Characterization, Diagnostic Analysis and Assessment of Progress of Community Recovery after Cyclone Aila in Bangladesh

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by

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Abstract

International policies of disaster management is undergoing a change due to emergence of Sendai Framework, Sustainable Development Goal, and local ongoing development. In case of countries like Bangladesh that are undergoing a rapid change in economic development, and where international aids, humanitarian organizations and NGOs play a vital role in post-disaster recovery, such international changes impact widely and deeply. Accordingly, National disaster management policies and priorities in Bangladesh are also undergoing a paradigm shift from post-disaster relief to pre-disaster preparedness. Such changes became evidently visible in Bangladesh after two recent devastating cyclone- Cyclone Sidr (strike in 2007) and Cyclone Aila (strike in 2009). New approaches of disaster recovery- Government-NGO partnership approach, Build Back Better (BBB) were adopted for post disaster recovery of Cyclone Sidr and Cyclone Aila. However, questions on recovery quality and progress e.g. how much the principles of BBB were adopted, how is the outcome, are remaining unanswered due to absence of any proper monitoring practices. This circumstance motivated this research to examine the Cyclone Aila with an aim of answering the questions related to recovery quality, progress, and outcome. Accordingly, this research sets the following broad objectives:

I. To understand Aila recovery mechanism in the context of BBB
II. To investigate and quantify the inclusiveness of Aila recovery with respect to Pre-existing vulnerability reduction
III. To characterize and categorize Aila recovery measures in the context of BBB
IV. To assess the progress of Aila recovery in the context of BBB

To this end the overall research can be summarized with four broad parts. In first parts attempts were made to understand the overall recovery mechanism and coordination. The methodology included extensive literature review, institutional survey, expert interview and focus group discussion. The research constructed a matrix of recovery initiative that illustrates “who has done what” and “who prioritized what”. Surprisingly the findings evidence that short-term measures like aid, emergency repair of infrastructures, supports in available livelihood options, etc. were adopted ignoring long-term viable measures. It also concludes that NGOs preferred to work in emergency aids, short-term aid for water supply, sanitation, and hygiene (WASH), livelihood, education and disaster preparedness sector. Whereas, the Government mostly involved in infrastructure and coastal polder

recovery. Unfortunately most of these implemented initiatives were also for short-term. The result of the analysis on coordination structure says that local level coordination of humanitarian aid and NGOs are inadequate. It concludes that the present approach of coordination by conducting monthly meeting only is neither ensuring harmonization of humanitarian aids, nor adoption of viable recovery measures.

The second part of the research quantifies inclusiveness of recovery with respect to pre-Aila vulnerability reduction (PAVR). It develops a composite methodology of diagnostic analysis to quantify the inclusiveness. It firstly identifies pre-Aila vulnerabilities and indicative recovery measures that ensure PAVR, and finally quantifies the inclusiveness of recovery with respect to PAVR. The result indicates lack of comprehensive consideration of PAVR in Aila recovery. According to the scale of inclusivity developed under this research, the PAVR measures related to physical safety, WASH, local economy, disaster preparedness, and social relations and networks are poorly included in the Aila recovery. Thereby it suspects community in Koyra is still living with pre-existing vulnerabilities.

In the third part, this research characterizes each implemented recovery measure by two criteria – i) effectiveness to improve the community safety, ii) contribution to PAVR. The research also proposes four categories of recovery depending on its agreement with the safety goal of BBB which are: i) "retreat or new construction reality is required," ii) "struggle to reach normalcy", iii) "returning to a normalcy with PAVR," and iv) "BBB." The result says most of the implemented recovery measures are successful for "short to mid-term" and "low to moderately" contribution to PAVR. Eventually, those measures are showing low agreement with BBB and recovery of different sectors fall in the category of "struggle to reach normalcy." The results again support the assumption – community is living in a repeated vulnerability.

In the final part, the research attempted to measure the progress of sectoral recovery with respect to the BBB. It proposes a synthetic approach of constructing recovery curve by peoples' perception. With the application of the proposed methodology it constructs synthetic recovery curves of coastal polder, housing, local economy, water supply, sanitation and hygiene, and infrastructure. The results illustrate that there is a trend of improvement of sectoral conditions. However, it concludes that with comparison to the

future community as elicited by BBB principles the present condition of the different sectors is far away from the BBB goal.

With relation to the obtained results, the research recommends for urgent need of investment in DRR to adopt long-term measures, retrofitting the existing humanitarian aid coordination at local level, linking BBB principle with SDGs, adopting hazard map-based land use plan, and prioritizing development of safe cluster village on elevated land rather than in-situ housing provision as housing recovery support.

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Abbreviation

ADB	Asian Development Bank
ADP	Annual Development Plan
BBB	Build Back Better
BWDB	Bangladesh Water Development Board
CEIP	Coastal Embankment Improvement Project
CFS	Core Family Shelter
CI	Corrugated Iron
DDM	Department of Disaster Management
DER	Disaster Emergency Response
DP	Development Partner
DRR	Disaster Risk Reduction
EKN	Embassy of Kingdom of Netherlands
ERF	Early Recovery Facility
FGD	Focus Group Discussion
GO	Governmental Organization
HCTT	Humanitarian Coordination Task Team
HO	Humanitarian Organizations
HTW	Hand-pump Tube well
KII	Key Informants Interview
LCG	Local Consultative Group
LGED	Local Government Engineering Department
NGO	Non-Governmental Organization
PAR	Pressure and Release

PAV	Pre-Aila Vulnerability
PAVR	Pre-Aila Vulnerability Reduction
PIO	Project Implementation Officer
RHS	Rainwater Harvesting System
UNDP	United Nations Development Program
UNISDR	United Nations International Strategy for Disaster Reduction
UNO	Upazila Nirbhahi Officer
WASH	Water, Sanitation, and Hygiene
WB	World Bank

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Chapter 1 Introduction

1.1 Background

Being geographically located in a cyclone prone area Bangladesh has a long history of tropical cyclone related disasters (Akhand, 2003). In last 50 years the country has experienced several devastating cyclones (in terms of human lives and economy) including Bhola cyclone (1970), 1985 Cyclone, 1991 Cyclone, Cyclone Sidr (2007), and most recently Cyclone Aila (2009) (Sadik, Nakagawa, Rahman, Shaw, Kawaike, & Fujita, 2018; Shah Alam Khan, 2008). The disaster management strategy of the country has been praised internationally for its gradual success in saving human lives (Haque et al., 2012). The journey started soon after the devastating Cyclone Bhola of 1970. Prompted by the deadly cyclone soon after Bangladesh's independence, the new government launched a cyclone preparedness program, which established a vast network of volunteers for risk communication and evacuation management in 1972. After a cyclone in 1985, the government realized the need of cyclone shelters across the coastal area and initiated constructing multipurpose cyclone shelters in coastal areas (Shah Alam Khan, 2008). Soon cyclone shelters were found very effective in saving lives. Besides, coastal embankments which were constructed to protect agricultural lands from high tide often found effective in preventing damages from low-intensity storm surges (Shah Alam Khan, 2008). Government initiated a project for rehabilitating damaged embankments accepting their potential roles in preventing low-intensity storm surge. After yet another devastating cyclone in 1991, these initiatives of constructing multipurpose cyclone shelters were further strengthened along with afforestation program, public preparedness and awareness. This gradual improvement in disaster risk reduction resulted significant improvement in saving human lives during cyclone events after 1991 (Haque et al., 2012). With the adoption of Hygo Framework the country started its gradual policy shifts from emergency response to disaster preparedness. Soon after the two recent devastating cyclone i.e. Cyclone Sidr (2007) and Cyclone Aila (2009), the country with the facilitation from international organizations including UNISDR, World Bank, and different international organization Bangladesh started giving priority of adopting disaster risk reduction initiatives in Post-disaster recovery program (F. Mallick & Islam, 2014; World Bank, 2014). Researchers and academicians also started to focus on disaster recovery. New researches started appearing on recovery needs (B. Mallick, Rahaman, &

Vogt, 2011), individual recovery strategies (Parvin & Shaw, 2013), recovery policy (F. Mallick & Islam, 2014), resilience building (B. Ahmed, Kelman, Fehr, & Saha, 2016), etc. The Build Back Better (BBB) approach also started becoming popular when the country adopted the Sendai Framework for Disaster Risk Reduction (DRR).

The post disaster recovery after Cyclone Sidr and Aila were claimed to be planned in the context of BBB. However, the planning and implementation process, outcome of the newly adopted recovery approach (after Sidr and Aila) and its links to DRR are yet to be investigated scientifically. The situation in the affected areas evidences gaps and flaws in adopting BBB approaches (Hossen, 2016; New Age, 2016). The government realized the facts and gave focus on monitoring of post disaster recovery in the draft of new national disaster management plan (MoDMR, 2017). However, methodologies to monitor and evaluate recovery process and outcome especially from the context of speed, quality and its links to DRR lack localization and appropriateness. Therefore, the need of a scientific research to appropriate recovery monitoring tools and methods, and to explore the gaps and flaws becomes an urgent need which motivated this research. Accordingly, this research takes Cyclone Aila recovery as a case to investigate.

The recovery from the impact of the Cyclone Aila was particularly interesting because of the nature of the cyclone damage and thereafter the joint effort of Government and development partner to promote multi-sectoral recovery to enhance resilience. The systematic and comprehensive post disaster recovery had somewhat practiced after two recent devastating cyclones: Cyclone Sidr (2007) and Cyclone Aila (2009) (F. Mallick & Islam, 2014; Sadik, Nakagawa, Rahman, Shaw, Kawaike, & Fujita, 2018; World Bank, 2014). In both cases recovery mechanisms supported by the joint multi-development partners were established to promote multi-sectoral recovery. Therefore, this research would give a feedback to such newly adopted recovery approach, plan and coordination mechanism.

Since these situation and context are almost same in developing countries, this research would benefit not only Bangladesh but also other developing countries. Besides, it would inform the international humanitarian organizations, development partners and international platforms for disaster risk science about the local context of BBB which would eventually help them to ensure its appropriate application.

1.2 Cyclone Aila and Damages

The Cyclone Aila struck the south western coast of Bangladesh on May 25, 2009 (IFNet, 2009). The cyclone formed on May 23 in Bay of Bengal and at the time of landfall it reached to its maximum intensity as a "sever cyclone with core hurricane wind" according to Bangladesh Meteorological Department's classification (Debsarma, 2009) with 65 knots (around 120 km/hr) maximum sustained wind and 974 mb (equivalent to 974 hPa) minimum sea level pressure (IFNet, 2009; JTWC, 2009) (Figure 1.1). According to Saffir-Simpson's scale of hurricane it was only a "Category 1"cyclone. However, it coincided with high tide and new moon (spring tide) which resulted surge of 2m-6m (ECHO, 2009; IFNet, 2009) in the south west coast of Bangladesh. The cyclone killed 190 people and affected 3.9 million people in 11 coastal districts of Bangladesh (UNDP, 2010). It completely washed way 237 km of earthen embankment and 2,233km roads, and partially damaged 1,557 km earthen embankment and 6,621 km roads which eventually made the affected areas exposed to tidal flood and suspension of communication system in affected areas for a long time (UNDP, 2010). It also completely destroyed 243,191,houses and 445 institutions, and partially damaged 370,587 houses and 4,588 institutions(UNDP, 2010). A rough estimation of the government said the economic loss was around 269.28 million USD including losses due to damages of infrastructures, crops and livestock (Reliefweb, 2009). It severely affected water supply, sanitation and health services forcefully displaced around 201,982 people (including 76,478 families) (ECHO, 2009; UNDP, 2010). It was a severe humanitarian disaster and unlike another recent devastating cyclone (Sidr 2007) people's suffering continued for several years until the damaged infrastructures, embankments and housing were reconstructed (Sadik, Nakagawa, Rahman, Shaw, Kawaike, & Fujita, 2018).

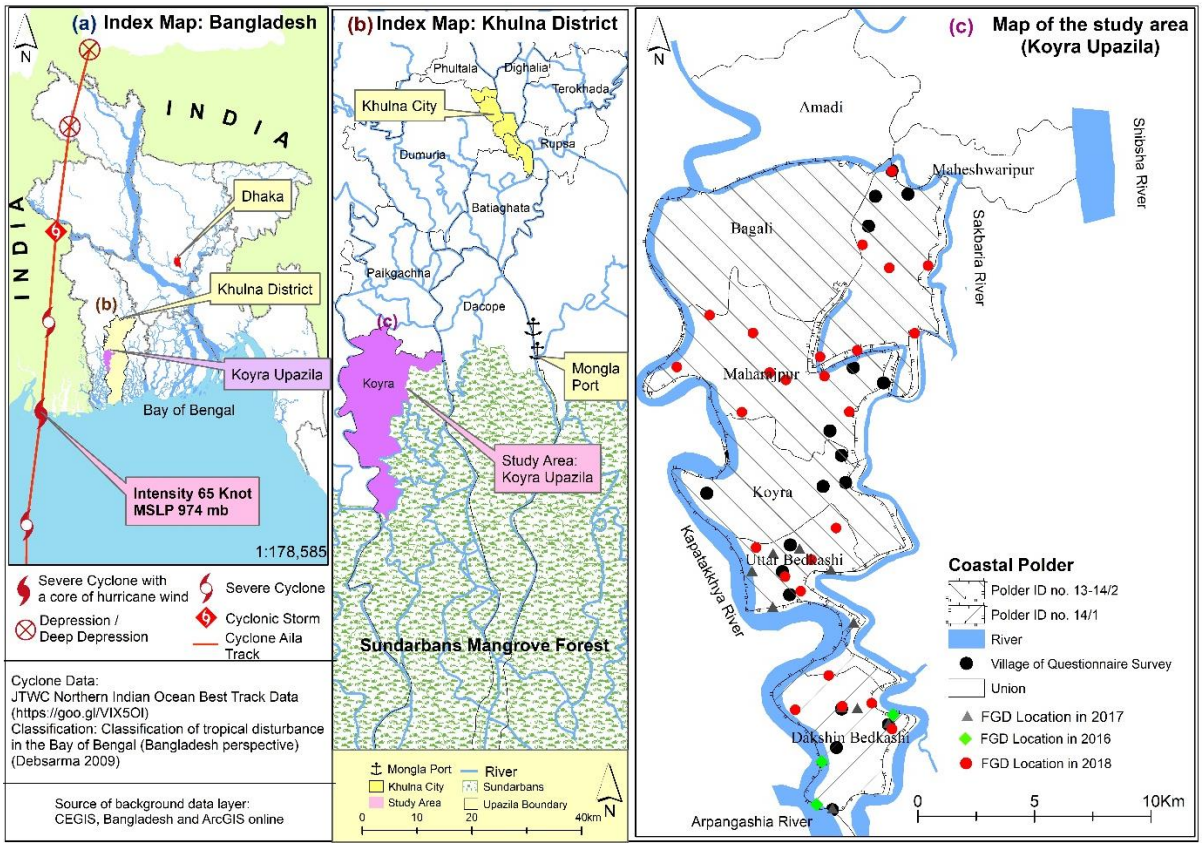


Figure 1.1 Map of the Study Area

1.3 Research Problem and Objectives

Despite a long experience of cyclone disaster and thereafter reconstruction, the coastal community is falling into repeated vulnerability (Sadik, Nakagawa, Rahman, Shaw, Kawaike, & Fujita, 2017). Although the country is making a paradigm shift from emergency response to pre-disaster preparedness, the post-disaster recovery is still very fuzzy in the policy documents. The involvement of multi-stakeholders including international NGOs, development partners, and local NGOs added another dimension (e.g. aid harmonization, coordination) to the issue of post-disaster recovery (Sadik, Nakagawa, Rahman, Shaw, Kawaike, & Fujita, 2017; Sadik, Nakagawa, Rahman, Shaw, Kawaike, Fujita, et al., 2017). As a signatory of Sendai Framework, the country adopted policies for holistic recovery (DMB-MFDM, 2010; MoDMR, 2017) and the Cyclone Aila recovery has been claimed to be one of the initiatives built on BBB approach (F. Mallick & Islam, 2014). Such claims along with international praise for being successful in saving human lives (Haque et al., 2012) influence the ongoing policy changes considering Aila recovery as the best case. However, the present situation evidences gaps

and flaws in recovery (Hossen, 2016; New Age, 2016). Which motivated this research to investigate the Aila recovery with an aim of informing ongoing policy changes.

