerged under water and the drinking water tube well are also submerged sometimes. So, water quality is degraded and there's create a demand of fresh water. People are affected in water borne diseases which causes a health damage.

The Gender Analysis conducted by the Gender in Humanitarian Action Working Group found that out of the 3.3 million people affected in 21 districts, more than 50% are women and girls (1.7 million); of them, 84,195 are Female-Headed Households, and 101,000 were pregnant women, and 1.6 lac were girls aged between 5 and 18. Women and girls from the most vulnerable groups faced severe food insecurity, gender-based violence, and inaccessibility to essential services. Gender Based Violence has seen a sharp increase in the upward trend since March 2020 due to COVID-19 pandemic/disaster, and lockdowns and floods further aggravated the situation. 80% of the people were displaced and lived either organized or makeshift shelters or neighbors and relatives houses.

Shelters are not adequate in numbers, and women and vulnerable groups do not prefer those due to inadequate facilities and protection concerns. Many of these vulnerable persons stayed on embankments and high roads with the constant fear of violence. Unfortunately, many people, including women and adolescent girls, would have to prolong these communal, living perpetuating the protection concerns due to the massive destruction of housing. It gave rise to anxiety, a deep sense of insecurity, and increase the risk of violence against women and girls. 60% of people at the Union level reported psychological depression and trauma.

Flood worsened the situation for those who had already lost livelihood due to COVID-19. Women and girls including the Female-Headed Households who rely on livelihood practices like poultry, livestock, vegetable cultivation, and tailoring, had no collateral to recover.

The Joint Need Assessment shows 11% of the Unions indicated maternal health care as a topmost priority. The health care system has broken down putting the lives of pregnant mothers and infants at risk. Water and sanitation facilities have been heavily damaged in flood-affected areas making women and adolescent girls vulnerable to communicable diseases including urinary tract infection (UTI) and reproductive tract infection (RTI).<sup>5</sup>

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<sup>5</sup> GiHA (2020) Preliminary Rapid Gender Analysis of Monsoon Flood 2020: <https://reliefweb.int/sites/reliefweb.int/files/resources/RGA%20Monsoon%20Flood%202020July.pdf>

### 2.3.3 Cyclone Amphan

In Bangladesh, COVID-19, Amphan, and monsoon flooding have collided to create complex crises. COVID-19 has left both countries' economies reeling. These effects have been felt most acutely by those working in the informal sector and in cities, which were brought to a halt by lockdowns. Migrant workers were especially affected. Due to COVID-19, these workers returned home to seek safety and shelter just weeks before Amphan hit. Those returning to regions impacted by Amphan were not only exposed to the cyclone, but were also deprived of the chance to send remittances from their former places of employment to help their families rebuild. COVID-19 has also made it very difficult to provide basic services, such as evacuation and shelters, in the face of natural hazards.

In addition, Amphan will have long-lasting impacts on coastal communities' livelihoods, as the storm surge has salinized large swaths of cropland, rendering them unusable for years to come. Rural, coastal community's dependent on agricultural have been hit particularly hard. Migrant workers who have returned to these communities will find it harder than ever to make a livelihood back home, but COVID-19 makes it unlikely they will be able to return quickly and safely to their old jobs in the cities.

In Bangladesh, unprecedented monsoon flooding, which began in June, has made it even harder to recover. To date, almost 890,000 Bangladeshis have been displaced and more than a million homes inundated. Owing in large measure to climate change, the frequency of these formerly once-in-a-lifetime events will only increase into the future.

In Bangladesh, national authorities ordered the evacuation of 2.4 million people. More than 12,000 shelters and public infrastructure, such as schools, were prepared for evacuees---three times as many than in previous years. In order to deal with COVID risk, all shelters were equipped with masks, sanitizers, and hand washing facilities with soap, and health clinics were prepped in advance to isolate any evacuees exhibiting symptoms.

Bangladesh continues to face a multitude of challenges in addressing COVID-19 post-Amphan, including a very dense population and limited health infrastructure. To date, it has recorded almost 275,000 confirmed cases and more than 3,600 deaths. However, concerns remain over the high cost of testing, low trust in the healthcare sector in general, and a limited testing regime based primarily out of Dhaka. The International Monetary Fund estimates that the country needs about \$250 million for clinical equipment, testing, and contact tracing from external funders just to respond to initial impacts.

On 16 May 2020 over the Indian Ocean Cyclone Amphan was formed and started moving north over the Bay of Bengal, towards north-east India coastal areas and south of Bangladesh. On 20 May 2020, the Bangladesh Meteorological Department (BMD) issued 'great danger' signal number 10 for costal districts of Satkhira, Khulna, Bagerhat, Jhalakathi, Pirojpur, Barguna, Patuakhali, Bhola, Barisal, Laxmipur, Chandpur and their offshore islands and chars. Following the great danger signal and evacuation order of the GoB, more than 2.4 million people were moved to 14,636 permanent and temporary shelters in 19 coastal districts before the cyclone hit the country's coast. The cyclone Amphan slammed into the coastal districts of West Bengal, India and

then it entered Bangladesh on 20 May evening with wind speed of 150 kmph and caused huge destruction in 26 districts across the country.<sup>6</sup>

#### *Damages on Agricultural sector due to cyclone Amphan:*

Super Cyclone Amphan, which smashed into the coastal districts of the country, wreaked havoc on agriculture, destroying standing crops and washing away fishes from most of the shrimp enclosures and water bodies in the coastal regions. The severe cyclonic storm, which brought in its wake heavy rain coupled with strong wind, uprooted hundreds of trees, snapped cables and damaged hundreds of houses, bringing life to a near halt. Thousands of trees were uprooted by its tidal surge as embankments broke down in coastal regions, inundating many villages. The damage and destruction of crops and fish farms have been huge. Based on the four ministries' information, the devastating cyclone has caused severe damage to agriculture, seasonal fruits, fisheries, and others. These ministries' all together estimate showed Tk 1100 crore loss incurred by the cyclone.

Farmers were worried about the huge losses in agriculture including Boro paddy, jute, vegetables, mango, cattle, poultry, and maize. Lots of artificial fish farms were blown away by the high tidal surge. In Pirojpur, seven thousand fish farms have been flooded due to the impact of Super Cyclone Amphan, which may incur a loss of Tk 400 crore. In Pirojpur out of 39,136 fisheries in the district, 6,755 have been inundated. According to the Department of Fisheries, 19,000 fish farms, fences and ponds have been damaged in 6 districts of Barishal division. In Bagerhat, the storm has washed away around 4,635 shrimp farms. District Fisheries Officer Khaled Kanak said 4,635 shrimp fishing grounds in the district were washed away by the storm. The fish farmers of the district have suffered a lot. Officially, Tk 90 lakh loss has been estimated. Officials said mango has been cultivated on 26,150 hectares of areas in Rajshahi and Chapainawabganj districts where it's expected to yield 2,44,000 tonnes of mangoes this year. On the other hand, another seasonal mouthwatering summer fruit litchi is also damaged at Bagtipara, Lalpur, and Gurudaspur by the cyclone. Gurudaspur Upazila Agriculture Officer Abdul Karim said litchi has been cultivated on 410 hectares of land. Farmers collected litchi from 110 hectares of land while 25 percent of litchi remaining on 300 hectares of land has been destroyed.<sup>7</sup>

#### *Damages on Infrastructure due to cyclone Amphan:*

- ✓ 2,05,368 House Damaged
- ✓ 440 KM Road Damaged
- ✓ 76KM Embankment Damaged
- ✓ 18235 Tube well Damaged

#### *Impact on women and girls:*

The majority of the hard-hit areas are remote char and riverbank erosion-prone areas that constantly experience deterioration of resilience due to frequent natural disasters. For example, many of these affected areas were also affected by super cyclone Sidr in 2007 and Cyclone Aila in 2009, taking several years to restore livelihood. And in these current situations, particularly

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<sup>6</sup> Char in Bangladesh refer to island in river, a piece of land surrounded by water.