Moreover, the country is on its way to graduate from the list of least developed country (UN-CDP, 2018) which implies necessary political changes in DRR strategies. Accordingly priorities and dimensions of DRR should also be changing. An in-depth examination of post-disaster recovery would therefore necessary to inform the policy making in this changing economic and political environment. Moreover, a scientific research to investigate the recovery after recent Cyclone Aila to understand the process of recovery, how it links to DRR, and assessing the outcome of recovery in the context of BBB is necessary to scientifically evaluate the adoption of BBB in Bangladesh. Therefore, this research has been designed considering the following objectives:

i. To understand the Aila recovery mechanism in the context of BBB
ii. To investigate and quantify the inclusiveness of Aila recovery with respect to Pre-existing vulnerability reduction
iii. To characterize and categorize Aila recovery measures in the context of BBB
iv. To assess the progress of Aila recovery in the context of BBB

It is obvious that findings of this research in line with these aforementioned objectives would inform the policy making process. Nonetheless, the methodology developed for this research to achieve those objectives would also be useful for developing monitoring tools for recovery plans and policies.

1.4 Study Area

Our research considered Koyra Upazila (Figure 1.1) as the case study site because the area was severely damaged by Cyclone Aila. Koyra is a coastal upazila[1] of the Khulna District. The upazila is located at the border of the Sundarbans mangrove forest and about 100 km away (by road) from Khulna City. Similar to other coastal areas in Bangladesh, Koyra Upazila was also protected from salinity intrusion and tidal flooding by coastal embankments (coastal polder ID 13-14/2 and 14/1) (Figure 1.1). When the cyclone struck, the entire upazila was inundated because of overtopping and breaching at 34 places of the coastal embankments (Roy, Kumar, Mehedi, Sultana, & Ershad, 2009). The cyclone affected a population of 152,496 in Koyra (Koyra Upazila Council, 2010). Aila

[1] Upazila is the third level of administrative unit in Bangladesh Since it functions as a subunit of a district, it can be defined as sub-district.

damaged 81 km of embankments (between polder 13–14/2 and 14/1), 680 km of earthen road, 163.5 km of asphalt road, 49 bridge culverts, 42,440 houses, nine academic institutions, 192 religious institutions, the crops on 11,500 hectares, and 10,364 fish aquaculture farms in the upazila (Koyra Upazila Council, 2010). Thereafter, the government and its development partners considered Koyra Upazila as a priority area for recovery and reconstruction.

1.5 Outlines of the Dissertation

This dissertation consists of six chapters. Chapter 1 presents the background of the research, description of the study area, research problem and specific objectives. The overall research can be split into several major components in accordance to the objectives, which are developing a storyline of overall recovery mechanism, pre-Aila vulnerability (PAV) analysis, analysis and quantification of inclusiveness of recovery with respect to PAV, characterization and categorization of recovery measures and finally the assessment of recovery progress. These major components have been described along with a short introduction, description of adopted methodology, details of the results and concluding remarks in four different chapters from Chapter 2 to Chapter 5. Since the methodology adopted for different parts of the research have been described in the relevant chapters, there is no separate chapter on methodology only.

Chapter 2 describes the research related to the first objective. It includes overall storyline of the recovery, “who had done what”, “who priorities what” and the examination of overall coordination mechanism. Chapter 3 is related to the second objective and it presents identifies PAVs, and quantifies inclusiveness of recovery to PAVR. Chapter 4 presents the research related to the third objective. It includes characterization and categorization of recovery with respect to the safety aspect of BBB. Chapter 5 presents the assessment of recovery progress in line with the fourth objective. Finally, the Chapter 6 makes an overall concluding remarks along with few recommendation and future research directions.

Chapter 2 Cyclone Aila Recovery Mechanism at Koyra: Storyline and Coordination

2.1 Introduction

Cyclone Aila struck west coast of Bangladesh on May 25 of 2009 with the intensity of 'Severe Cyclonic Storm' (Max intensity 65 Knots, minimum MSLD 974 mb) as per IMD classification (JTWC, 2009). Although the cyclone was weaker in compare with another recent cyclone, Sidr (2007), the economic impacts and people suffering outweighed the impact of any severe cyclone struck in recent time (B. Mallick & Vogt, 2014). Because, the cyclone made the landfall during spring-high tide which resulted 2~6m (ECHO, 2009; IFNet, 2009). The weakening coastal infrastructures and pre-existing vulnerabilities resulted prolonged human suffering and high economic loss. Both the Government and international humanitarian agencies responded quickly.

The role of humanitarian organizations in disaster response is growing in Asia with lots of success stories and criticism (Osa, 2013). With this trend, NGOs have grown to become an important sector for development in Bangladesh (M. R. R. Islam, 2016). Their contribution in disaster management especially in improving community resilience are published at international level (B. Ahmed et al., 2016). Recognizing the role of NGOs in post-disaster recovery, the government of Bangladesh has considered the GO-NGO partnership in national disaster management framework (Khan & Rahman, 2007). At the time of humanitarian crisis in post-cyclone Aila period, NGOs have played an important role in emergency response and recovery (Tada, 2011; Walton-Ellery, 2009). However, aid effectiveness, accountability, coordination of NGOs in disaster response are being criticized with field evidence (R. Islam & Walkerden, 2015; Mahmud & Prowse, 2012; B. Mallick, Ahmed, & Vogt, 2017). This chapter of the dissertation presents the overall storyline and coordination structures of Aila recovery in Koyra to illustrate the overall recovery mechanism. This exercise of examining the recovery mechanism ultimately helped the progress of the research towards further analysis including quantifying inclusiveness of recovery and assessing the progress.

2.2 Approach and Methodology

This part of the research is focused on Aila Recovery mechanism taking Koyra Upazila as a case study site. With the aim of understanding recovery mechanism this research

was evolved through theoretical and subjective analysis supported by literature reviews, policy analysis, stakeholder analysis, and institutional analysis. Finally, the findings were reviewed and validated by Focus Group Discussion (FGD) with local people. A step by step systematic approach was followed for understanding Aila recovery mechanism. It involved developing a storyline by case study, a matrix of recovery activities identifying "who has done what", scrutinising recovery coordination structure. Institutional survey and Key Informants Interview (KII) helped to construct a matrix of Aila recovery activities. In addition the information obtained from the institutional survey and literature review, FGDs were helped to develop overall story line and to validate the "recovery matrix". The details of the field survey technique i.e. institutional survey, KII and FGDs are described below:

2.2.1 Institutional survey and key informants interview

Institutions, especially local NGOs involved in recovery and reconstruction in Koyra, were identified using a snowball sampling technique (Goodman, 1961). Since the list of NGOs involved in Aila recovery and their activities were not well-documented and archived in any single place (for example, local government offices), we adopted the snowball technique as described in Figure 2.1. Additionally, local representatives of the Department of Disaster Management, the Bangladesh Water Development Board (BWDB), the local Government Engineering Department, the deputy team leader of the Coastal Embankment Improvement Project (CEIP), and the director general of the Water Resources Planning Organization and a researcher from Japan who works with JICA and conducted a research on Aila recovery were interviewed as key informants.

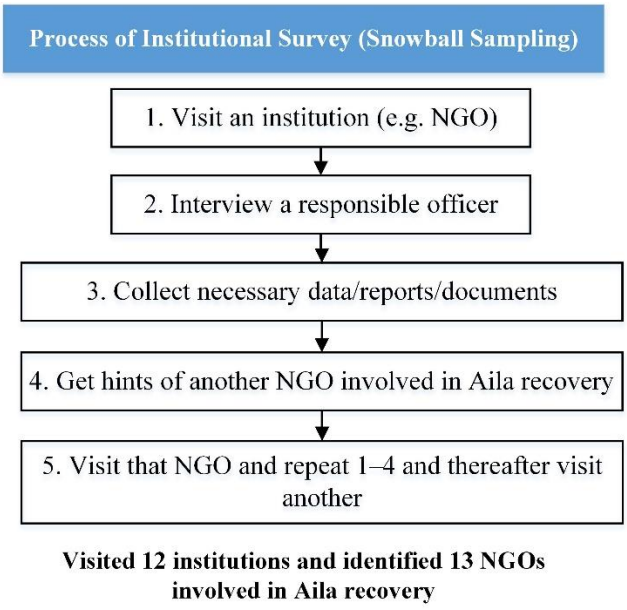


Figure 2.1 Process of Institutional Survey

2.2.2 Focus group discussion

To comprehend and validate the overall storyline of the recovery, a series of FGDs with local people were conducted at 14 villages in 2016 and 2017 (Figure 2.2). Although FGDs were conducted informally, interviewers followed structured questionnaires and compiled notes on discussion issues. The average number of participants in the 14 FGDs was 10 (maximum 13 and minimum seven), with one-third of participants being female (except at three locations where participants were only male). The three males-only FGDs were conducted at rural growth centers (market places) with mostly local traders and shoppers where women are rarely found. Though the study area covers the entire Koyra Upazila, FGDs at this stage were conducted only in Uttar Bedkashi and Dakshin Bedkashi unions[2]. These two unions were in priority for each recovery initiative. Almost all NGOs who worked in Koyra had projects in these unions as well. Therefore, these two unions represented the overall scenarios of the upazila from the planning context.

[2] Union is a forth level administrative units of Bangladesh. This is sub-unit of upazila.

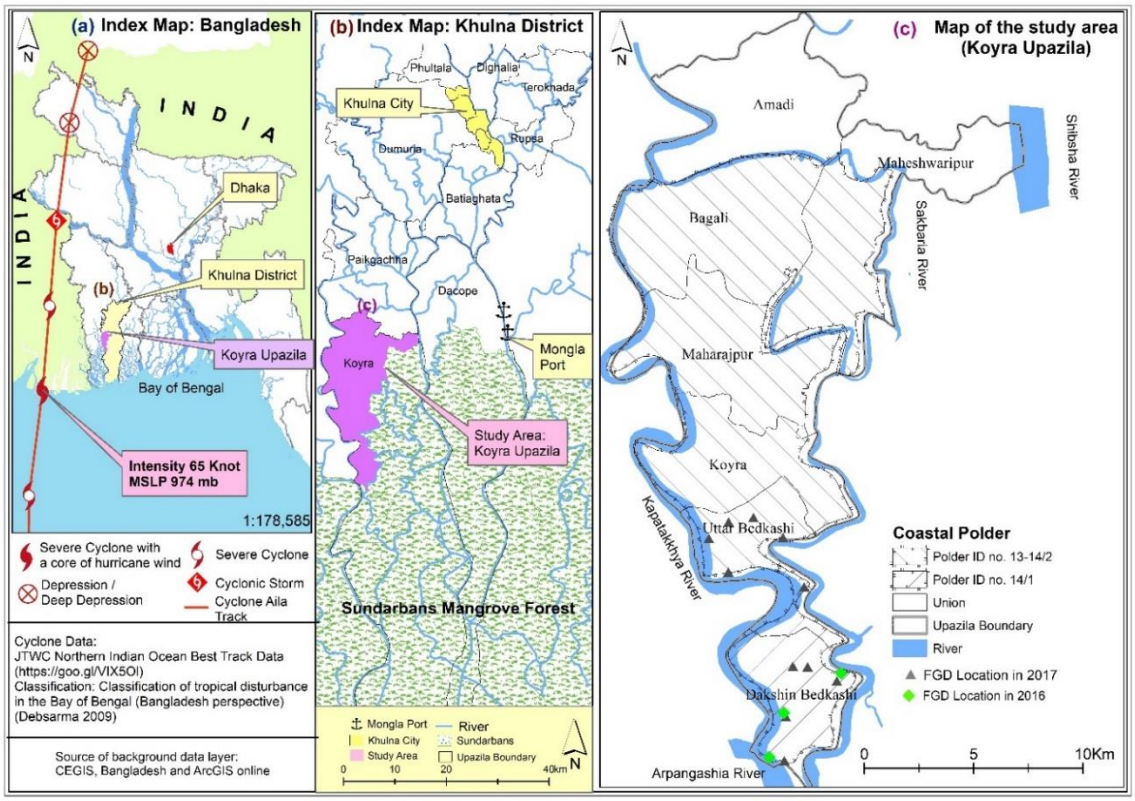
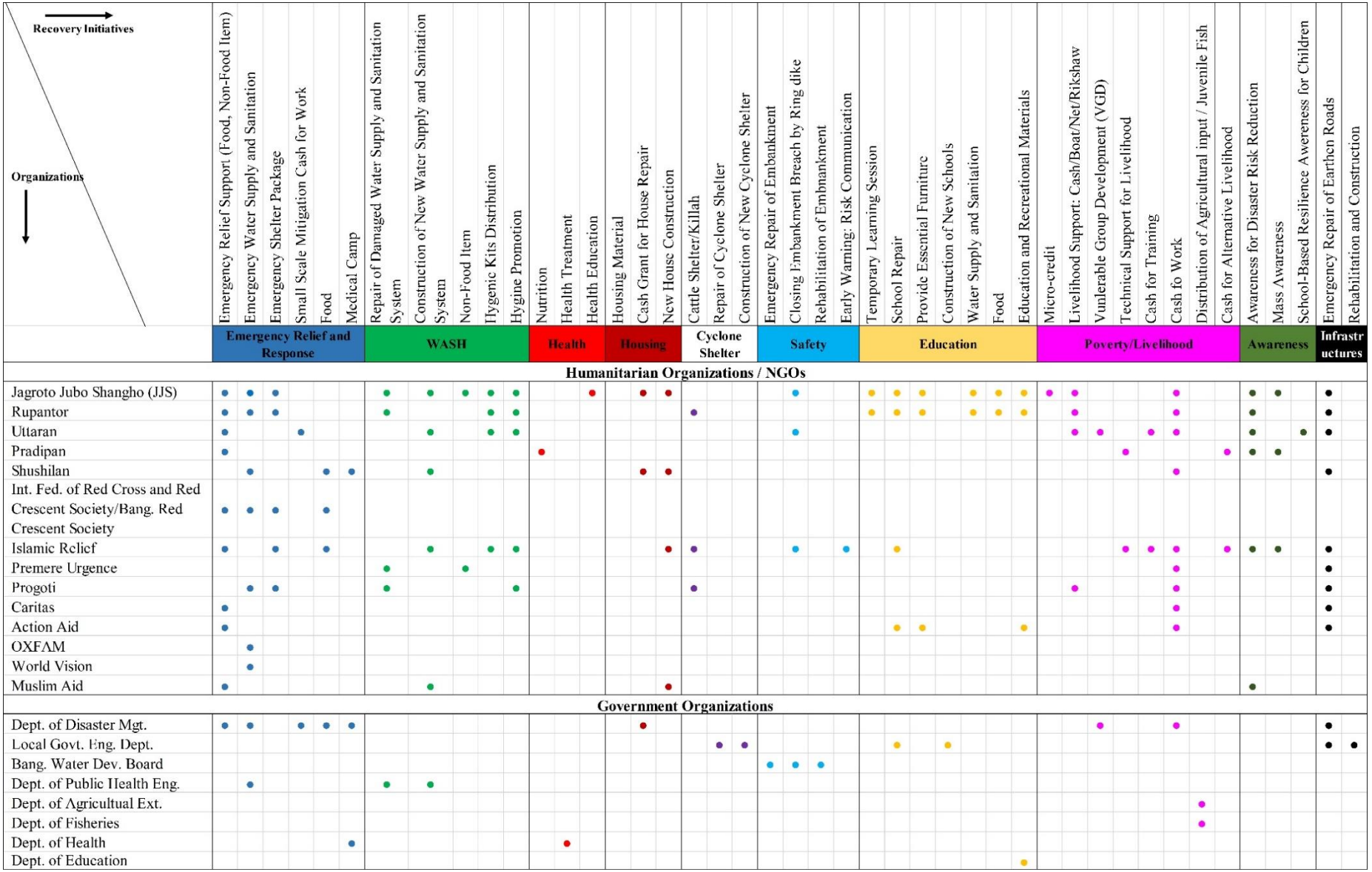