<sup>7</sup> <https://bangladeshpost.net/posts/amphan-damages-agriculture-badly-34026>

women and girls are disproportionately impacted, and their sufferings are prolonged by long periods of inundation, displacement, ongoing extreme weather, loss of livelihood, and the added fear of coronavirus pandemic.

In the hardest-hit districts, it is estimated that nearly 820,000 women – including over 49,316 pregnant women and 29,133 female-headed households – were affected by Cyclone Amphan. The Rapid Gender Analysis confirmed that certain groups were hit particularly hard, including female-headed households, pregnant and lactating women, people with disabilities, sex workers, transgender persons, adolescent boys, and girls. In the aftermath, women and girls are at greater risk of gender-based violence such as domestic violence and early marriage in a context of existing gender inequality and discrimination.

Monsoons following cyclone Amphan further pushed the most vulnerable groups at the verge of existential risk. At a household level, increasing food insecurity impacted the female-headed households, adolescent girls, and pregnant mothers the most; around 80% of the unions indicated irregular food intake or skipping meals as real sufferings for women and girls. Cyclone Amphan, in the context of COVID-19, has a significant implication on the livelihoods of women in Bangladesh as **91.8% of the total employment of women is in the informal sector**: domestic workers, daily laborers, street vendors, cleaners, sex workers, including transgender persons, and other informal workers who have rapidly lost their means to earn an income. Recovery programming should use the opportunity to address inequalities and transform harmful gender norms where possible.

Food was identified as the most prioritized immediate need due to the food insecurity induced by the COVID-19 lockdown that has obstructed the livelihoods of millions and pushed many poor households below the poverty line. The negative coping mechanisms adopted in the aftermath of Cyclone Amphan include reduced meals, selling productive assets, taking loans, and falling into the vicious cycle of indebtedness. The impact on women and girls is drastic, leading to SGBV, domestic and Intimate Partner Violence (IPV), exploitation and abuse, child marriages, child labor, and trafficking. Safety measures for women and girls in the shelters and the displaced community remain a concern, and existing shelters are not gender, age, and diversity-friendly. Protection and safety issues are increasingly compounded by the loss of habitat, loss of income and school closures, etc.<sup>8</sup> Gender-Based Violence has been in the upward trend due to COVID and lockdown conditions. Cyclone Amphan and floods only aggravated the situation; 80% of the people are displaced and living in other places, either organized or makeshift shelters or neighbor's or relatives' houses. These give rise to anxiety, a deep sense of insecurity, and increase the risk of Violence against women and girls; in fact, 60% of people at the Union level report psychological depression and trauma.<sup>9</sup>

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<sup>8</sup>GiHA (2020)The Rapid Gender Analysis - Cyclone Amphan, by Gender in Humanitarian Action Working Group (GiHA): <https://reliefweb.int/report/bangladesh/rapid-gender-analysis-cyclone-amphan>

<sup>9</sup> GiHA (2020) This Preliminary Rapid Gender Analysis Of Monsoon Flood 2020 has been a Gender in Humanitarian Action working group production: <https://reliefweb.int/report/bangladesh/preliminary-rapid-gender-analysis-monsoon-flood-2020-gender-humanitarian-action>



Indigenous women and girls - Due to limited access to information, poor access to health services, higher rates of infectious diseases ,malaria, TB, inadequate sanitation, clean water, hygiene facilities, and other essential services, indigenous women and girls are higher socio-economic vulnerability in this crisis. They are also at increased risk of different kinds of abuse/ exploitation and trafficking now. The situation of these indigenous women, who are often the main providers of food and nutrition to their families, is even greater.<sup>10</sup> International women migrant workers and Ready-Made Garment workers, female sex workers, women domestic workers, day laborers, older women also suffered severely due to job losses and income resulting from these disasters and pandemic.

### 3 Post Disaster Need Assessment

#### 3.1 Damage & loss assessment: Existing practice and gaps

Damage and loss assessments are one of the central parts of any disaster recovery strategy. After Cyclone Sidr in 2007, the forum for development dialogue and donor coordination of the Local Consultative Group agreed to conduct a Joint Damage-Loss and Needs Assessment (JDNLA) (Haque et al., 2019). Their assessment identified priority areas and recommended interventions to support the Government of Bangladesh in cyclone recovery efforts as a long-term disaster management strategy. Based on this, a 15-year long-term strategic plan of action came on light with the support of World Bank. A Damage-Loss and Needs Assessment (DNA) cell was established within the Disaster Management Bureau (DMB) for the institutionalization of the DNA methodology across all government departments and at all administrative levels, down to the Upazila level. The cell is responsible for strengthening the existing data collection by using a standardized template (FORM-D) and to build the capacity of relevant agencies and administrative levels to conduct DNA. After the cyclone Mahasen, the Department of Disaster Management gradually shifted to a formal damage and loss assessment in the name of Joint Needs Assessment (JNA) since 2011. The JNA approach has embedded in it a national coordination mechanism and has the buy-in of a broad range of stakeholders including the DDM, MoDMR, NGOs and INGOs. Usually, the primary purpose of the assessment is identifying the actual impact scenario, and find out immediate and mid-term needs through contextualized primary (both GoB and field data collection) and secondary information (NAWG 2020a). The primary data is by individual interview as well the information from local administrations, public representatives. The assessment is usually done based on baseline secondary pre-crisis information from Government (BBS). Then the sector specific needs are assessed by the respective clusters.

However, there are several dimensions of flood/cyclone damages, which are often overlooked in flood damage assessment and hence in risk reduction plans. Flood damage classifications are well discussed in literature (e.g. Parker et al., 1987; Jonkman et al., 2007; Mertz et al. 2004). Flood/cyclone damages can be classified into direct and indirect damages, where

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<sup>10</sup> GIHA (2020) COVID-19 Bangladesh, Rapid Gender Analysis: [https://reliefweb.int/sites/reliefweb.int/files/resources/RGA%20Bangladesh.Final\\_.May2020.pdf](https://reliefweb.int/sites/reliefweb.int/files/resources/RGA%20Bangladesh.Final_.May2020.pdf)

direct damages are those which occur due to the physical contact of flood water with humans, property or any other objects and indirect damages are induced by the direct impacts and occur – in space or time – outside the disaster event. Both types of damages are further classified into tangible and intangible damages, depending on whether or not they can be assessed in monetary values. Tangible damages are damage to manmade capital or resource flows which can be easily specified in monetary terms, whereas intangible damage is damage to assets which are difficult to transfer to monetary values.

Majority of the studies on flood/cyclone risk assessment, especially in developing countries including Bangladesh, focused on direct damage assessment. While sectoral damages are assessed after each disaster event, agricultural damage assumes the dominant parameter when it comes down to spatial mapping of flood/cyclone risks. A major constraint has been the scarcity of sectoral damage data as a function of flooding characteristics such as depth, duration, velocity etc. (i.e. flood damage functions or damage curves), and the difficulty in assessing indirect flood damages, which may constitute substantial proportion of the total flood.