Figure 2.2 Map of the Villages where FGDs were conducted

2.3 Storyline of Aila Recovery

The storyline can be simply described with a matrix (Table 2.1), which presents a list of recovery activities along with implementing agencies. It simply illustrates "who has done what" and "who priorities what." The matrix highlights the involvement of a large number of nongovernmental organizations (NGOs) along with relevant government organizations (GOs) in Koyra's recovery. The table suggests that the coordination structure at a local level was not perfectly functional at the time recovery in Koyra (Sadik, Nakagawa, Rahman, Shaw, Kawaike, Fujita, et al., 2017). The matrix depicts the sectors which were preferred by different NGOs, and which sectors were ignored. A large number of NGOs were involved in emergency relief operations, livelihood support, sanitation, and emergency repair of infrastructure; fewer were involved in the health, cyclone shelter, safety, and rehabilitation sectors. In general, NGOs activities were limited to short-term measures, whereas GOs were involved in both long-term and short-term measures. All the recovery initiatives can be divided into four major work groups: humanitarian aid-driven emergency response, emergency repair of critical infrastructures, humanitarian aid-driven recovery, and government-led emergency recovery and rehabilitation.

Table 2.1 The Matrix of Cyclone Aila Recovery Activities



Source: Institutional Survey in 2016, FGD in 2016 and 2017

2.3.1 Emergency response

Soon after the Cyclone Aila hit, the government and international communities responded immediately to the cyclone damage with provisions of humanitarian assistance (Table 2.1). The government primarily provided cash grants, rice, and food assistance (through programs for vulnerable groups) (Koyra Upazila Council, 2010; Tada, 2011; UNDP, 2010). NGOs, with the help from international communities, provided emergency material relief (food and nonfood items), emergency shelter and housing, emergency water supply and sanitation, cash grants (to compensate for work and training), and emergency health support (Table 2.1; Roy et al. 2009; Tada 2011; UNDP 2010). Humanitarian aid-driven responses were commonly criticized for the lack of coordination among NGOs, overlapping activities, gaps in service areas, insensitivity to local needs, and corruption (Mahmud & Prowse, 2012; Rahaman & Khan, 2017).

2.3.2 Emergency repair of critical infrastructures

In rural areas the emergency critical infrastructures include rural roads, coastal embankments and allied structures. Several initiatives to repair rural infrastructure by engaging local people under “cash for work” or “food for work” schemes were initiated by the GOs and NGOs. But all such programs were short-term measures (Ashraf & Shaha, 2016; F. Mallick & Islam, 2014), and were not always successful due to the delayed repair of damaged coastal polders (polder no 13–14/2 and polder no 14/1). The embankment’s repair was urgently needed by the local people as any delay hindered the implementation of other recovery initiatives (ECHO, 2009). Weather conditions during monsoon season and the shortage of emergency funds exacerbated the delay and increased storm impact on agricultural output (Tada, 2011). Due to constraints in the emergency budget, the completion of urgent repair work was limited in scope. In response to this, different NGOs offered their assistance to repair the embankments, but the BWDB could not allow this due to legal barriers, and concern for the NGOs’ engineering capabilities.

(a) Repair of embankment

(b) House with sanitation facilities provided by UNDP

(c) Waters tanks of a home based Rain Water harvesting System

Photo 2.1 Pictures of Different Initiatives of Aila recovery Implemented in Koyra

2.3.3 Humanitarian aid driven recovery

Similar to earlier disaster recovery cases, international humanitarian organizations including NGOs and development partners played a great role in Aila recovery. At first, immediately after the cyclone hit, the government did not call of humanitarian aid. Around a month later government requested for support in recovery and reconstruction of infrastructure and livelihoods (B. Mallick et al., 2011; UNDP, 2010). In response to the request, UNDP led a joint program of a multilateral fund for Aila recovery under the umbrella of the newly established coordination mechanism named "Early Recovery Facility (ERF)" (UNDP, 2016). Water, sanitation and hygiene (WASH), health, housing, shelter, safety, education, livelihood, awareness, and infrastructure were major sectors of recovery initiatives supported by the "ERF".

Water, Sanitation and Hygiene (WASH)

Sanitation was one of the critical sectors which was affected severely by the Cyclone Aila. It seems from the table 2.1 that this was a most preferred sector for NGOs to involve. As an early recovery measure NGOs repaired the damaged water supply and sanitation system first. Thereafter, the new water supply e.g. the Rainwater Harvesting System (RHS) or hand pump tube wells and sanitary latrine were constructed at households of the neediest families. Besides, community ponds were improved by re-excavating, raising the height of the bund and installing Pond Sand Filters (PSF). Apart from the conventional technologies, few advanced and innovating technologies were also introduced. For inference, in Maheswaripur union of Koyra, a desalinization plant had been installed and handed over to local union council for maintenance. Local people can

buy 5 liters of fresh drinking water with only 6 US cents (0.06 USD). Besides, NGOs launched hygiene promotion related activities. These efforts indeed improved their water supply and sanitation situation. However, adoption of appropriate technology and DRR are still unsolved issues. Hand pump tube-wells are effective only in few villages where the shallow aquifer is salinity free. Since Koyra is located in the coastal area where salinity is very high, the pond sand filter and rainwater harvesting system are very useful in most of the villages. However, maintenance of RHS and PSF is also an issue since it is financially difficult for local people or the community. Saline water shrimp farming is practiced very extensively there which causing rising of salinity in a pond surrounded by saline water shrimp farms. Although the earthen bunds of the ponds have been re-constructed, embankment failure or breach at the time of storm surge will lead inundation of these ponds by saline water again.

Health

Apart from the emergency health services, health sector recovery was a rarely interested sector for NGOs. NGOs' activities were limited to nutrition program, health education and hygienic kits distribution. However, improvement of health facilities like the capacity development of existing hospitals by improving medical facilities, treatment facilities, or construction of new hospitals were not found in NGOs' provided supports. Therefore, health facilities as a whole have not been improved so much than the pre-Aila condition.

Housing

Housing is considered as one of the major sectors where NGOs have provided an extensive support. Firstly, NGOs provided housing materials like corrugated iron sheet, bamboo sheets, etc. to some families. Thereafter, they came up with another package of support called transitional shelter (Photo 2.1 a & b). By definition, a transitional shelter is a house (of 2 years lifespan) newly constructed for a family on his own land where the beneficiary family can reside until a long-term durable solution is provided (Bangladesh Shelter Cluster, 2015). Since there was no recommended design, different NGOs constructed transitional houses differently. Although, by definition transitional cluster indicates the beneficiaries are eligible for long term durable housing solution, they did not get the durable house provided by UNDP later. Around 20% - 30% affected families had received these transitional houses (source: FGD in 2017).

Finally, the "ERF" of UNDP constructed brick house (Photo 2.1 (b)) along with sanitation facilities which they called the 'core family shelter (CFS)' under a component named 'resilient village' for only 265 Aila affected people (De Silva & Shafie, 2014). The "ERF" prioritized affected families who did not receive transitional shelter. Similar to transitional houses, there was no recommended design but a general guideline which allowed different NGOs constructing the core family shelter differently in different upazilas.

Cyclone Shelter

Similar to health sector NGOs did not much involve in the recovery of cyclone shelter. Generally, cyclone shelters were rehabilitated and newly constructed by the government with the help of development partners. However, few NGOs activities were found in maintaining cattle shelters at the period when the area was inundated. Before Aila, there were only 5 cyclone shelters in Koyra upazila whereas at present 12 new shelters have been constructed and six more are under construction. Among them, only five shelters have livestock shelter. However, the numbers of cyclone shelters are still inadequate. One cyclone shelter will be shared by the people from 3 wards (source: FGDs in 2017).

Safety from cyclone and storm surge

In this research, activities related to embankment recovery, early warning mechanism, evacuation, and any other structural and non-structural measures which would contribute increasing safety to cyclone and storm surge has been considered in 'safety' cluster as mentioned in Recovery matrix (Table 2.1).

While the government department, Bangladesh Water Development Board (BWDB) was facing a hard time to initiate emergency recovery of embankments, NGOs helped the community to build a temporary earthen dike (locally called the ring dike) around the embankment opening (due to breaching by Aila). NGOs also constructed earthen roads and raised the bund around the shrimp farming ponds which resulted in compartmentalization of tidal floods and helped local people to resume their livelihood activities. However, these measures are short-term and do not ensure protection from storm surge.

BWDB approached to different development partners for financing in the recovery of embankments. Under the "ERF" umbrella, the Embassy of the Kingdom of Netherlands implemented a recovery initiative in Koyra where they rehabilitated around 2.92 km of

embankment out of 81 km damaged sections (EKN & UNDP, 2015). The rest of the embankments were rehabilitated with financial supports from the World Bank and the Annual Development Program of the Government (JICA & OCCL, 2012). Despite continuous criticism, the early warning system which was designed for protecting two seaports of the country has not been revised yet (Akhand, 2003; JICA & OCCL, 2012). However, NGOs initiated several program targeting dissemination of warning and awareness building. International Federation of Red Cross and Red Crescent Society and Bangladesh Red Crescent Society's initiatives on improving risk, Risk communication, developing community volunteer organizations, capacity development of such organizations really helped to improve the mechanism of effective evacuation and rescue.

Education

The Cyclone Aila caused complete damage to 9 and partial damage to 70 educational institutes in Koyra. The collapsed road communication system eventually suspended operation of schools and other academic institutes for a long time. At that time, NGOs initiated temporary learning sessions at evacuation centers and along the embankments where the displaced population took temporary shelter (for more than a year). NGOs also helped to repair partially damaged institutes and provided educational material. Since most of the houses were either washed away or collapsed (42,440), children's books were also washed away. NGOs provided books and other educational materials. Moreover, NGOs continued school-based nutrition program, sanitation promotion program, and disaster awareness programs.

Livelihood support

Supporting the livelihood of the affected people is another major cluster of recovery activities of NGOs. Almost all the NGOs who were working in Koyra had activities related to livelihoods. Followed by the emergency relief, NGOs ran a program of 'cash for work' which was mostly a scheme for emergency repair of rural infrastructure by employing affected people. Though this program was for a short period (60 days), it helped the affected people by giving an opportunity of income to survive. NGOs and local government (union council) jointly made a list of eligible families depending on their economic condition, needs and damage caused by Aila. One person from each listed family could get the opportunity to work in 'cash for work' scheme.

Since this scheme was for a short period, at the time of monsoon when reconstruction work was not possible people were living at the risk of poverty. Thereafter, during the period of no 'cash for work', NGOs ran another scheme of 'cash for training'. Under this scheme, NGOs provided training on disaster awareness, livelihood, and sanitation and paid some honorarium to the participants.

Apart from these short-term supports, NGOs also provided cash grant for alternative livelihoods, net, and boats for fishers, rickshaw puller, etc. to affected families to resume their livelihood activities. NGOs also provided seeds, juvenile fish, and other agricultural inputs to promote agricultural and shrimp farming activities.

During the FGD, local people were expressing high gratitude towards NGOs. NGOs helped them to survive during their hard time when embankments were open and the entire area was inundated by the tidal flood. Afterward, when the embankment was repaired and rehabilitated, NGOs helped them to resume their income earning activities. Although, local people have resumed their income earning activities, their fear of uncertainty of income has not over. Since their economic activities very much depend on agriculture, their income vulnerability to storm surge due to the prevailing poor condition of the embankment is high.

Disaster awareness for preparedness

NGOs launched several training programs on improving disaster preparedness, DRR, and climate change adaptation. These training programs were designed to motivate the community to evacuate with preparedness at the time of cyclone warning. During FGD, local people were mentioning these training programs as helpful to become prepared and not be panicked at the time of any disaster event.

Rural infrastructures

NGOs involved only in emergency repair and recovery of rural earthen roads. Under the 'cash for work' scheme NGOs employed Aila affected people in repairing of rural roads. NGOs also helped the local community in converting earthen bunds of the shrimp aquaculture pond to walkways. These supports helped the community in resuming their road communication. However, these were only short-term measures. These reconstructions did not consider any additional DRR measures or any improvement of design. Neither, any new road has been constructed which would increase road network than the pre-Aila period.

2.3.4 Government-led emergency recovery and rehabilitation

Cyclone Aila hit the southwestern region at a time when the government was trying to recover the community from the damage caused by a previous cyclone (Sidr) that struck in 2007. To initiate the Cyclone Aila recovery, the government first attempted to include Aila recovery initiatives in the aids which were provisioned to support Cyclone Sidr recovery projects. Later the government adopted specific plans for Aila recovery followed two approaches: (1) segmenting and prioritizing the reconstruction activities under the Annual Development Plan (ADP) of the government; and (2) formulating special projects (with foreign aid) for large-scale projects. For example, rural roads were reconstructed initially by modifying the Emergency 2007 Cyclone (Sidr) Recovery and Restoration Project (ECRRP) initiated by the World Bank. Later the ADP and Rehabilitation of Aila- Affected Rural Infrastructure Project (RAARIP) were formulated to complete the unfinished rehabilitation tasks (Sadik, Nakagawa, Shaw, et al., 2017). A few coastal polders and allied structures were restored to pre-disaster design condition by modifying the World Bank-funded Water Management Improvement Project. The remaining polders were restored by the ADP and a project funded by EKN. Unfortunately, none of these projects considered the improvement and incorporation of new DRR measures. For the improvement of coastal polders, the BWDB initiated the Coastal Embankment Improvement Project (CEIP) in 2013, which includes one of Koyra's polders (polder no 14-1). However, the physical work in Koyra has yet to start as the detail design is still in progress according to interviews with project officials in 2016 and 2017. Apparently, the overall recovery is very encouraging due to the joint approach of government and development partners, and a wide range of rehabilitation and development activity is soon to begin. But interviews indicate little evidence that recovery activities undertaken so far have reduced the preexisting vulnerabilities of the community.

2.4 Coordination and Delivery Mechanism of Humanitarian Aids

2.4.1 National level coordination

Following the Paris Declaration (2005), Bangladesh established the Local Consultative Group (LCG), which is the key coordination structure at the national level (Walton-Ellery, 2009). The LCG consists of 18 thematic working groups. Each working group is jointly chaired by the relevant ministry and a development partner (DP). Among the 18 working groups, Disaster Emergency and Response (DER) coordinates among all DP, HOs and

NGOs that are working in the disaster sector. The DER ensures national level coordination by arranging meetings, issuing common guidelines and making platform for dialogues among the development partners from different clusters. This LCG structure in practice only enables a platform for communication and consultation, which may result in good cooperation, but does not ensure coordination, in-depth dialogue, and alignment to national priorities and policies (Rahaman & Khan, 2010).

2.4.2 Delivery of humanitarian assistance

Under the DER structure, the Humanitarian Coordination Task Team (HCTT) is responsible for coordinating humanitarian work, early recovery and resilience. In addition, the HCTT coordinates with other clusters i.e. Food security, nutrition, health, water supply and sanitation, education, early recovery, logistics, shelter and child protection, which are represented by different UN bodies.

In this aid-driven response and recovery effort, NGOs work as the delivery agent for DPs as illustrated in Figure 2.3 (a). At the time of a disaster, different DPs from different clusters contract their partner NGOs to deliver their support to the local community. For quick implementation, a DP splits their humanitarian assistance into several components or work packages and contracts several NGOs to implement those components. The same NGO can be contracted by several DPs. A DP works in multiple clusters and in each cluster multiple DPs work together. Rather than integrating all humanitarian assistance projects into one large program, different DPs implement their projects independently by contracting a number of NGOs. As a result, the number of NGOs and the number of projects at the local level (which is Upazila in this case) dramatically increases. In the case of the response and recovery efforts after Aila in Koyra, we identified 14 NGOs contracted by 10 DPs from 8 clusters. Maintaining coordination among these large numbers of NGOs and monitoring their work became an unmanageable task for the local government of Koyra during the response and recovery period.

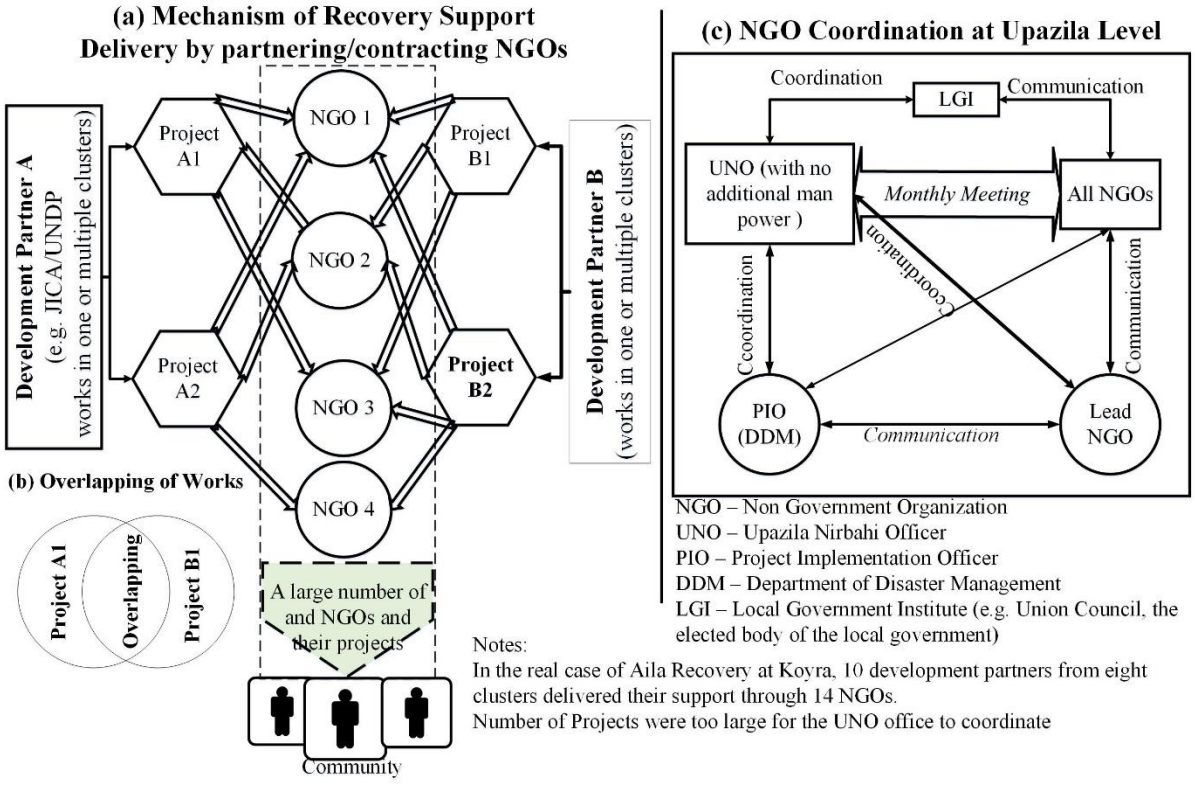


Figure 2.3 Coordination Mechanism of Humanitarian Aid driven Recovery Activities at Upazila level

2.4.3 Local level coordination

As illustrated in Figure 2.3 (c), coordination among NGOs at the Upazila level is maintained by the UNO (Upazila Nirbahi Officer, the chief executive officer of the Upazila Government). The UNO maintained coordination by arranging a monthly coordination meeting. The UNO periodically assigns an NGO to coordinate with others and to prepare a combined report of activities to present in the meeting. All the NGOs are required to receive a certificate from the UNO to clear budgets from their donors (i.e. development partners). Since it is not possible for the UNO to monitor directly the activities of NGOs without any additional capacity, he can only judge an NGO by its regular presence in the coordination meeting and issues the 'Certificate of Project Completion.' The responsibility for overall monitoring of NOGs activities is given to the Project Implementation Officer (PIO) of the Department of Disaster Management at the Upazila level (Figure 2.3, c). However, without any additional resources and manpower, the PIO can only maintain close communications with NGOs. Thus, this mechanism does not ensure coordination.

To understand the outcome of the coordination during Aila recovery, representatives of the major six NGOs involved in Koyra recovery efforts and two NGO coordinators were interviewed during field visit. It is understood from the interview that this mechanism only ensured sharing of general information among the NGOs. Most of these NGOs are competitors. They compete with each other to gain contracts for new projects from funding agencies. As a result, they tend to withhold information on notable features, strengths and innovative thinking of ongoing projects to secure their competitiveness for the future. Thus, the original objective of the coordination meeting cannot be achieved.

A similar situation occurred in the case of Aila recovery in Koyra, which eventually ended up in un-coordinated recovery efforts, corruption, and some areas being overlooked during recovery planning and implementation (Mahmud & Prowse, 2012). During the FGDs, local people repeatedly mentioned issues of corruption and misuse of power. To avoid corruption and misuse of power, the NGOs adopted a participatory approach of selecting beneficiaries where they conducted a series of meetings with local people in the presence of representatives from local government institutes. The list of beneficiaries was prepared very publicly and transparently (as reflected in the discussion in FGDs). However, local people claimed that the prioritization and selection of villages for implementing humanitarian support e.g. housing was influenced by powerful elites. In practice, the coordination structure did not ensure proper monitoring of these issues.

2.5 Concluding Remarks

From the discussions on overall storyline of Cyclone Aila recovery it can be summarized that except livelihood support and disaster preparedness, NGOs activities were mostly limited to providing short-term measures. Although these short-term measures helped the community towards a recovery, the principle of recovery as per the Sendai Framework could not be achieved. Since long term DRR measures were not adopted, the underlying vulnerabilities to cyclone and storm surge remain similar to the pre-Aila situation. Local people expressed the fear of similar severe damage from a future similar cyclone and storm surge during FGDs which support these evidence of underlying vulnerabilities. This findings motivated this research to identify the preexisting vulnerabilities and to investigate the recovery activities from the context of the reduction of pre Aila vulnerabilities.

The analysis of coordination structure strongly suggests that lack of local-level coordination contributed in failure of not recognizing long-term needs. The competition among local NGOs undermined the effectiveness of the coordination structures. This research thereby recommends to review the coordination structure, strengthen the UNO office with resources for effective coordination. The findings also recommend that international NGOs and DPs should work out on how to reduce the competition among local NGOs. Since NGOs are delivering humanitarian aids, competition among them is not desirable.

Analysis and findings of this part of the research has been reported in an international conference in Bangladesh (Sadik, Nakagawa, Rahman, Shaw, Kawaike, & Fujita, 2017), in the research monologue of DPRI annual (Sadik, Nakagawa, Shaw, et al., 2017) and finally in an academic journal (Sadik, Nakagawa, Rahman, Shaw, Kawaike, Fujita, et al., 2017).

Chapter 3 Study on Inclusiveness of Aila Recovery with Respect to Pre-Aila Vulnerabilities

3.1 Introduction

This part of the research investigates the pre-Aila vulnerability (PAV) and finds the answer whether the Aila recovery is inclusive of pre-Aila vulnerability reduction (PAVR). The preliminary research as described in Chapter 2 motivated to investigate the Aila recovery from the context of vulnerability reduction. With the recent change in disaster management policies and the overall economy this research becomes contemporarily important.

Recently Bangladesh has fulfilled the eligibility criteria to graduate from the list of "least developed country" (UN, 2018). The country has been praised internationally for achieving a remarkable progress in saving human lives during disaster (Haque et al., 2012). It adopted policies for mainstreaming DRR as well as vulnerability reduction into development process (DMB-MFDM, 2010; MoDMR, 2017). Along with saving human lives, there is also a growing importance of saving economic resources and livelihoods as development continues (MoDMR, 2017). However, despite these policy changes, DRR at place is still yet to be effectively adopted. Even after repeated cyclone hit and thereafter recovery since 1970, sources of vulnerabilities e.g. poverty, settlements in low-lying coastal area, inadequate numbers of cyclone shelters, overdependence on traditional livelihoods, growth of isolated settlements, are still at place (Alam & Collins, 2010; B. Mallick et al., 2017; Sadik, Nakagawa, Rahman, Shaw, Kawaike, & Fujita, 2018). The recent recovery efforts after Cyclone Aila has been claimed to be planned adopting Sendai framework (F. Mallick & Islam, 2014; UNDP, 2010) and BBB principles. However, unfortunately, the analysis of storyline of the Aila recovery under this research suggests lack of consideration of long-term measures for DRR (Sadik, Nakagawa, Rahman, Shaw, Kawaike, Parvin, et al., 2018; Sadik, Nakagawa, Shaw, et al., 2017). Therefore, to give a feedback to the policy making process and to ensure safety of the community from the future disaster it is obvious to investigate the ongoing recovery from the context of DRR. Since reducing pre-disaster vulnerability is a pre-requisite of DRR, this research aims at investigating pre-Aila vulnerability and to investigate recovery mechanism from the context of pre-Aila vulnerability reduction. With this aim, the

research adopted diagnostic analysis of recovery which included identification of PAVs, indicators of PAVR, and examining whether the recovery plans inclusive of measures for PAVR. Finally it quantifies the inclusiveness of Aila recovery to PAVR.

3.2 Methodology

This research attempted diagnosis of the Aila recovery in Koyra from the perspective of DRR. Diagnostic analysis is related to analyzing the performance (of a system) which includes an organized way of identifying problems and the causes behind those (Edquist, 2011). Accordingly, this research examined the Aila recovery to identify PAV with root causes and to determine whether these root causes were considered to resolve while recovering the community. To this end, the methodology consisted of two broad steps - i) analysis of PAV and identification of indicators of PAVR to examine recovery, ii) measuring the degree of inclusion of each indicator within recovery.

3.2.1 Vulnerability analysis and identifying indicators of recovery inclusive of Pre-Aila vulnerability reduction measures

"Pressure and Release (PAR)" model of vulnerability (Wisner, Blaikie, Cannon, & Davis, 2004) was mostly followed for analysis of vulnerability. The practice was mostly theoretical and evidence-based which was based on literature review. The theoretical assumptions of the frequently-cited PAR model defined vulnerability as a product of unsafe conditions that originate from a problem's root causes. In addition, the Access model of vulnerability (Wisner et al., 2004) implied that if the root causes and resultant pressures would not be resolved through recovery, the unsafe condition would continue. A case study on Cyclone Orissa (Chhotray & Few, 2012) supports the PAR theory. The case study evidences that people are living in a repeated vulnerability because of not resolving root causes of vulnerability by post cyclone recovery.

Similar scenario was also observed in Koyra during the reconnaissance field visit. Ongoing human suffering due to repeated embankment failure, erosion, and inundation are still major problems (Hossen, 2016; New Age, 2016; Sadik, Nakagawa, Rahman, Shaw, Kawaike, Parvin, et al., 2018). This observation motivated this research to examine the Aila recovery from a context of vulnerability reduction as described by the PAR model. The model proposed the approach of vulnerability analysis by identifying root causes and outcomes of vulnerability. This research accordingly attempted identifying root causes of pre-existing vulnerability and their outcomes. Additionally,

this research attempted identifying possible measures for reducing these root causes. Later, while investigating Aila recovery, adoption of these measures were treated as indicators of consideration of PAVR in recovery.

The root causes of pre-Aila vulnerabilities were identified by a review of relevant existing studies, and were validated by the FGDs. A modified PAR model for a Bangladesh cyclone case (Awal, 2015), the Disaster Crunch Model developed through a systematic analysis of post-Aila conditions (C. K. Saha, 2015) and damage assessment report of Cyclone Aila (ECHO, 2009; Roy et al., 2009) were very helpful in understanding PAVs. Several case studies (Abdullah, Zander, Myers, Stacey, & Garnett, 2016; R. Islam & Walkerden, 2015; B. Mallick et al., 2017, 2011; B. Mallick & Vogt, 2014; Sadik, Shaw, Rahman, Nakagawa, & Kawaike, 2018) helped to identify the root causes of vulnerabilities, dynamic pressures, and possible reduction measures. FGDs with local people helped validate the root causes, clarified the overall PAV context, and finalized indicators of PAVR measures. A total of 14 FGDs were conducted in Uttarbedkashi and Dakshin Bedkashi union of Koyra (Figure 2.2) in 2016 and 2017. Since this part was conducted along with understanding the overall recovery mechanism presented in the previous chapter, for the details of the field survey and FGD administration section 2.2 of the previous chapter can be referred.

The process of understanding PAV ultimately helped with the selection of a set of indicators for the diagnostic analysis of the recovery with respect to PAVR. These indicators were applied to quantify the inclusiveness of recovery with respect to PAVR.