### 3.1.1 Collection and analysis of pre-disaster baseline data

Pre-disaster baseline data indicates the human, social, natural, physical, and financial capital assets of the study area at normal time. This study will consider geographical, demographic and socio-economic data relevant to the affected areas including human-development indicators such as literacy rates, poverty levels, access to potable water and sanitation facilities, education facilities and school enrolment, and the incidence of communicable diseases as baseline data. An attempt will be made to disaggregate the data by sex, age, cultural/religious characteristics for the identification of specific susceptibilities and prospects that women, girls, boys and men, and different cultural/religious groups and which are required to be acted upon post-disaster. This dataset will help in determining the overall impact of the disaster across all sectors and will contribute to identify the vulnerability as well as the underlying causes of the disaster. The census data of Bangladesh Bureau of Statistics, BBS (BBS 2011) will be extensively used to assess the baseline of human, social, natural, physical, and financial capital. Table 1 shows the example of BBS data that will be used in this study. Where the baseline data is not available in the Census, sector or local surveys or sector and disaggregated reports will be used to estimate a baseline data based on discussion with key informants. GFDRR (2013) suggests the estimation of baseline data on the basis of visual impressions of unaffected areas which will also be adopted in case of missing information. In certain situations, where satellite imagery of pre-disaster situations is available, these images will be interpreted to develop sector-wise baseline data. For example the baseline information used to formulate the Agricultural Sector overview includes descriptions of: The people (farmers, fisher folk, and pastoralists) and their principal livelihood activities; Infrastructure and livelihood assets related to agriculture (including physical assets and productive equipment and inputs used to sustain agricultural livelihoods), as well as land ownership arrangements; Production of, delivery of and access to agricultural goods and services; Governance and decision-making processes linked to and supporting the Agricultural Sector (including institutions, social organization and the policy environment); and Pre-existing risks and

vulnerabilities (including existing preparedness plans). After Selecting capital and collecting existing data from BBS, PPS and cluster sampling method was done to select villages. Several PRA tools such as FGD, KII etc. will be used to collect data from Study area.

Table 1: The list of data collected from Bangladesh Bureau of Statistics (BBS)

Human Capital	Social Capital	Natural Capital	Physical Capital	Financial Capital
Male to female	Literacy	Number of tubewell/area	Primary school/area	Number of borrowers
Employed people/population 100*(Capable people (1-dependent people+disabled people)/population)	employed people/population		madrasha/area	employed people/area
Literate people Population/Community Clinic	population/mosque Population/Primary school		secondary school/area mosque/area Community Clinic/area	Number of Livestock Number of Boat
Population/tubewells population/micro credit	Population/madrasha Population/secondary school		Shelter centre/area Number of tubwel/area Pucca and semi pucca house/area	
Percentage of people who have own house			Length of pucca road/area	
Indigenous knowledge	Number of mosques going people			

Collected Data list from study areas

Semi-structure

1. Livelihood and Covid-19 situation
2. Gender aspects
3. Recovery aspects
4. Indigenous knowledge
5. Flood preparedness

FGD

1. Livelihood basis recovery process (Agriculture, Fisherman, Livestock)
2. Recurrent recovery process

3. General Livestock problems (gender)
4. Livelihood basis Indigenous knowledge
5. Priority of demand in rehabilitation and recovery

## KI

1. Organization role in rehabilitation and recovery

## Case study

1. Early marriage
2. Recurrent flood rehabilitation and recovery
3. Raising plinth
4. Education during Covid and flood situation

From all of these sectors following information will be generated:

## Data from field- Risk

1. Occupation
2. Access to religious place
3. Access to community clinic
4. Homestead plantation
5. floating gardens/ hanging vegetable garden.
6. Electricity service/solar
7. No. of Poultry
8. No of Dairy /cattle owner
9. Household Size
10. No of tube wells
11. No of disable people.
12. Housing Status
13. Access to relief goods
14. Family Involved in Recovery Process
15. Household plinth (ft)
16. HH access to mass media
17. Insurance
18. HH with access to micro credit
19. access to Savings
20. Properties of sanitation
21. Effectiveness of social relationship.
22. Mode of rehabilitation and recovery process
23. Effectiveness of Paka road length
24. Effectiveness of Embankment length
25. Effectiveness of Growth Center (Hat/ Bazar)
26. Effectiveness of Ghat/Deck
27. Effectiveness of Culvert
28. Effectiveness of Drainage
29. Effectiveness of Indigenous Knowledge

- 30. No of Educational institute
- 31. No of students and teacher
- 32. No of health worker
- 33. Literacy rate
- 34. No of deep well
- 35. pond
- 36. Bamboo bush
- 37. Canal
- 38. Male female ratio
- 39. cultivable land
- 40. No of shelter
- 41. No of volunteer

### Details of Raniganj Union

#### Pre-disaster baseline condition

In Raniganj district the total number of population are 20513. Among them 40.2% are male, 39.5% are female and 20.3% are children. The total number of person with disabilities are 332 corresponding 1.6% of the total population as shown in Fig. 4. The percentage of person with disabilities in adult male, female and children are 43.7%, 30.7% and 25.6% correspondingly.

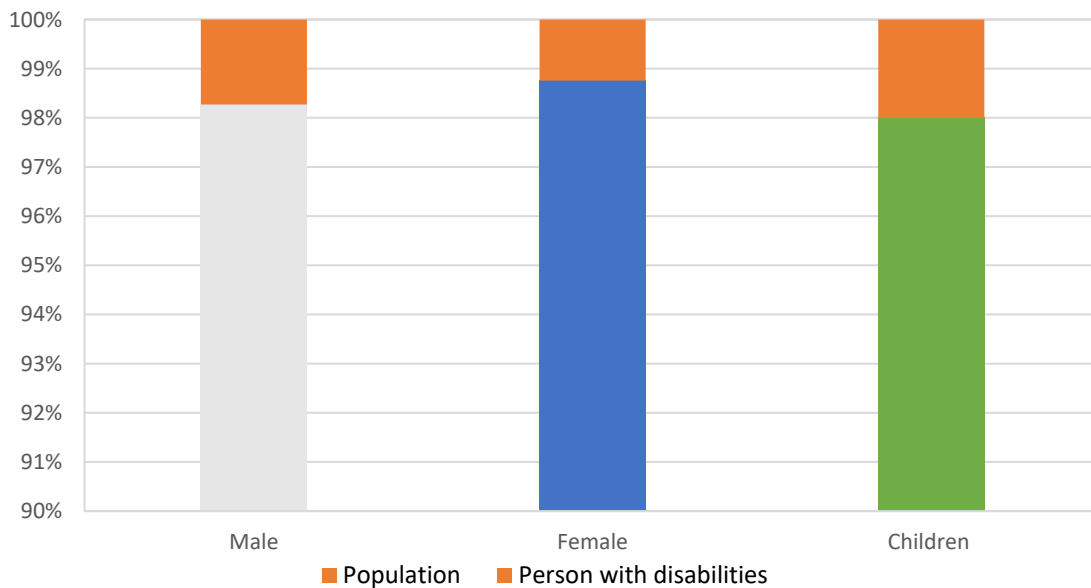


Fig. 4: Population distribution of Raniganj district

The total number of houses were 5404, among them Paka bari are 480, Semi paka 1424 and Katcha bari are 3500. The union contains 35 Km roads including asphalt, brick and earthen road. As the union is very near to Brahmaputra-Jamuna river, it has flood protection embankment of 5 Km. the detailed list of Infrastructure and Physical Assets of Raniganj union is listed in Table 2

Table 2: Infrastructure and Physical Assets of Raniganj Union

Infrastructure and Physical Assets		Unit	
House			
	Paka bari	No	480
	Semi Paka Bari paka bari	No	1424
	Kacha Bari	No	3500
Electricity line		Km	100
Mobile phone tower		No	2
Number of religious organizations	Mosque	No	46
	Temple	No	11
	Church	No	0
Road (Km)	Paka	Km	15
	Brick	Km	2
	Kacha	Km	18
Bridge and culvert	Bridge	No	5
	Culvert	No	27
Embankment		Km	5
Educational Institute	Primary school	No	17
	High school	No	4
	College	No	0
	Madrasha	No	5
	Community School	No	1
Tubewell			
	Deep	No	17
	Shallow	No	217
	Hand/Mannual	No	4200
Industries	Agricultural	No	0
	Non-agricultural	No	0
Hygienic toiles			4980
Water reservoir	Ponds	No	35
	Small water reservoir	No	0
	Others (if have)	No	0
Healthcare center	Hospitals	No	0
	Clinics	No	0
	Community clinics	No	4
Total number of fishing equipments	Boats	No	25