3.2.2 Measuring the degree of inclusion of PAVR in Aila Recovery

A screening method of assessing recovery (Contreras, 2016) was modified by including the degree of inclusion of pre-existing vulnerability reduction in the assessment process. In addition to the simple screening technique based on literature review and observation, expert judgment (Sadik, Nakagawa, Rahman, Shaw, Kawaike, Fujita, et al., 2017) and a scoring technique (Animesh K. Gain, Mojtahed, Biscaro, Balbi, & Giupponi, 2015; Giupponi, Mojtahed, Gain, Biscaro, & Balbi, 2015) were included. Details of the preliminary screening, expert judgment-based scoring and computation are displayed in Figure 3.1 and Table 3.1. As illustrated in Figure 3.1, the overall assessment included three processes: (1) a primary screening of recovery initiatives; (2) an expert evaluation; and (3) measuring the degree of inclusion of PAVR measures in recovery.

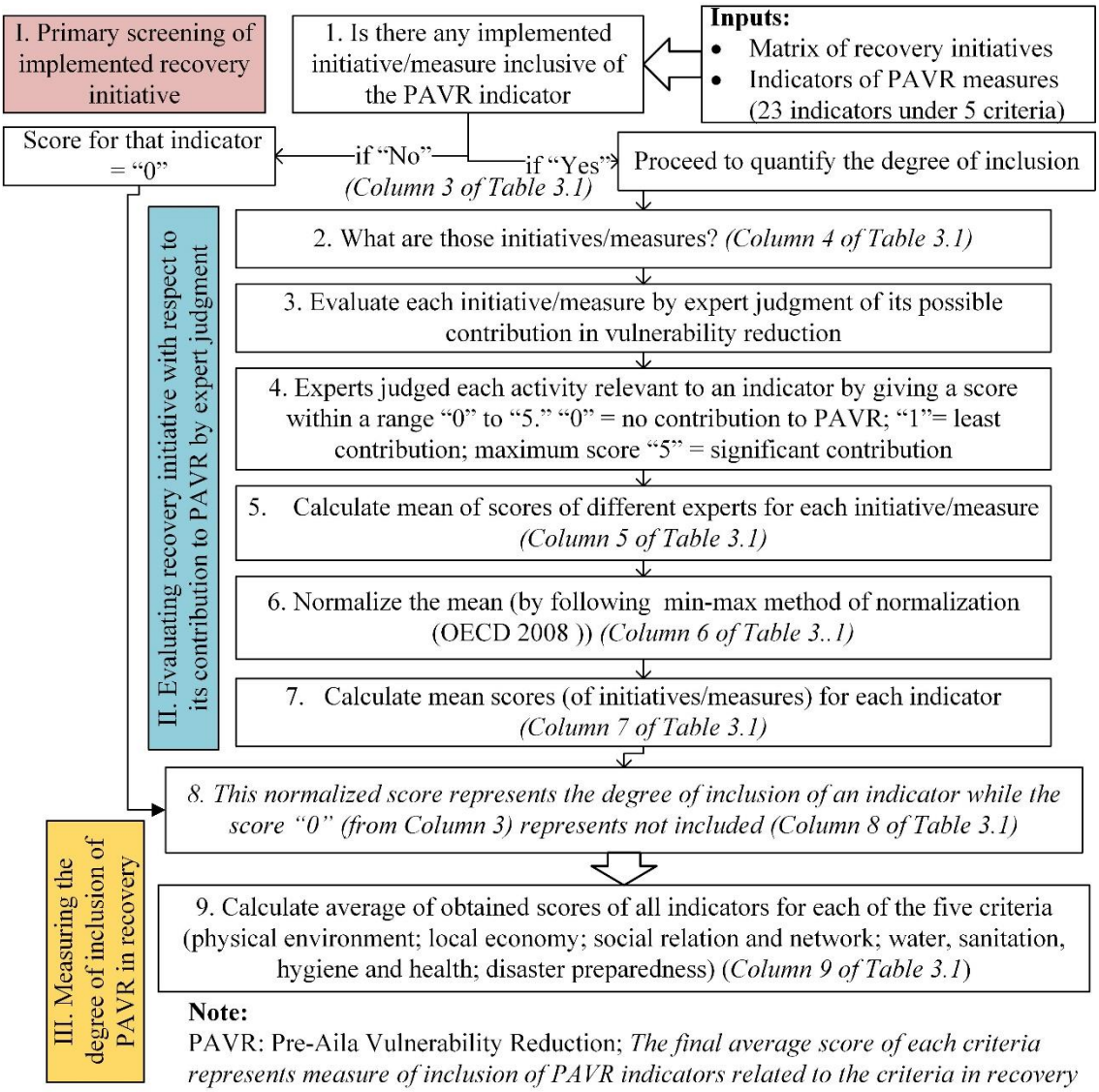


Figure 3.1 The Diagnostic Analysis of Aila Recovery to Examine Inclusion of PAVR

Primary screening of implemented recovery initiatives

The primary screening was the first step towards assessing the inclusion of the PAVR in recovery. The screening was a practice of cross-checking all implemented recovery initiatives with respect to the question whether the relevant PAVR measure (as identified in PAV analysis) was considered in recovery. It involved cross-checking and reviewing the relevant reports of Aila reviewing the relevant reports of Aila response projects (ECHO, 2009; IFRC, 2010; Roy et al., 2009; Walton-Ellery, 2009), project documents of different donors (EKN & UNDP, 2015; IOM, 2010), relevant reviews (Abdullah, Stacey, Garnett, & Myers, 2016; Abdullah, Zander, et al., 2016; JICA & OCCL, 2012; Tada, 2011), project documents of UNDP early recovery facilities (UNDP, 2011; UNDP, EKN, AusAid, & SDC, 2013), unpublished documents collected from local NGOs and

field observation. The findings were validated by interviewing key informants of different institutes during institutional survey. As illustrated in Figure 3.1, if an indicator from the indicator set of PAVR measures was found "not-included" in recovery, the corresponding score was considered as "0". If it was found included, then the steps of evaluating the initiatives with respect to its contribution to PAVR by expert judgment were followed to determine the "degree of inclusion" of the PAVR measure in recovery.

Evaluating recovery initiative with respect to its contribution to PAVR by expert judgment

In the second step, the evaluation of identified recovery initiatives with respect its "contribution to PAVR" was done by expert judgment. To measure the "degree of contribution to PAVR" experts were selected from NGOs that were directly involved in the Cyclone Aila recovery through a process of institutional survey. A total of 13 NGOs were identified by the institutional sur vey in 2016, among them six (6) were major NGOs that had implemented large-scale projects in Koyra. Among these six major NGOs, experts who had direct experience of involving in Aila recovery in Koyra were selected from four NGOs.

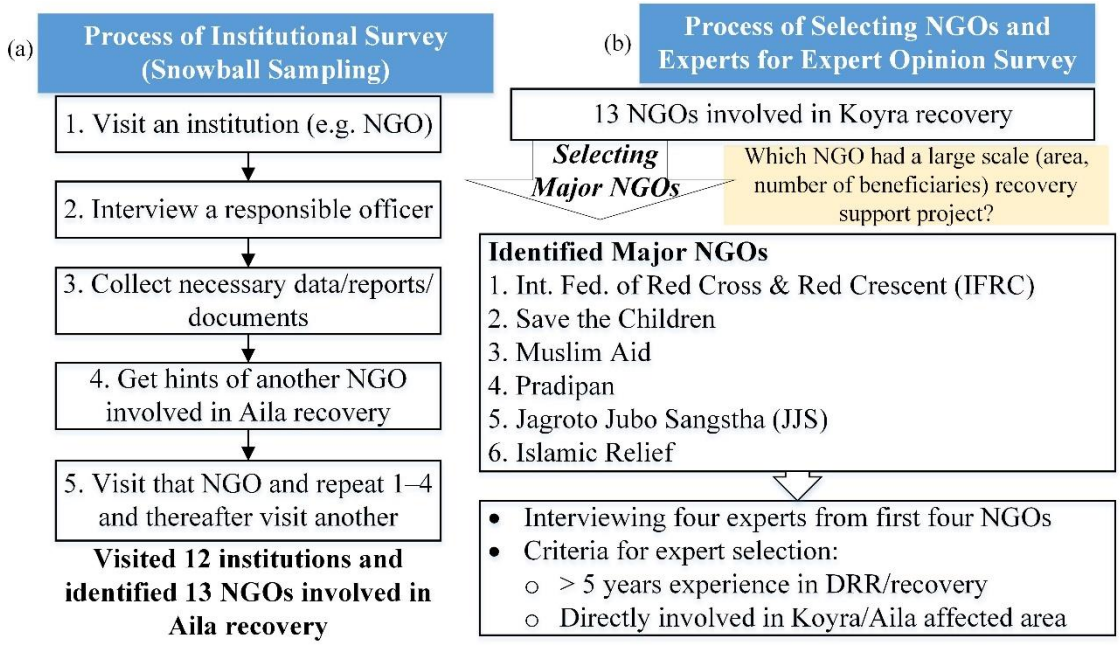


Figure 3.2 Process of Institutional Survey and Selection of Experts

Additionally, an international expert who also directly involved in research on Aila recovery in Koyra was interviewed. These interviews were conducted in 2017. Experts were asked to quantify the "degree of contribution to PAVR" of each recovery measure

by their judgment following a scoring technique (Animesh K. Gain et al., 2015; Giupponi, Giove, & Giannini, 2013; Giupponi et al., 2015) and using a quantitative scale ranging from "0 (no contribution)" to "5 (significant contribution)." The questionnaire of expert interview is provided in Appendix I. The details of the methodology and results of this evaluation by expert judgment has been published in an academic journal of Japan Society for Natural Disaster Science (Sadik, Nakagawa, Rahman, Shaw, Kawaike, Fujita, et al., 2017).

Measuring the degree of inclusion of PAVR in recovery

Experts provided scores which are numbers within the range of 0 (no contribution) to 5 (significant contribution). These scores were then normalized using the min– max method (OECD, 2008). Finally, the score representing the degree of inclusion was calculated for each indicator within the range of "0 (not included)" to "1 (completely included)". This number represents measurements of inclusion of an indicator within the recovery process. The calculation process is described by the Table 3.1. Details of each calculation step can also be found in the notes after the table. Since all the indicators were grouped into five criteria, an average was also calculated for each criterion, representing the degree of inclusion of the PAVR criterion in recovery.

Table 3.1 An Example of Scoring and Calculating Inclusiveness of Aila Recovery to PAVR Indicators

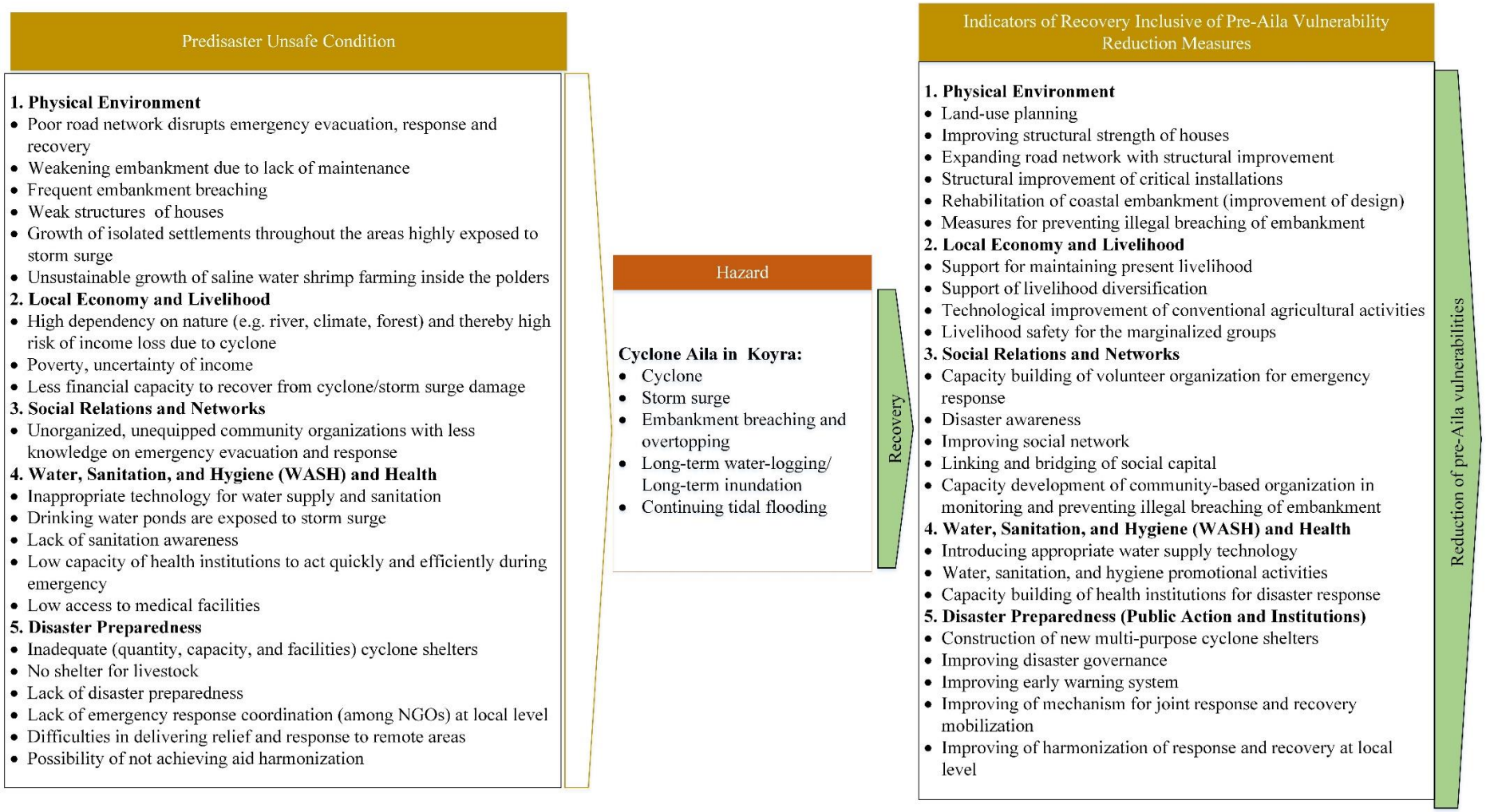
1. Criterion	2. PAVR Indicators	I	II				III	
		3. Primary Screening [a]	4. Implemented Actions/Measures Related to the	5. Experts' Judgment on Impact on PAVR (0–5 scale) [c]	6. Normalization of Expert Judgment [d]	7. Average of Scores of Relevant Measures [e]	8. Degree of Inclusion of the Indicator [f]	9. Degree of Inclusion of the PAVR Criteria in Recovery [g]
Criteria	A	FE [a]	A1	Note "c"	Note "d"	Note "e"	Note "f"	Note "g"
			A2	Note "c"	Note "d"			
	B	FE [a]	B1	Note "c"	Note "d"	Note "e"	Note "f"	
	C	0	N/A				0	

Notes: [a] If the indicator is not included/covered by any recovery initiative, then the score = 0, meaning non-inclusion of the indicator. If it is included, then the score was decided by further expert evaluation and judgment and marked as "Further Evaluation (FE)"; [b] The list of initiatives inclusive of the indicator; [c] Mean of scores given by five

experts, who were asked to evaluate the potential impact of the action/initiative on PAVR. Experts evaluated the action/initiative by giving a score between "0" and "5." "0" = no contribution to PAVR, 1 = the least contribution, and 5 = significant contribution; [d] Normalization of the score using min-max method (OECD 2008); [e] Arithmetic average of calculated scores in column 6 for each indicator; [f] Column 3 multiplied by column 7; [g] Mean of scores in column 8 under each criterion.