	Trawler	No	
	Nets	No	
Agriculture			
	Grain fields	Hector	101
	Seedbed	Hector	82
Livestock	Sheep	No	1080
	Goats	No	3200
	Cows	No	3500
	Buffaloes	No	40
	Ducks	No	7400
	Chickens	No	8500

### 3.2 Assessment of Flood and Cyclone effects

#### Damage Assessment of infrastructure and physical assets:

Prior to initiate any recovery activities, the effect of the disaster in terms of total or partial damage of physical assets and infrastructure should be assessed particularly for Social infrastructure such as the number of homes, education and health facilities, government buildings, community infrastructure, cultural and religious centers, Basic infrastructure such as transport and communications (roads, bridges, ports, airports, and train lines, among water and sanitation systems, irrigation systems, energy generation, distribution and supply lines; Productive sectors such as agricultural infrastructure, industrial and commercial installations, and businesses and service-based industries (GFDRR 2013a). After valuing the damages in physical terms (number, extension in terms of area or surface, as applicable), normally they are converted into monetary value which needs to be treated as baseline cost. In case of the calculation of reconstruction costs post-disaster price alterations and improvements associated with risk reduction needs to be considered. However, due to the time limit of the project the damage assessment will not be done extensively rather the secondary literatures (i.e. NAWG, 2020a, 2020b) will be considered. Three affected sectors agriculture, public infrastructure and socio- environmental.

#### *Agricultural Sector*

Firstly, from the study area the following information will be collected through secondary literatures, FGD, KII and Semi structured survey to assess the post-disaster conditions of the agriculture sector in the study area.

- Affected Geographic areas, including variations (e.g., urban/rural);
- Population number and percentage of the affected farmers, fishermen and pastoralists which will be disaggregated to the extent possible by gender/age/marginalized groups;
- If there exists any Migration and internal displacement of fishers, farmers, pastoralists, etc. due to the specific disaster.
- Seasonal and recurrency factors such as timing/duration of planting, harvest, etc.
- Most vulnerable population groups (small-holder farmers, wage workers, self-employed, female-headed households, etc.);
- Overall level of food insecurity, malnutrition rates etc;
- Pattern of disaster (flood/cyclone)-How long the disaster is expected to affect livelihoods and food security;
- Gender and social inclusion analysis

The table below lists some of the physical assets will be considered in the damage assessment for each of the agriculture sub-sectors.



Table 3: Indicators of agricultural damage assessment

Crops	Livestock	Fisheries and aquaculture
Agricultural land (e.g., soil erosion, sedimentation, salinisation)	Animal deaths or disappearance	Fisheries enforcement and monitoring, control and surveillance Boats/vessels and engines (marine and inland) (vessels, buildings)
Stored agricultural inputs	Animals slaughtered because of endangerment as a direct result of the disaster and therefore do not reach the market. (Note: The by-products of the slaughtered animals (e.g. dairy, eggs, meat) are part of the production process and should be considered a loss).	Aquaculture inputs (fish larvae, lime, therapeutants)
Farm equipment and machinery	Pasturelands	Aquaculture production (ponds, cages, tanks and farm buildings)
Irrigation systems and infrastructure	Livestock sheds	Aquaculture feed mills and storage facilities (may be accounted for by the industry sector)
Drainage systems, equipment and infrastructure	Stored feed and fodder	Post-harvest assets (ice plants, freezers and storage buildings, etc.)
Perennial trees (e.g. plantations)	Livestock equipment and machinery	Major fisheries infrastructure (ports, landing facilities, harbours, markets, etc.)

### *Public-infrastructure Sector*

In public-infrastructure section, the damage information of rural roads and embankments will be considered. The following damage information is essential for the estimation of disaster effects,

and must be collected as the first stage of the assessment as per the recommendation of UNDP (2011):

- Internal roads, walkways and footpaths within the community, providing access to the national arterial or local road system (village roads, earthen walkways in the community, house-to-house connection roads, etc.).
- Small-scale and low-cost structures built for various community purposes such as drainage structures, pipe culverts, box culverts, footbridges, retaining walls, protection of slopes, embankments or protection walls, small earthen dams, etc.).
- Most recent origin and destination surveys in the affected and nearby areas;
- Marginal operating costs of the transport modes for different types of vehicles;

The secondary literatures (i.e. NAWG, 2020a, 2020b) will be considered for the assessment of damages. The information from the local officials of the Local Government Engineering Department (LGED), Bangladesh Water Development Board (BWDB) and the damage information from local UNO will also be act as a potential source of damage data.

### *Socio-environmental Sector*

This section will cover two cross-cutting issues gender and environment. The gender issues should be identified in regard to access, ownership, control and use of physical, natural and financial capital that may be crucial for the livelihoods and food security of women and men of the affected area by damage of land, valuable resources and public infrastructures. Therefore, when the information in agriculture or infrastructure sector will be collected the following gender dimension will be included. For example, in while generating the information in *Ownership of land and housing* the Formal and informal women's share of land and household wealth female heads of households who are extremely vulnerable in disaster in particular, widows and minors to claim property and land needs to be identified. In case of Productive assets, the informal family support provided by women for subsistence of farming/household will be assessed. Often women may operate micro- and small businesses from their homes to supplement family food and income which will be framed under this study mainly through secondary literature, FGD, KII and Semi structured survey. The following listed information will be collected during the data collection of others sectors to assess the gender issues in recovery process.

#### Demographic information:

- Population of the village by sex and age groups and income.
- Number (%) of disable people in the village with type of disability
- Literacy level of female population (if possible, by broad age group)
- Number/percent of female headed household
- Principal occupational pattern of female population

#### Intrahousehold power dynamics:

- Role of women in family decision making process
- Ownership of resources by the female population:

- a. What resources – ( e.g. land, housing, storage, skills, income, money, valuables, livestock, crops, tools/ equipment, savings, loan arrangements) do men and women use to carry out their activities? Who owns these resources? Have any of the resources used by men and women been lost?
  - b. Do men and women have the same control over these resources or the ability to decide how and when to use them?
  - c. Are there any new resources available to women and/or men?
  - d. Who (men, women, widows, female heads of households) has priority access to these new resources, and what are the effects in terms of power relations, etc.?
- Utilization of resources for damage by flood/cyclone, recovery and preparation for future
  - Contribution/role of female population in facilitating to upkeep the principal livelihood/income of the household

#### Women's participation and leadership

- Number of women's rights organisations
- Percentage of women leaders at local and community levels.
- Membership of NGOs by the female population
- Role of women in disaster home management that lead to disaster management
- Are women members of any disaster management committees?
- Are there women volunteers ?
- Women leadership in disaster management committees and local authorities

#### Access to finance

- Status of funding of women's rights organisations especially at the grassroots levels
- Range of credit taken from the NGOs
- Utilization of the credit /investment of credits by sector/purpose
- Investment related to flood/cyclone recovery
- Level of indebtedness of women – especially from informal credit
- Access to services – such as fodder banks, seed banks, formal saving and credit services

#### Early warning and evacuation

- From where women receive the flood/cyclone warning
- Is there enough flood/cyclone shelter in the area?
- How is the accessibility towards the centers (distance, road, building condition, social supportive system etc.)
- Is there enough facilities for the women/girls in the centers?
- Is there any facilities for pregnant/elderly/disable persons in the centers?
- Is there any volunteer or other facilities to help these vulnerable people in evacuation?