3.3 Pre-Aila Vulnerabilities and Indicators of Recovery Inclusive of PAVR

The PAVs have been classified into five major categories of unsafe condition as defined by (Wisner et al., 2004): (1) physical environment; (2) local economy and livelihood; (3) social relations and networks; (4) water, sanitation, and hygiene (WASH) and health; and (5) public actions and institutions for disaster preparedness (Figure 3.3). The success of recovery in DRR would largely depend on inclusion of appropriate measures to resolve unsafe conditions under these categories. Therefore, to examine Aila recovery from the context of pre-existing vulnerability reduction, 23 indicators were selected, which corresponded to necessary PAVR measures. The summary of the PAV assessment and the 23 selected indicators for recovery inclusive of PAVR are provided in Figure 3.3 and briefly discussed thereafter.



(a pre version of this figure has been published in Sadik, Nakagawa, Rahman, Shaw, Kawaike, and Fujita (2018) as an output of this Ph.D. research)

Figure 3.3 Pre-Aila Vulnerabilities and Reduction Measures which are Supposed be Included in Aila Recovery

3.3.1 PAV of physical environment and relevant PAVR measures

The weakening structural condition of coastal embankment due to lack of maintenance, erosion and illegal practices of breaching made the embankment highly vulnerable to storm surge during Aila (JICA & OCCL, 2012; Roy et al., 2009; Tada, 2011). As a result the earthen embankments in Koyra were breached at 34 locations by the storm surge during Aila (Roy et al., 2009). The practice of illegal breaching has a relation with land use. In the 1960s, coastal polders were constructed to prevent rice field from tidal flood and salinity intrusion. Attractive market of shrimp, rising salinity, and adverse impact of polders (for example, water logging) influenced large farmers to shift from rice to shrimp farming. Thereafter the need to embankment to prevent land from salinity rich tide became unnecessary. Shrimp farmers started either installing pipes or cutting the embankment to irrigate their shrimp aquaculture ponds by salinity rich river water. Thus the root causes of the vulnerability of coastal polder is linked with land use (including land regulation limiting shrimp aquaculture), improvement of structural and operational design, and community agreement to shift from saltwater shrimp farming to rice cultivation. A comprehensive land use plan for zoning of shrimp farming and settlements, and an improved maintenance plan and budget coastal polders are the key to DRR according to remarks obtained during FGDs and interviews with BWDB personnel.

In Koyra, another critical unsafe condition is road communication. Along with the road condition, road network was also very poor, maintenance was inadequate, and investment in transportation infrastructure was also low which resulted an unsafe condition which ultimately affected evacuation behavior during Cyclone Aila (B. Mallick et al., 2011). During the cyclone, the storm surge could easily erode the road and suspended rural communication for a longtime.

The housing related unsafe condition is rooted in poor structures of houses and growth of isolated houses in highly vulnerable areas (Alam & Collins, 2010; Sadik, Nakagawa, Rahman, Shaw, Kawaike, Parvin, et al., 2018). The cyclone washed away 23,820 houses and partially damaged 18,620 houses in Koyra (Koyra Upazila Council, 2010), which finally displaced around 42,000 people (M. R. Islam & Hasan, 2016).

Similar to other coastal areas, traditionally settlements grew scatteredly in Koyra without an integrated embankment system to protect them from the tidal flood. Due to poor road network, and the growth of such isolated settlements, evacuation routes were deficient.

The capacity of the cyclone shelters were also very inadequate. As a result, such high population were highly exposed to cyclone and storm surge (F. Mallick & Islam, 2014; Sadik, Nakagawa, Rahman, Shaw, Kawaike, Parvin, et al., 2018; World Bank, 2014). Therefore, reduction of housing related vulnerability is strongly linked with a land-use management practice that is inclusive of new settlement conception and construction, practices spatial planning, and prioritizes comprehensive land management (Mallick and Islam 2014).

3.3.2 PAV of Local economy and livelihood, and relevant PAVR measures

Similar to other coastal areas, major livelihoods in Koyra are shrimp farming, rice cultivation, fishing, agricultural labors and shrimp trading which were highly dependent on nature (Sadik, Shaw, et al. 2018; Sadik and Rahman 2009). This high dependency of livelihood system as well as local economy on nature was a critical PAV (Sadik, Shaw, et al., 2018) which is believed to be the principal reason of sudden drop in the local economic output due to the suspension of all agricultural-related activities in the post-Aila period (Abdullah, Stacey, et al., 2016). A survey found that economic loss, income loss and general suffering were highest for nature depended livelihood systems e.g. shrimp farmers, shrimp related business, and agricultural farmers (Abdullah, Stacey, et al., 2016). Therefore, reduction of this livelihood and economy related vulnerabilities are linked with livelihood support (for example, relief, cash for work, and cash for training), livelihood diversifications, technological improvement of agricultural practices, etc. (Sadik, Shaw, et al., 2018). More dependable and resilient vulnerability reduction must involve long-term measures that achieve diversification of the economy, improvement of structural safety, and technological improvement of agricultural activities, for example, by the introduction of saline-tolerant rice (Abdullah, Zander, et al., 2016; ECHO, 2009; Sadik, Shaw, et al., 2018).

3.3.3 PAV of social relations and networks, and relevant PAVR measures

Community-based organizations in coastal areas of Bangladesh including Koyra had limited capability to carry out emergency evacuation and response due to capital constraints (financial and technical) and poor social networking (R. Islam & Walkerden, 2015; C. K. Saha, 2015). Participation of community in water management is considered as an important measure to reduce vulnerability especially in coastal areas (Sadik & Rahman, 2009). Unfortunately, in coastal areas of Bangladesh community participation in water management is also very vague and suffered from inefficiency, inequality, and

unsustainability (Dewan, Buisson, & Mukherji, 2014; A. Gain, Mondal, & Rahman, 2017). Lacking meaningful local authority and control, most communities could not prevent illegal embankment breaching. Therefore, capacity building of social organizations and linking, bridging, and networking social capital (R. Islam & Walkerden, 2015; Nakagawa & Shaw, 2004) are keys to promoting and achieving PAVR. Such capacity development would also ensure community participation in water management which is another key measure to realize PAVR. Institutionalizing participatory coastal polder management along with a permanent fund for the community-based organizations and a permanent fund for local government for polder maintenance are also necessary to ensure meaningful involvement of local governments and community in polder management (Dewan et al. 2014).

3.3.4 PAV of WASH and health, and relevant PAVR measures

Pre-existing WASH and health related vulnerabilities in Koyra were rooted in lack of appropriate fresh water supply technology, high dependency on pond-water, and lack of sanitation awareness which resulted in long-term post-Aila suffering (Mallick et al. 2011; Tada 2011). Due to high salinity in surface water and ground water, ponds, pond-sand filter, and rain water harvesting systems were popular water supply sources. Due to lack of protection measures ponds, pond sand filter were highly exposed to storm surge. Moreover, maintenance of these sources were also very poor due to limited financial and technological capacity of the community.

Due to poor road network, access to health facilities were limited along with the capacity of health institutions, which disrupted emergency health response and caused inadequate health support post-Aila (Mallick et al. 2011; Tada 2011). Therefore, three viable measures are needed to achieve PAVR: (1) promote water, sanitation, and hygiene (WASH) and health; (2) build the capacity of health institutions to improve the medical response to disaster; and (3) introduce appropriate technology for an upgraded, protected post-cyclone water supply.

3.3.5 PAV of disaster preparedness and relevant PAVR measures

From the perspective of disaster preparedness, inadequate capacity of cyclone shelters, conventional cyclone warning system designed to warn seaports, uncoordinated relief efforts, and a lack of proactive disaster preparedness were major pre-Aila unsafe conditions (Mallick et al. 2011; Tada 2011) related to the disaster preparedness. Studies

found that the people in the Aila affected areas did not follow evacuation orders because of a lack of trust in the warning system, ignorance, and the challenge of low capacity cyclone shelters with no space for livestock (Saha and James 2016).

Un-coordinated humanitarian aid and lack of NGO coordination mechanisms at the local level were additional root causes that hindered disaster emergency response from being efficient (Sadik, Nakagawa, Rahman, Shaw, Kawaike, Fujita, et al., 2017). A large number of NGOs started providing recovery support to the local people under the coordination of UNO office. The approach of NGO coordination was only arranging monthly coordination meetings at UNO office, which did not ensure effective coordination (Sadik, Nakagawa, Rahman et al. 2017). With no additional resources for monitoring and coordinating humanitarian organizations involved in relief and recovery, it became a very difficult challenge for the UNO office to ensure alignment of humanitarian support to local needs and national disaster management plans.

3.4 Inclusiveness of Aila Recovery with Respect to Pre-Aila Vulnerabilities

The 23 PAVR indicators as presented in Figure 3.3 are recovery measures that should be included in Aila recovery to ensure elimination of root causes PAV. The diagnostic analysis was applied to examine the inclusion of PAVR in Aila recovery in a quantitative approach. The results are presented in Table 3.2 to 3.5 with explanations in the following sub-sections.

3.4.1 Inclusion of physical environment related PAVR measures in recovery

The diagnostic analysis founds out of six physical environment related PAVR indicators, four are completely missing and only two are partially included in Ail recovery (Table 3.2). The result founds that hazard-based land use plan, increased road network, improvement of coastal embankments, and viable measures for preventing embankment breaching were completely missing in Aila recovery in Koyra (Table 3.2). Eventually, the degree of inclusion of the criteria, physical environment-related PAVR in the recovery becomes very low.

Improving structural strength of houses is one of the partially included indicator. In Aila recovery, housing was a focus sector and the NGOs provided improved houses with a raised plinth level and measures for withstanding windstorms to many impacted families. However, these improved homes were provided to only 20–30% of the affected families and were planned without consulting local hazard maps or land-use plans (Sadik,

Nakagawa, Rahman, Shaw, Kawaike, Parvin, et al., 2018). These reasons led the experts (during the interview) to give only a moderate score to the contribution of housing to PAVR which made the degree of inclusion moderate as well.

The study finds no increase of network after Aila recovery. Although both GOs and NGOs reconstructed damaged roads (LGED, 2016; UNDP, 2011), no new road has yet been constructed to expand the road network (according to information provided by the LGED office Koyra), which was a major unsafe condition leading to vulnerability before Cyclone Aila (Mallick et al. 2011). In all cases, a conventional design with no hazard mitigation improvement was followed. Field observation and FGDs indicate that the lack of DRR measures is evidenced by frequent road damage by heavy rain and tidal flooding.

Structural improvement of critical structures is another partially included indicator. Several of the damaged administration buildings of the upazila were reconstituted specifically to take into account the need for additional DRR measures and improvements. For example, buildings were elevated on multistoried stilt-structures, constructed with reinforced cement concrete (RCC) foundations, and built on elevated sites, among other improvements. New cyclone shelters were also constructed in compliance with improved designs and new guidelines were recommended for the coastal area (LGED, 2016; UNDP et al., 2013). But only a small number of the shelters were constructed with associated livestock shelters, which discouraged experts from giving the maximum score possible during their evaluation.

Coastal embankments were restored without improvement of their original design, and with neither maintenance mechanisms nor additional DRR. The only project that considered the improvement of the embankment is still in a study phase. Since no viable measures for preventing the illegal breaching of an embankment could be found in recovery initiatives, the relevant indicator was considered as missing.

3.4.2 Inclusion of local economy and livelihood related PAVR measures in recovery

Out of four indicators, one is completely missing and three are partially included in recovery plan. Support for maintaining present livelihood by providing cash grants, short-time income opportunity (under cast for works programs); support from livelihood diversification by providing training and grants; and safety for marginalized groups were partially considered in the recovery plan. NGOs and GOs provided different support

programs, including cash aid, cash for work and training, and training for alternative livelihoods to promote self-recovery (JICA & OCCL, 2012; Mahmud & Prowse, 2012; Tada, 2011; Walton-Ellery, 2009). These supports were short-term measures. Moreover, the reduction of uncertainties and vulnerabilities embedded in traditional livelihood and local economy were not ensured by these support initiatives. With these facts, experts judged these recovery support as moderate contributors to PAVR, which eventually resulted in the moderate scores assigned to their degree of inclusion within recovery programs (Table 3.3).

On the other hand, unfortunately no initiative was found in recovery that addressed technological improvements to the conventional, unsustainable practices of shrimp farming and other agricultural activities. The final score for the inclusion of this cluster of initiatives— the reduction of local economy and livelihood activity related PAV—was thereby found lowered (Table 3.3).

Table 3.2 Inclusiveness of Aila Recovery to Physical Environmental related PAVR Indicators

1. Criterion	2. PAVR Indicators	3. Primary Screening [a]	4. Implemented Actions/Measures Related to the Indicator [b]	5. Experts' Judgment on Impact on PAVR (0–5 scale) [c]	6. Normalization of Expert Judgment [d]	7. Average of Scores of Relevant Measures [e]	8. Degree of Inclusion of the Indicator [f]	9. Degree of Inclusion of the PAVR Criteria in Recovery [g]
Physical Environment	Land use planning	0	N/A				0	0.22
	Improving structural strength of housing	FE	Core family shelter	2.8	0.56	0.58	0.58	
		FE	transitional shelter	3	0.60			
	Increase of road network with structural Improvement	0	N/A				0	
	Structural Improvement of critical installation	FE	Reconstructing administrative buildings of local govt.	2.4	0.48	0.74	0.74	
		FE	Constructing new cyclone shelter	5	1			
	Rehabilitation of coastal embankments (improvement of design)	0	N/A				0	
	Measure for preventing embankment breaching	0	N/A				0	

Notes: [a] If the indicator is not included/covered by any recovery initiative, then the score = 0, meaning non-inclusion of the indicator. If it is included, then the score was decided by further expert evaluation and judgment and marked as "Further Evaluation (FE)"; [b] The list of initiatives inclusive of the indicator; [c] Mean of scores given by five experts, who were asked to evaluate the potential impact of the action/initiative on PAVR. Experts evaluated the action/initiative by giving a score between "0" and "5." "0" = no contribution to PAVR, 1 = the least contribution, and 5 = significant contribution; [d] Normalization of the score using min-max method (OECD 2008); [e] Arithmetic average of calculated scores in column 6 for each indicator; [f] Column 3 multiplied by column 7; [g] Mean of scores in column 8 under each criterion.

Table 3.3 Inclusiveness of Aila Recovery to Local Economy/Livelihood, and WASH and H related PAVR Indicators

1. Criterion	2. PAVR Indicators	3. Primary Screening	4. Implemented Actions/Measures Related to the Indicator	5. Experts' Judgment on Impact on PAVR (0–5 scale)	6. Normalization of Expert Judgment	7. Average of Scores of Relevant Measures	8. Degree of Inclusion of the Indicator	9. Degree of Inclusion of the PAVR Criteria in Recovery
Local Economy and Livelihood	Livelihood safety for the marginal	FE	Safety nets for ultra-poor	3.6	0.72	0.72	0.72	0.47
	Support for maintaining present livelihood	FE	Cash for work (40 days / 60 days program)	2.4	0.48	0.615	0.615	
			Livelihood support: cash/boat/net/rickshaw distribution	4	0.80			
			Distribution of seeds/agricultural input/juvenile fish	3.6	0.72			
			Cash for training	2.3	0.46			
	Support for livelihood diversification	FE	Training and cash grant for alternative livelihood	2.8	0.56	0.56	0.56	
	Technological Improvement of conventional agricultural activities	0					0	
WASH and H	Introduce appropriate water supply technology	1	Re-excavation / construction of Ponds	2.8	0.56	0.58	0.58	0.43
			Installation of deep tube-wells/RHS	3	0.60			
	WASH promotion	1	WASH promotion	3.6	0.72	0.72	0.72	
	Capacity building of health institutes for disaster response	0	NA				0	

Notes: Please see notes after Table 3.2 for definitions and further details of the calculation

3.4.3 Inclusion of WASH and health related PAVR measures in recovery

Among the three WASH and health related indicators, three were found partially included with one completely missing. After Cyclone Aila, GOs and NGOs installed hand-pump tube wells, re-excavated ponds, and installed pond sand filters (PSF), and household-level rainwater-harvesting systems (RHS) in different affected villages (Sadik, Nakagawa, Rahman, Shaw, Kawaike, & Fujita, 2018; UNDP et al., 2013). However, in a few villages, ponds and PSFs were not effective due to salinity intrusion from the nearby saltwater shrimp farms (Sadik, Nakagawa, Shaw et al. 2017). Similarly, RHS suffered from maintenance issues and capacity limitation. With these facts, experts judged these initiatives as only moderate contributors to PAVR (Table 3.3). For the promotion of WASH and health, NGOs and GOs have partnered to launch several nationwide campaigns. Sanitation was one of the priority issues in humanitarian aid. The housing units provided by NGOs for affected families were equipped with sanitation facilities. However, these facilities did not include DRR measures to ensure safety from a tidal flood. A number of campaign programs were only short-term and project-based, which reduced their impact. Experts therefore evaluated them as moderate contributors (Table 3.3).

Although sanitation was partially included in recovery, the improvement of health facilities was not included. No project or initiative was found that targeted capacity building of the local health institutions to enhance effective and quick response during a disaster emergency.

3.4.4 Inclusion of social relations and networks related PAVR measures in recovery

The degree of inclusion of PAVR indicators related to social capital were found low. Table 3.4 shows that two indicators were completely missing and three were only partially considered in the recovery process. Experts judged the relevant implemented measures were of moderate contribution to PAVR. For example, due to the continuing uncertainty about the technological and financial capacities of the local volunteer organizations, experts considered the initiative of forming local volunteer groups to broadcast warnings and assist with emergency evacuations as a moderate contributor. Similarly, since the sustainability and continuation of disaster awareness by training programs and information campaigns were not assured, experts judged the initiative as a moderate PAVR contributor. New groups of local volunteers, better community-NGO

partnerships, and expanded community training might improve social networks, but institutionalization of these networks still needs to be resolved (Islam and Walkerden 2017). Similar to the social network expansion, building more links and bridges between social capital centers is also important (Nakagawa and Shaw 2004). During Aila recovery, links and bridges between local communities and local administrations, local government institutions, academic societies, science and technological societies, and neighboring communities were overlooked. These concerns influenced the experts to give a moderate score for the contribution of network improvement to PAVR. To ensure community participation in water management, the BWDB plans to form several water management committees comprised of local people. Taking into account examples from other coastal areas of Bangladesh, these committees are often not effective in maintaining embankment due to political and financial challenges, as well as weak legitimacy (Dewan, Mukherji, & Buisson, 2015; Animesh Kumar Gain & Schwab, 2012). The capacity development of community-based organizations in monitoring and preventing illegal breaching of embankments is also a missing link.

3.4.5 Inclusion of disaster preparedness and governance related PAVR measures in recovery

The degree of inclusion of PAVR measures related to disaster preparedness was found to be somewhere between low and moderate (Table 3.5). Only the initiative to construct cyclone shelters was comprehensively included in recovery efforts. Twelve new cyclone shelters have since been constructed and six more are under construction (Sadik, Nakagawa, Shaw et al. 2017). The "ERF" had components related to improving disaster governance that included capacity building of GOs and NGOs in disaster management, and policy and guideline formulation for emergency response and NGO coordination (UNDP, 2011; UNDP et al., 2013). The government prepared a national plan for disaster management (DMB-MFDM, 2010). But the practice of the plans and policies was limited because the capacity of local government to implement the new initiatives was deficient. Despite establishing a new national level coordination structure, local level coordination suffers from a lack of harmonization, difficulties with coordination among NGOs, and inexperience with proper monitoring (Sadik, Nakagawa, Rahman et al. 2017). Therefore experts judged these initiatives as moderate contributors to PAVR.

The early warning system that was designed to protect rivers and seaports of the country (Akhand, 2003) has not been changed. Nonetheless the existence of a warning system

and its dissemination do not guarantee that people will follow the evacuation order unless the reasons for noncompliance are addressed (S. K. Saha & James, 2016). By improving the warning system in the recovery phase without addressing the root causes of why people ignored cyclone warnings during the Aila emergency, this indicator was considered excluded as a PAVR contributor. Harmonization is a product of integration, coordination, and alignment (Rahaman & Khan, 2010, 2017). The integration of different sectoral recovery at a local level—for example, infrastructures, coastal embankments, and livelihoods—is still missing in Aila recovery. The coordination and alignment of humanitarian aid lack an efficient coordination structure at a local level (Sadik, Nakagawa, Rahman et al. 2017). Therefore the indicator "harmonization of response and recovery at the local level" was considered excluded from the recovery.

Table 3.4 Inclusiveness of Aila recovery to Social Relation related PAVR Indicators

1. Criterion	2. PAVR Indicators	3. Primary Screening	4. Implemented Actions/Measures Related to the Indicator	5. Experts' Judgment on Impact on PAVR (0–5 scale)	6. Normalization of Expert Judgment	7. Average of Scores of Relevant Measures	8. Degree of Inclusion of the Indicator	9. Degree of Inclusion of the PAVR Criteria in Recovery
Social Relation	Capacity building of Volunteer Organization for emergency response	FE	Formation of groups and capacity building by training	3.4	0.68	0.68	0.68	0.41
	Disaster awareness	FE	Community training for DRR and CCA awareness	3.6	0.72	0.69	0.69	
			Mass awareness and campaign	3.2	0.64			
			School based resilience awareness for children	3.6	0.72			
	Improve social network	FE	Formation of local committee and volunteer groups and capacity building by training	3.4	0.68	0.67	0.67	
			Building NGO-community partnership	3	0.6			
			Increase consultation between community and local government	3.6	0.72			
	Linking and bridging of social capital	0	N/A				0	
	Capacity Development of community based organization in monitoring and preventing illegal breaching of embankment	0	N/A				0	

Notes: Please see notes after Table 3.2 for definitions and further details of the calculation

Table 3.5 Inclusiveness of Aila Recovery to Disaster Preparedness (Public Institution and Action) related PAVR Indicators

1. Criterion	2. PAVR Indicators	3. Primary Screening	4. Implemented Actions/Measures Related to the Indicator	5. Experts' Judgment on Impact on PAVR (0–5 scale)	6. Normalization of Expert Judgment	7. Average of Scores of Relevant Measures	8. Degree of Inclusion of the Indicator	9. Degree of Inclusion of the PAVR Criteria in Recovery
Disaster Preparedness (Public Institution and Action)	Construction of new multi-purpose cyclone shelter	FE	Construction of new multi-purpose cyclone shelter	5	1	1	1	
	Improve disaster governance	FE	Establishing early recovery facility (by UNDP) for national level coordination	3.4	0.68	0.656	0.656	0.47
			Introducing NGO coordination meeting at UNO office	2.4	0.48			
			Developing emergency preparedness guideline (for NGO)	3.6	0.72			
			Development of disaster management plan	4	0.80			
			Training for local disaster management professionals/ UNOs,/government officials	3	0.60			
	Improve early warning system	0	NA				0	
	Improve mechanism for joint response and recovery mobilization	FE	Establishing early recovery facility (by UNDP) for national level coordination	3.4	0.68	0.68	0.68	
	Improve harmonization of response and recovery at local level	0	NA				0	

Notes: Please see notes after Table 3.2 for definitions and further details of the calculation

3.5 The Overall Inclusiveness of Aila Recovery to PAVR

The spider diagram of Figure 3.4 compares the degree of inclusion of five PAVR criteria in Aila recovery as obtained from the Table 3.2 to 3.5. From the pattern of the diagram it can be easily understandable that the recovery was not comprehensively planned and neither was planned giving equal importance to each criteria. It suggests less fruitful results from the recovery and logically indicates that physical environment, WASH and health, local economy, and livelihoods are still in a vulnerable condition similar to the pre-Aila period. The overall result of the diagnostic analysis strongly reveals the shortcomings of the attempt to include vulnerability reduction within the post-Aila recovery programs. Thus the finding implicitly states that the community in Koyra is still living in an underlying vulnerability similar to the pre-Aila period despite the recovery effort.

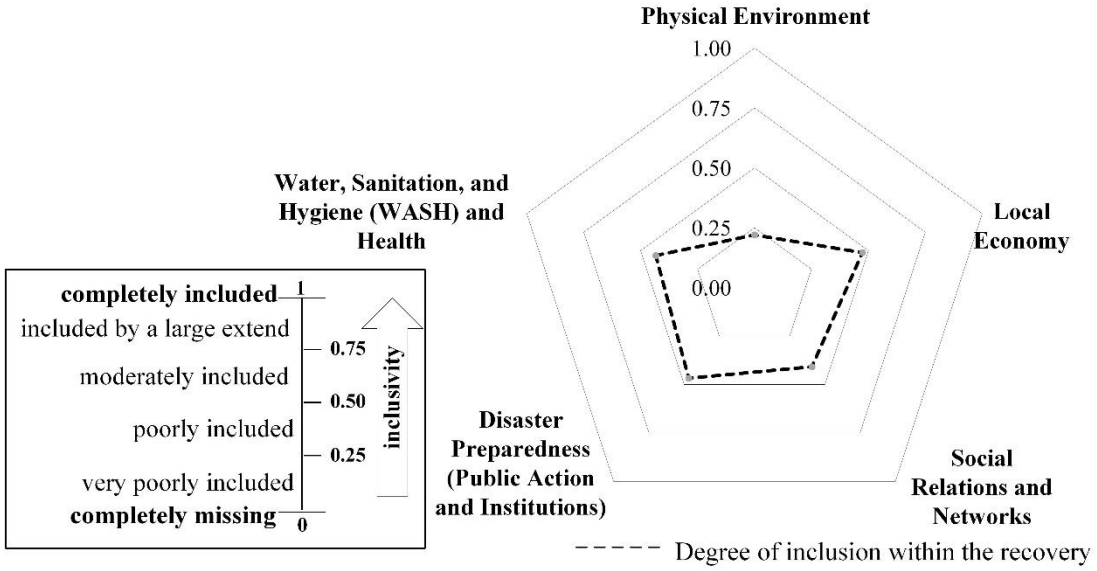


Figure 3.4 The inclusiveness of Aila Recovery in Koyra to PAVR

3.6 Concluding Remarks

The government of Bangladesh and disaster management practitioners believes the Cyclone Aila recovery is a paradigm shift from the conventional relief-based disaster management approach. The GO-NGO partnership post-disaster reconstruction is a new example in Bangladesh. Government claims that the recovery was planned considering BBB approach.

However, finding suggests the recovery lacks comprehensive consideration of pre-existing vulnerability reduction. The overall findings of the diagnostic analysis indicate

that short-term initiatives, such as temporary housing, small cash grants, cash for work, awareness building, short-term policy formulation, community training, and support for ongoing livelihood activities, were prioritized in the recovery period. On the other hand, viable and long-term measures for eliminating the root causes of the vulnerabilities were not properly addressed.

Necessary measures, like hazard-based land-use planning, expanded road networks, improved coastal embankments, technologically advanced agricultural practices, linking of social capital, improved early warning system, coordination and harmonization of NGO efforts at a local level, and increasing capacities of health institutions were completely missing from recovery planning and practice.

The overall results also conclude that the degree of inclusion of viable PAVR measures within Aila recovery is poor which is causing an ongoing vulnerability. Because cyclone is a frequent and recurrent hazard, the community is still living in a vulnerability similar to the condition before Aila.

This research thereby strongly recommends that at the time of identifying viable DRR measures, root causes of PAV should be carefully considered. It also advocates for DRR investment which should be a priority for Bangladesh at present.

From this part of the Ph. D research, a scientific article has been published in an international journal (Sadik, Nakagawa, Rahman, Shaw, Kawaike, & Fujita, 2018) as an academic requirement of this Ph.D program.

Chapter 4 Characterization and Categorization of Recovery

4.1 Introduction

The chapter 3 evidently presented that Aila recovery was not adequately inclusive of reduction of pre-existing vulnerabilities. The finding thereby suggested despite recovery community might be living with similar vulnerabilities in same unsafe condition. Such finding motivated this research to further examine the outcome of the recovery from the safety aspect of BBB. Thereafter attempts were made to characterize the recovery measures and categorize the recovery outcome from the perspective of BBB.

4.2 Methodology

This part of the research was designed adopting a composite methodology which included an institutional survey (subsection 2.2.1, Figure 2.1), expert interview (subsection 3.2.2, Figure 3.2), household questionnaire survey and criteria-based mapping of recovery measures.

The matrix of recovery initiatives developed by reviewing literature and institutional survey has been presented and discussed in Chapter 2, subsection 2.2. That recovery matrix was an important input of this research. In this part, recovery initiatives presented in Table 2.1 are characterized and their overall outcome is categorized from the perspective of BBB (Mannakkara & Wilkinson, 2014; UNISDR, 2017).

4.2.1 Adoption of BBB

The United Nations defined the approach of BBB as "the use of the recovery, rehabilitation and reconstruction phases after a disaster to increase the resilience of nations and communities through integrating disaster risk reduction measures into the restoration of physical infrastructure and societal systems, and into the revitalization of livelihoods, economies and the environment" (UNISDR, 2017). This definition highlights the integration of disaster risk reduction in all sectoral recovery processes to increase resilience. This subjective definition of BBB can be further explained with the BBB framework developed by Mannakkara and Wilkinson (2014) where they describe the BBB with four major attributes: risk reduction, community recovery, implementation, and monitoring. A number of attributes of BBB have been proposed by different authors, which include safety, security, livelihood, risk reduction, vulnerability reduction, equity, community participation, long-term successfulness, comprehensiveness, and

mainstreaming of recovery works in the development process (Clinton 2006; Kennedy et al., 2008; Maly 2018). Among these diverse attributes of BBB, disaster risk reduction and effectiveness as a long-term measure are two frequent attributes directly related to a safer community with enhanced resilience. This safer community is the most important goal of BBB (Clinton 2006; Kennedy et al., 2008; Maly 2018). This research considered the goal of the safer community to define the criteria of characterizing and categorizing Aila recovery initiatives.