The effects of disaster on Environmental sector are quite vast some environmental effects may occur immediately after the disaster, like the land and water pollution caused by overflowing of sewage systems, some take time to manifest so long time therefore may not be able to be captured as part of the assessment i.e. eutrophication in a lake a few months after a flooding. Therefore, the following areas will be considered to assess the disaster effects on environment:

- 1.Environmental effects caused by the disaster and relief operations as well as potential environmental pressures from recovery;
2. Response-related or coping mechanisms resulting from the disaster that can impact the environment or create new environmental risks;
3. Factors which may have impacted the access of stakeholders to environmental resources, particularly vulnerable groups such as women, indigenous people, and ethnic minorities with high dependence on natural resources for livelihoods;
4. Underlying environmental drivers, such as environmental degradation that may precipitate or aggravate a future disaster; and
6. Opportunities to build back greener.

#### *Disruption to the production of and access to goods and services*

In addition to the damage caused by the flood 2020/cyclone Amphan to physical, natural and financial capitals, it typically affects the service delivery, including the functioning of markets and the goods' availability and quality and other services needed for agricultural, livestock and fisheries production. Therefore, the disaster effect's on overall production of goods and services at macroeconomic level, the and micro-economic level like household increment or decrement of household income will be assessed for agriculture sector through secondary literature, FGD, KII and Semi structured survey.

Flood 2020/cyclone Amphan severely damaged public infrastructure and thus the community processes critical to the livelihoods has been disrupted. Therefore, the destruction of internal and external road communication and embankment, disruption of drainage, water supply and sanitation facilities, which eventually lead to increased health hazards in the community and disruption of information and communication networks will be consider in this section under the disaster effects on public infrastructure.

As mentioned earlier in socio-environment sector gender and environment will be considered. Therefore, the changing pattern of women's productive employment outside and inside the home due to disaster needs to be counted. There might be other direct and indirect financial losses due to the disaster in particular female-headed households, such as: loss due to changes in school attendance rates of girls and boys and due to work, safety; transportation costs related to changes in access of women and men to water, sanitation, markets, workplaces, health facilities will also consider in this section. In Environmental sector the Environmental goods or services may have been totally or partially destroyed during the considered flood and cyclone will be considered.

Disasters reduce the purchasing power. For example, the unit cost of community access of the waste management may change after the disaster.

Governance and decision-making processes

The Governance and decision-making processes correspond to the external factors that influence life and livelihoods, including access to capitals and services and to power and decision-making ultimately influencing empowerment and vulnerability. The key Indicators To Assess Effect On Governance And Social Processes is listed in Table 4.

Table 4: Indicators to assess the disaster effect On Governance and Social Processes

<p>Agriculture sector</p>	<p>Crops</p> <ul style="list-style-type: none"> <li>• The institutional arrangement for coordinating seed industry functions-their operations, disaster effect, and strengthening policy to support recovery.</li> <li>• Seed related policy and regulatory frameworks</li> <li>• The impact of disaster on the local capacity for plant breeding, seed extension and seed quality control.</li> </ul> <p>The effect of disaster on irrigation system’s ownership, management and governance arrangements</p> <ul style="list-style-type: none"> <li>• Current or potential conflicts with regards to irrigation system and water use generated due to the disaster. <ul style="list-style-type: none"> <li>• Women’s ownership and control over productive assets – land, housing, livestock, fishing ponds , equipments et al</li> <li>• Impact on the national and grassroots Womens Rights Organisations.</li> </ul> </li> </ul>
	<p>Livestock</p> <p>The impact of the disaster on key government offices responsible for livestock</p> <ul style="list-style-type: none"> <li>• The customary institutions and arrangements relating to livestock production and natural resource management.</li> <li>• Social networks, associations, cooperatives, community-based organizations and other key actors in the affected areas, their role, capacities, and needs.</li> <li>• The role of the private sector in the animal health delivery system, and how their participation can be promoted and used to supply needed goods and services.</li> <li>• The indigenous coping strategies and spontaneous recovery strategies that should be supported or avoided depending on their negative or positive effect.</li> </ul>

	<ul style="list-style-type: none"> <li>• Rights of access or potential conflict and the implications for livestock movement and migration.</li> <li>• How community leadership and organization has been affected</li> </ul>
	<p>Fisheries/Aquaculture</p> <ul style="list-style-type: none"> <li>• The institutional arrangement for coordinating seed industry functions-their operations, disaster effect, and strengthening policy to support recovery.</li> <li>• How existing fisheries and aquaculture support offices, staff, finances and equipment can be used</li> <li>• Fisheries and aquaculture policies and management initiatives that could impact or support recovery.</li> <li>• The role of the private sector in the sub/sector and how their participation can be promoted and used to supply needed goods and services.</li> <li>• Key social organizations and networks associated with fisheries/aquaculture</li> <li>• How community leadership and organization has been affected.</li> <li>• The policy and legislative implications of the disaster, and the elements of policy and management that may need to change to support recovery</li> <li>• The knowledge, skills, resources, systems, policies, regulations, accountability systems and reporting systems that need to be strengthened to support recovery.</li> </ul>
Public infrastructure sector	<ul style="list-style-type: none"> <li>• Disruptions in local governments/communities services in construction and maintenance of roads, infrastructure;</li> <li>• Disruption in local governments/ communities services in construction and management of water distribution and sanitation systems and loss of watsan services;</li> </ul>
Socio-environmental sector	<p>Gender</p> <ul style="list-style-type: none"> <li>• Cost for increased coordination and capacity needs responsible for gender/women’s affairs and its local presence, humanitarian response and recovery process</li> <li>• Cost for increased coordination and capacity needs to ensure consultation and participation of women and men in the post-disaster recovery decision making.</li> </ul>

	<ul style="list-style-type: none"> <li>• Differences in coping strategies between male and female-headed households, ethnic groups, and other population groups.</li> </ul> <p>The roles of different household members with regard to <i>household management</i>, livestock care and management, including use and disposal rights with particular reference to gender</p> <ul style="list-style-type: none"> <li>• The specific role of different population groups (women, men, ethnic groups, <i>elderly, disable</i> etc.) in fisheries</li> </ul> <p>Environment</p> <p>Damage to physical resources including infrastructure, vehicles, equipment of the institutions dealing with environment.</p> <p>Inability to enforce environmental legislation.</p>
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Increased risks and vulnerabilities

Key issues to consider in terms of estimating losses due to changes in risks and vulnerabilities include:

Table 5: Indicators to assess the disaster effects in increasing risks and vulnerabilities

Agriculture sector	<p>Additional hazards such as further recurrent flood in same monsoon or storm surge due to monsoon depression</p> <ul style="list-style-type: none"> <li>• <i>Weather</i> forecast, such as the forthcoming season (e.g., precipitation);</li> <li>• Secondary shocks, such as fish disease resulting from inappropriate supplies for restocking or loss of processed fish due to prolonged lack of market access;</li> <li>• Environmental risks, such as further deforestation, pollution due to excessive use of fertilizer</li> <li>• Social and political risks</li> <li>• New vulnerabilities created by the disaster</li> <li>• Population group that are especially vulnerable or food insecure.</li> </ul>
Public infrastructure sector	<p>Vulnerability situation deteriorates; increased risks of loss of assets;</p> <ul style="list-style-type: none"> <li>• Risk of health hazards and increased water prices;</li> <li>• Risk of increased price of essential commodities; and</li> </ul>
Socio-environmental sector	<p>Gender</p> <ul style="list-style-type: none"> <li>• Increase costs of accessibility of services for vulnerable women;</li> </ul>

	<ul style="list-style-type: none"> <li>• Costs of services to address the distinct post-disaster psychological needs of women, girls, boys , disables, and men;</li> <li>• Cost of targeting the food insecurity of elderly women and men living alone, female- or child-headed households, etc. that have lost or reduced livelihoods.</li> <li>• Cost of care for orphaned/unaccompanied boys and girls/persons’ with disability</li> </ul> <p>Environment</p> <p>Climatic risk</p> <ul style="list-style-type: none"> <li>• Number of Women's Rights Organizations involved.</li> <li>• Percentage of women leaders in DRM committees and teams at various levels</li> <li>• Percentage of women and socially excluded groups in the recovery process, disaster risk management committees, and teams at all levels.</li> </ul>
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After extracting from the effects above mentioned elements that have financial implications, either in terms of damaged infrastructure and physical assets or from loss due to changes in financial flows as linked to disruption of service production/delivery and access to goods and services, disruption of governance and social processes, and increased risks and vulnerabilities, all are valued in monetary terms. Usually, the monetary value of damage is also expressed as repair and replacement and costs. The damage to fully destroyed physical assets is estimated by multiplying the number of destroyed units with the replacement cost or current market price. The damage to partially destroyed physical assets can be estimated by multiplying the number of partially damaged units by their average unit cost of repair or rehabilitation. The value of the total damage from the disaster can then be estimated by aggregating the values of fully destroyed assets and those of partially destroyed assets.

3.2.1 Assessment of Flood and Cyclone impacts

The impact analysis will focus on the macro level medium and long-term impacts due to flood 2020 and cyclone Amphan. It will combine a quantitative assessment of the macro-economic impact with a quantitative and qualitative impact assessment on human development. The elements of each of these components of disaster impact are outlined below.

Economic impact at macro and micro level

A disaster may have macroeconomic impacts which may last for several years (UNDP 2013). To measure the impact on macroeconomic variables, analyses are usually made of the post-disaster performance on Gross domestic product (GDP); Balance of payments (BOP); Fiscal sector (budget); and Inflation. Based on the damage and loss estimation in sec 3.4.3, the assessment will be made on the impact of 1) disaster-induced changes in agricultural GDP; 2) reduced agricultural-



related exports; 3) increased agricultural-related imports; and 4) higher than normal government expenditure and lower tax revenue related to the Agricultural Sector.

It should be noted that it is not expected that the effects on community infrastructure would have any significant economic impact on GDP.

At micro level the following information will be collected to assess the impact of Flood 2020/cyclone Amphan from local business/industries

- Number of the days closed due to flood/cyclone
- Number of days partially closed due to flood/cyclone
- Normal output during a complete closer without flood/cyclone
- Normal output during a partial closer without flood/cyclone

Total indirect losses are sum of losses caused during both complete and partial closure.

#### Human development impact

Flood/cyclone can also have a lasting socio-economic and human development impact which should be assessed. Therefore, the impact at the macro and micro level, such as: Impact on poverty; Impact on overall levels of food and nutrition; Impact on Millennium Development Goal 1 and Impact on household and personal income in the study area will be assessed basically through secondary literatures, FGD, KII and Semi structured survey.

#### 3.2.2 Identification of sectoral recovery needs

The quantitative data obtained from the assessment of disaster effects and disaster impact in as described in section 3.3.3 and 3.4.4 will be consolidated to get a global picture of all three sectors of the study area. At the same time, the assessment results will be categorized by geographic area to facilitate a comparative analysis and prioritization. The needs will be determined using the following four components of each sector.

- The reconstruction of damaged infrastructure and physical assets.
- The resumption of production, service delivery and access to goods and services;
- The restoration of governance and decision making processes;
- The reduction of risks.

#### 4 Recovery Framework

The assessments (damage & loss and human impact) will produce an integrated sectoral scenario of the damages and needs that will be then summarized into a Recovery Strategy. The strategy will identify recovery priorities, a cost structure, stakeholders, and suggests a timeframe for recovery. It should be noted that the recovery strategy will need to be followed through with a detailed recovery framework which comprises information on the policy and institutional arrangements, financial mechanisms, monitoring and evaluation systems for recovery. Here already developed science-based tools will be used to strategizing the strategy for BBB, linking sectoral needs and prioritization and financing

The following tools have been developed at IWFM, BUET through a number of internationally collaborative projects for last 10 years (2010-2020) which will be used to develop the recovery framework.

- ✓ Dynamic Flood Risk Model (DFRM) is a flood risk generating tool based on the combination of various flood characteristics such as depth, duration, velocity, and several risk elements showing in various spatial scale (upazilla, union, village). An example of such risk map is shown in Fig. 5

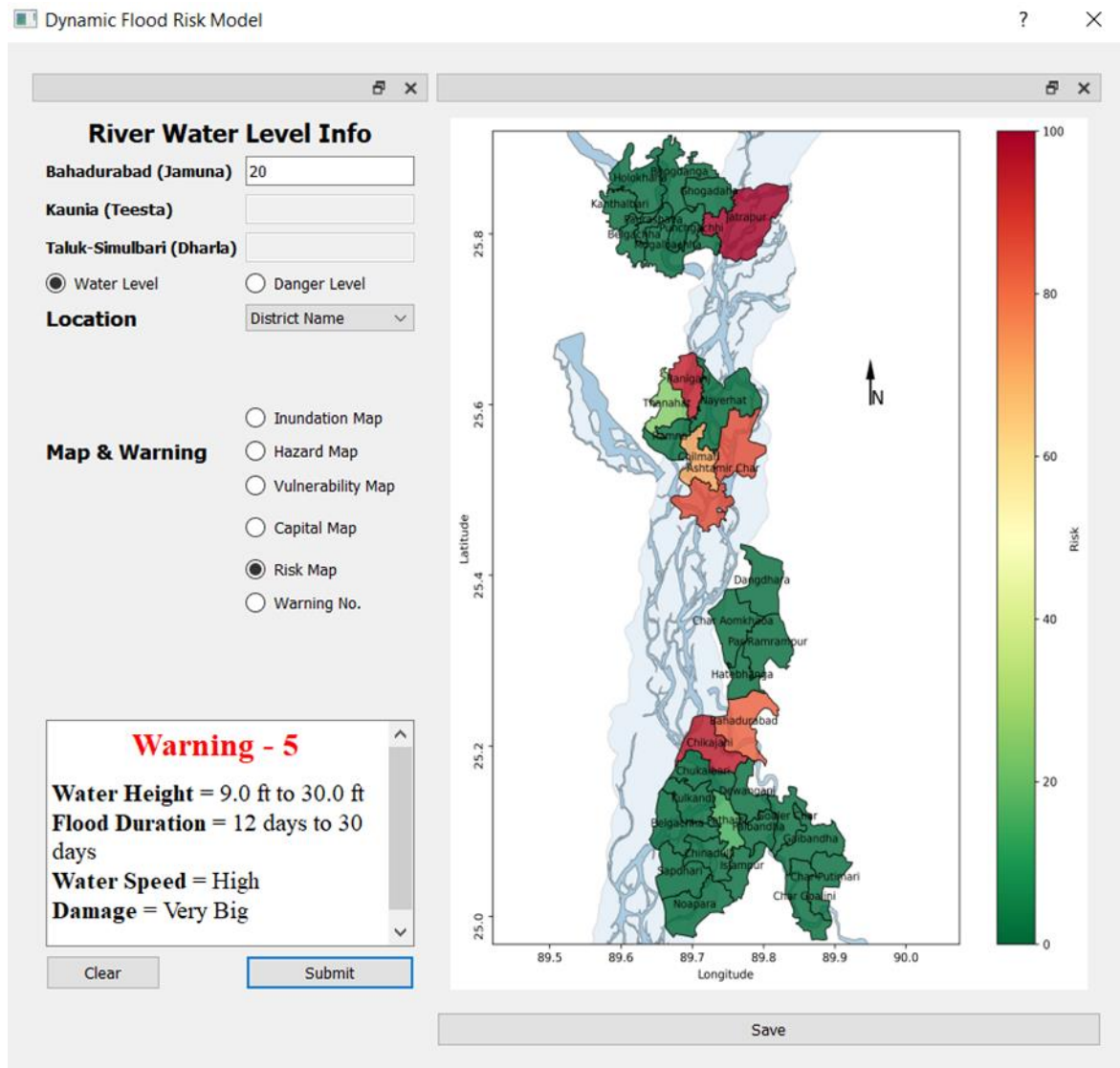


Fig. 5: An example of flood risk map in Kurigram-Jamalpur area using Dynamic Flood Risk Model (DFRM)

- ✓ Cyclone Classified Model (CCM) is developed based on various wind speed, different landfall location of a cyclone, water depth and thrust forces of those cyclones. CCM helps to indicate the structural damages of various regions for an incoming cyclone.

- ✓ Dynamic Adaptation Model (DAM) is used to find the need for adaptations to reduce the emerging risks due to climate change and can also be used as a pre- and post-disaster adaption assessment tool. An example of Dynamic Adaptation Model (DAM) to delineate the adaptation deficiency in a particular hot-spot area is shown in Fig. 6.

**Adaptation Model Output**  
**Present-day Risk Hotspot and Adaptation Deficiency in Midecentury Flood Hotspot**

Hotspot Name	Adaption Name	Adaptation Deficiency
Rajapur	Polder	56%
	Paka and semi Paka house	55%
	Loan	41%
	Communication Infrastructure	20%
Matlab	Polder	55%
	Paka and semi Paka house	54%
	Loan	41%
	Growth Center	30%
Hajiganj	Polder	52%
	Loan	35%
	Growth Center	33%
	Paka and semi Paka house	25%
Terokhada	Paka and semi Paka house	80%
	Loan	52%
	Communication Infrastructure	35%
Abhaynagar	Polder	62%
	Paka and semi Paka house	51%
	Communication Infrastructure	41%
	Growth Center	37%

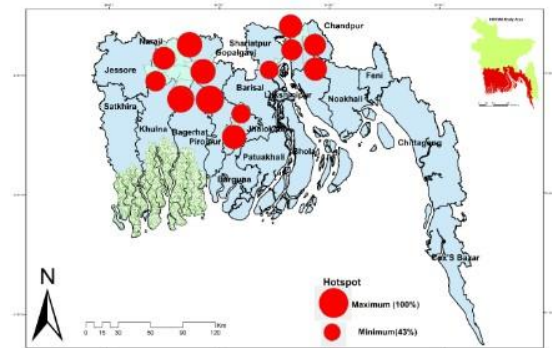


Fig. 6: Example of Dynamic Adaptation Model (DAM) to delineate the adaptation deficiency in a particular hot-spot area.

- ✓ Delta Dynamic Integrated Emulator Model (DDIEM) is a decision-making tool that helps to show the biophysical changes as well as socio-economic changes of various adaptations at different time scale. Doing trade-off of the biophysical changes and socio-economic changes helps the policy makers to decide of adaptations (interventions) strategy which will be practically needed for a specific zone.

#### 4.1 Strategizing for Build-Back-Better (BBB)

To make any recovery initiative sustainable in line with BBB, it necessary to assess its capacity to cope any future disaster. Here the concept of coupled DFRM- DAM-CCM-DDIEM will be used. The quantitative additional risk generated from CCM and DFRM can be an input to DAM. Knowing various adaptations strategy from DAM assists to put as inputs of Biophysical model and DDIEM. Finally, the requirement of those adaptations can be optimized coupling DAM and DDIEM. Though DFRM, DAM, CCM and DDIEM are independently developed and their purposes are different, but practically, these work in a cyclic way and hence, it is possible to consider them altogether as a coupling model.

#### 4.2 Linking sectoral needs and prioritization

Recovery needs in the agriculture, public infrastructure, and socio-economic sectors due to flood 2020 and cyclone Amphan will need to be prioritized and sequenced (short-term, medium-term and long-term). To formulate appropriate interventions in the sector recovery strategy, a *response analysis* which links the assessment results and situation analysis with response formulation and planning using the DFRM- DAM-CCM-DDIEM will be done. The Dynamic Adaptation Model (DAM) will be widely used in this case. The Fig. 7 presents a conceptual overview of a response analysis framework that will be used in this study.

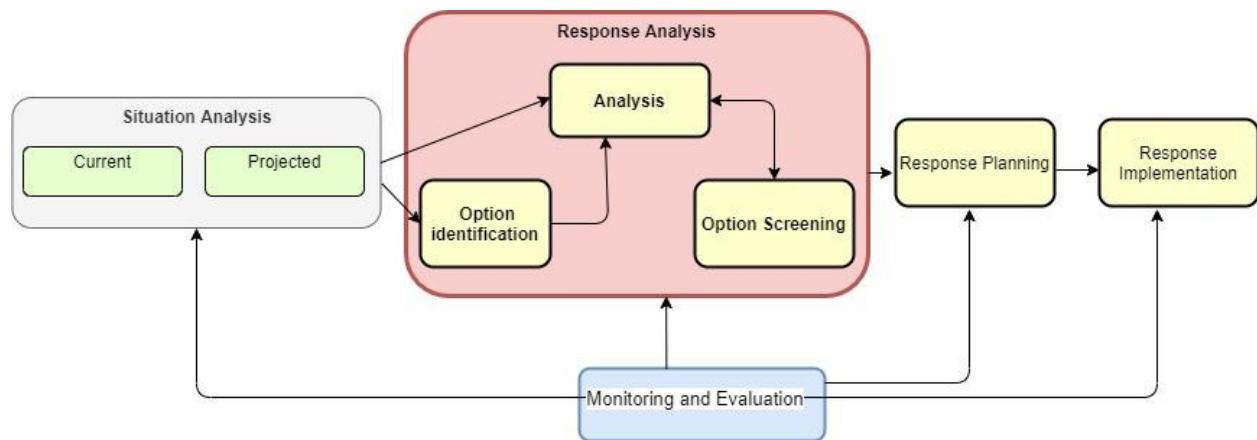


Fig. 7: Conceptual framework of response analysis

The concept of resilience triangle will be used here (Fig. 8). By analyzing several options the most quick and sustainable options will be selected. This should include prioritizing critical needs expressed by the affected population and government, but also prioritizing vulnerable population groups, geographic areas most affected, conflict prevention and peace-building objectives when relevant, among others.

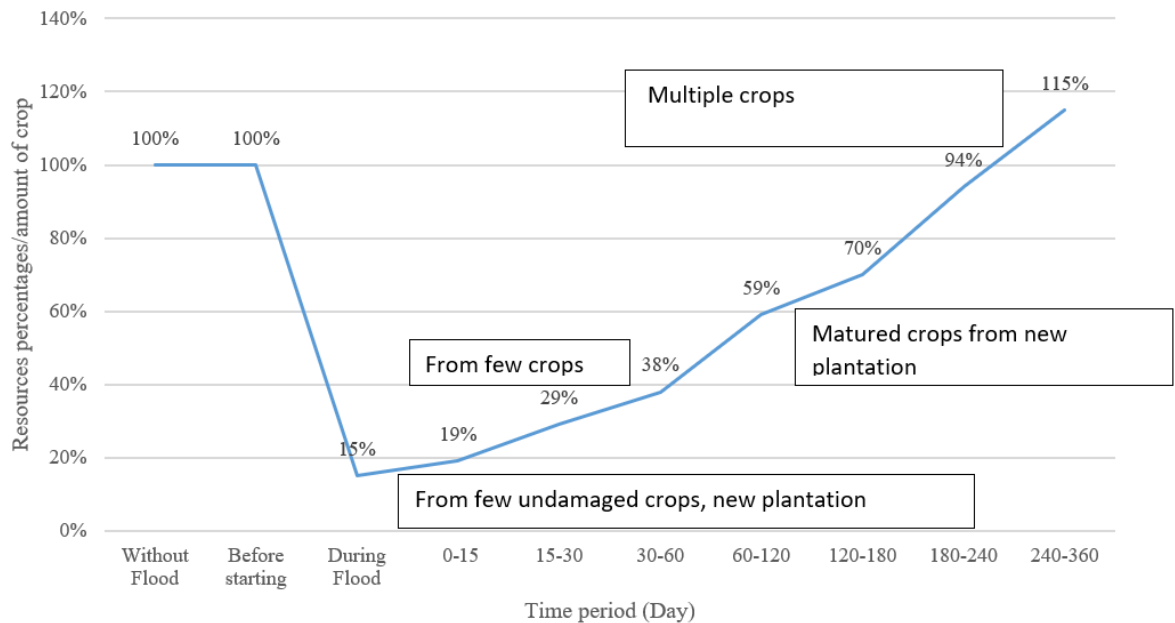


Fig. 8: Resilience triangle to restore the livelihood in Agricultural sector after flood

#### 4.1 Sector recovery strategy

In line with the PDNA guidance (GFDRR 2013) on the recovery strategy, the sectoral recovery plan will be developed where the key elements will be

- 1) Priority needs
- 2) Interventions required
- 3) Expected outputs
- 4) Recovery costs, and
- 5) Intended outcomes.

The assessments results obtained from sec 3.4.3 and 3.4.4 will be combined using the model studies in sec 3.5.1 and 3.5.2 and a results-based recovery plan will be developed. An example of such plan in agriculture section is shown in Table 6.

Table 6: An example of Results-Based Recovery Plan (source GFDRR (2013))

Priority Recovery Needs	Interventions	Expected Outputs	Recovery Costs	Intended Outcomes
To assist farmers affected by the disaster with the rehabilitation of farms	<ul style="list-style-type: none"> <li>Supply primary production inputs, training and marketing support.</li> <li>Multi sector support for traditional small-scale irrigation.</li> <li>Agricultural technical assistance and capacity building support.</li> <li>Restore farmers' access to agricultural land.</li> <li>Rebuild agricultural infrastructure.</li> </ul>	<ul style="list-style-type: none"> <li>Agricultural input package (tools, seeds, fertilizers, training) supplied to 290,000 farmers.</li> <li>Irrigation networks repaired to cover 15,000 ha of agriculture land.</li> <li>Three training centres established and 340 government staff trained.</li> <li>450,000m<sup>3</sup> of debris cleared to open up agricultural areas.</li> <li>8 processing and 34 storage facilities rebuilt.</li> </ul>	\$7,650,000	To rehabilitate and develop the Agricultural Sector.

#### 4.2 Financing and Implementation Arrangement

The Financing and implementation arrangement will be developed through the consultation with the ministries i.e Planning Ministry, Ministry of Disaster Management and Relief, Ministry of Agriculture, Ministry of Fisheries and Livestock, Ministry of Health, Ministry of Education, Ministry of Women and Children Affairs, Ministry of Social Welfare, Ministry of Water Resources, Ministry of Local Government, Rural Development & Co-operatives, Ministry of Social Welfare etc. A technical team comprising of experts from govt., UN, I/NGOs/Academia, will sketch down the implementation framework of the recovery strategy. It will elucidate the Coordination arrangements between government, civil society, and the private sector; Inter-sectoral arrangements and Inter-agency management arrangements (e.g., coordination unit or similar arrangements, support services to be established, such as offices, human resources, etc.).

To design and implement “gender-inclusive” recovery strategy and plan Gender Responsive Budgeting should be the part of Amphan Recovery Plan so that the plan's actions and commitments are not just tokenistic and superficial but backed with the budget and resources to realize gender and social inclusion.

#### 4.3 Focusing the future: Recovery plan for next the disaster

Through the development of recovery strategy for flood 2020/cyclone Amphan as discussed earlier the future recovery issues such as underlying gaps and challenges in recovery approach and initiatives, recovery needs in a post-disaster scenario, capacity building and coordination needs, and possible execution process, under different scenarios will be identified. Thus this study aims to developed a generic Pre-disaster Recovery Plan (PDRP) which is expected to guide future recovery efforts in different phases with improved recovery outcomes. With clear and agreed-upon guidelines for information gathering, tools for assessing pre disaster damages and needs and for providing assistance, defining recovery roles and responsibilities along with funding

arrangement, and most importantly focusing on ‘building back better’, it is expected that the disaster recovery efforts will gradually move towards reduction of vulnerability of affected populations and risk of future events, thus ensuring the sustainability of recovery efforts through inclusion with mainstream developments. The PDRP will contain-

1. A mechanism to form a collaborative planning team: A collaborative planning team including the members from all sectors will be formed and who will start from a common understanding of PDRP towards BBB.
2. Baseline information: This baseline information will coincide with the baseline information collected during PDNA. In addition to the information of the human, natural, cultural, financial, social and physical capital, Infrastructure and physical assets in pre-disaster time it will include the info of production and delivery of goods and services, and their access, governance and decision-making processes. The baseline information of IWFM developed model such as DFRM/ DAM/CCM/DDIEM will be used in this purpose.
3. Generation of disaster scenarios: Using the DFRM of CCM several disaster scenarios will be developed, Risks and vulnerabilities, analyze existing plans will be tested by using DAM.
6. Define strategies and actions: From disaster scenarios, PDRP will identify recovery needs and sectoral intervention leading to BBB, prioritize the recovery needs and determine the overall role of coordinating organizations during the disaster. It will have an estimate the recovery costs and financing method

## 5 Conclusion

Natural disasters are the ‘characteristic feature’ of Bangladesh due to its geophysical setting. Due to the low level of community resilience and the high exposure to multiple hydro-meteorological hazards, the damage and economic loss are increasing. Overlaying of the recent pandemic event (COVID-19) is fueling the situations to new dangerous and unpredictable levels. However, experience disclosed that the recovery from any disaster in Bangladesh is always handled in a scattered manner at sectoral levels with inadequate attention losing focuses as time passes. Therefore, it leads to long-lasting risk conditions in case of a recurrent disaster like floods and cyclones. There is always an absence of a comprehensive pre and post-disaster recovery planning framework and action plan triggered by science-backed damage and loss assessment tools. In the densely populated country, as the development activities are being implemented even in the known disastrous locations, the upcoming vulnerabilities and risks are also growing with the time that causes significant loss and damage every year by the recurrent disasters.

Under these circumstances, this study is focused to formulate a risk-informed, gender-inclusive, multi-sectoral coordinated disaster science-informed Disaster Recovery Strategy for Bangladesh. As the study area, the flood 2020 affected area Kurigram-Jamalpur and cyclone Amphan affected Koyra Upazilas are selected. Through this study, the Post-Disaster Need Assessment (PDNA) due to flood 2020 and Cyclone Amphan will be done first. The review of secondary literature, FGD, KII, and Semi-structured survey in the study area will be performed for

focusing on three sectors-agriculture, public-infrastructure and socio-environment for PDNA. Then based on the, PDNA Post-Disaster Recovery Strategy (PDRS) will be initiated. The sectoral needs and prioritization process will be facilitated by several science-based tools developed at IWFMM, BUET. Based on the PDNA and PDRS, the Pre-Disaster Recovery Plan (PDRP) for the next flood or cyclone will be developed. Thus, a complete recovery strategy for flood and cyclone is targeted to develop through this study which is expected to guide future recovery efforts in different phases with improved recovery outcomes.



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