4.2.2 Defining criteria of characterization

In consistence to the safety context of BBB two criteria – i) effectiveness as a long-term recovery measure, ii) its contribution to disaster risk reduction have been recognized to characterize each recovery measure. This characterization thereby evaluate the agreement of each recovery measure with the safety aspect of BBB.

The first criterion, "the effectiveness" of a recovery measure was defined as the degree of success to improve community condition toward a safer community for the long-term. This degree of success was assessed by peoples' perception (Figure 4.1). A total of 150 households were interviewed in 2017 to grasp the beneficiaries' judgment on "the degree of success" of each housing recovery measure.

The other criterion was the "contribution to PAVR" which was assessed by expert judgment. The reduction of pre-disaster vulnerability is a goal of disaster risk reduction and an important objective of BBB (Clinton, 2006; Sadik, Nakagawa, Rahman, Shaw, Kawaike, & Fujita, 2018). Therefore, this criterion represented the safety attribute of BBB.

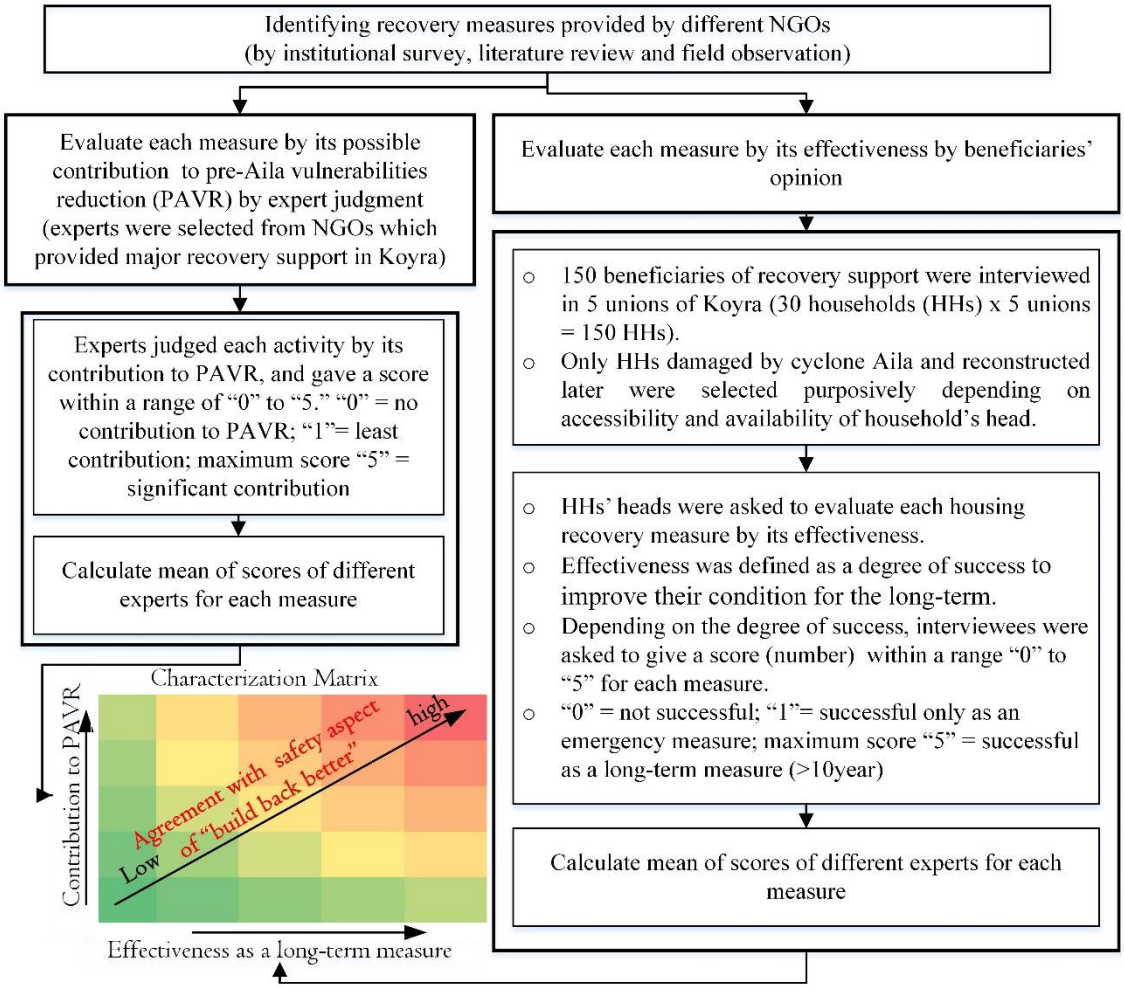


Figure 4.1 Methodological Process of Characterizing Recovery Measures

4.2.3 Surveys and technique for characterizing recovery measures

Questionnaire survey for measuring the "effectiveness"

The first criteria, "effectiveness" as defined by the "degree of success of a measure to improve the condition towards a better community", was measured by people's perception. To this end a household level survey of direct beneficiaries of recovery aids and supports (from GOs and NGOs) was administered. The overall design of the questionnaire survey is illustrated in Figure 4.2. A total of 150 selected households' heads of 5 unions were interviewed in 2017. The sample size was decided purposively considering limitation of time and accessibility.

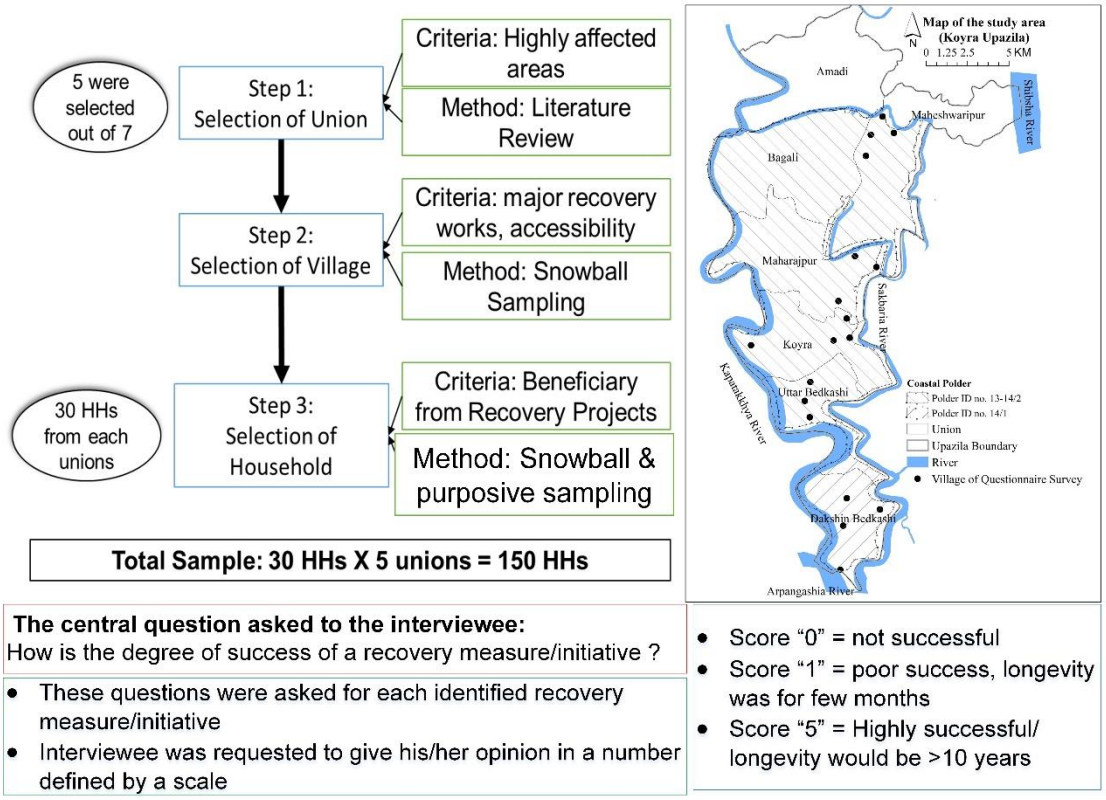


Figure 4.2 Design of Questionnaire Survey

Expert interview for measuring "contribution to PAVR"

To measure the "degree of contribution to PAVR" experts were selected from NGOs that were directly involved in the Cyclone Aila recovery through a process of institutional survey. A total of 13 NGOs were identified by the institutional survey in 2016, among them six (6) were major NGOs that had implemented large-scale projects in Koyra. Among these six major NGOs, an expert from each of the four NGOs who were directly involved in Aila recovery in Koyra was interviewed. Additionally, an international expert (JICA official) who also directly involved in a research on Aila recovery in Koyra was interviewed. These interviews were conducted in 2017. The details of this interview has been presented in subsection 3.2.2, Figure 3.2.

Characterization technique

It has been mentioned earlier that each recovery measure was characterized by two criteria - i) effectiveness as a long-term recovery measure, ii) its contribution to disaster PAVR (Figure 4.1). The effectiveness of each recovery measure which was defined by "degree of success" was measured by beneficiaries' perception. Interviewees were requested to give their judgment on the "degree of success" following a quantitative scale

during the questionnaire survey. The scale ranged from "0 (not successful at all)" to "5 (highly successful to improve the condition as a safer community for the long-term i.e. >10 years)" (Figure 4.2). Another criteria, "degree of contribution to PAVR" of each recovery measure was measured by experts' opinion. While interviewing experts were asked to quantify the "degree of contribution to PAVR" of each recovery measure by their judgment following a scoring approach (Gain et al., 2015; Giupponi, Giove, and Giannini 2013) and using a quantitative scale (Sadik et al., 2018) ranging from "0 (no contribution)" to "5 (significant contribution)." The details of expert opinion survey and a part of the results have been discussed Chapter 3. The obtained data was also published in an academic journal (Sadik, Nakagawa, Rahman, Shaw, Kawaike, Fujita, et al., 2017).

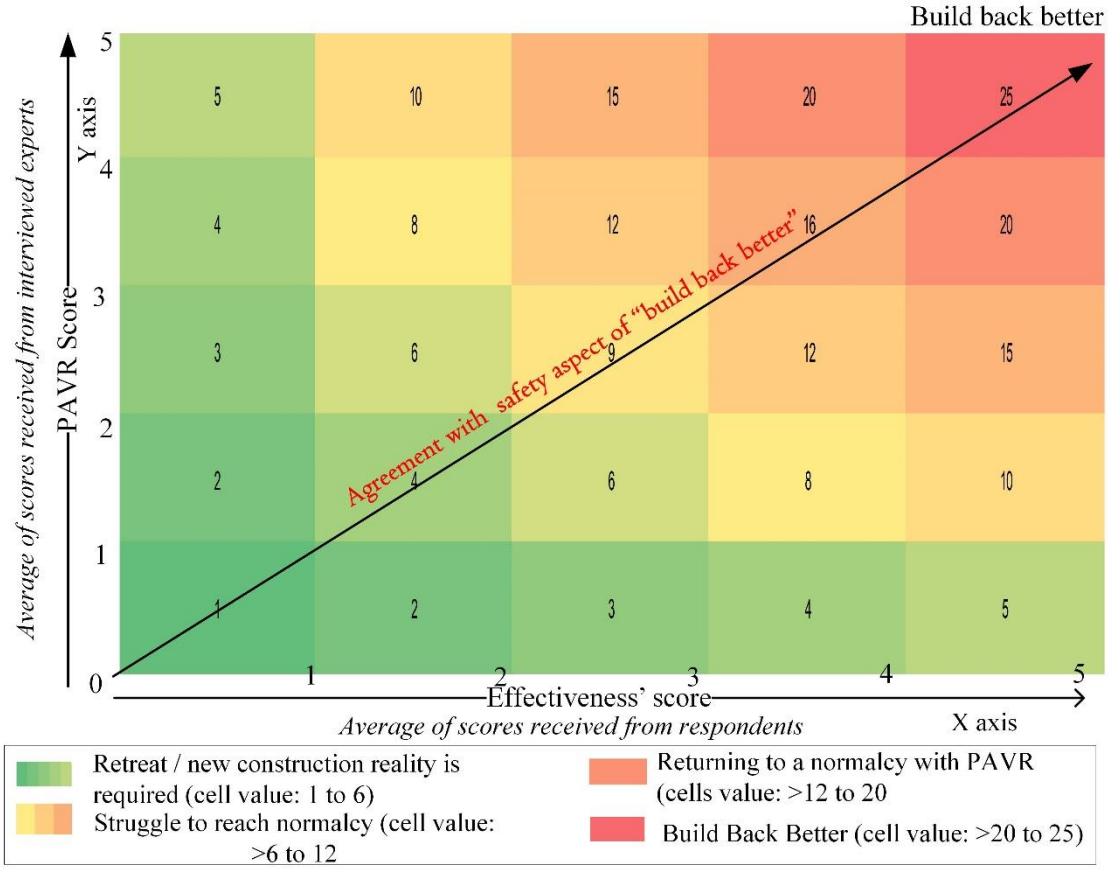
Method of Mapping and Categorization of Recovery Measures

After characterizing each recovery measure, it was plotted in a matrix. The matrix (Figure 4.3) has three dimensions. Dimension "x" represents "effectiveness of a recovery measure" which is the average of scores received from questionnaire survey. The dimension "y" represents the "degree of contribution to PAVR" which is the average of scores received from five experts. And the third dimension is color of a cell (of the matrix) which represents "agreement with BBB". The Warmer the color is, higher the agreement is. The "agreement with BBB" is the product of dimension "effectiveness of a recovery measure" and "degree of contribution to PAVR".

Finally, the recovery measures were categorized according to their "agreement with BBB". The matrix represents the characteristics of recovery measures according to their recovery outcome. Depending on the "agreement with BBB", the recovery measures were categorized into four categories (Figure 4.3, Table 4.1). The first three categories are theoretically similar to recovery patterns developed from the social context of Kobe recovery (Tatsuki, 2007) where the author explained three typologies of recovery depending on how the society felt about their lives after the recovery. The assumption on recovery progress and outcomes in the recovery types proposed in this research are similar to those of Tatsuki (2007). This research considered that the "retreat/new construction reality" would appear if recovery measures were either short-term but contributed highly to PAVR; or long-term but contributed poorly to PAVR. In both cases, the safety goal of BBB would not be achieved. In cases where both effectiveness and contribution to PAVR would be moderate or below moderate, the community would struggle to reach a level that was normal before the disaster. When both criteria would

be better than moderate, the resulted recovery would be in a process to returning to normalcy inheriting PAVR. However, the goal of BBB would only be achieved when recovery measures would be long-term and significantly contribute to PAVR. A further description of the recovery categories is provided in Table 4.1.

While collecting experts' opinions on PAVR and peoples' perceptions on the effectiveness of recovery measures, respondents took both attributes of a measure and outcome on overall society into account. Therefore, this characterization matrix illustrates the overall outcome of the housing recovery along with a subjective evaluation of recovery measures.



Note:

- "Effectiveness score" quantifies the degree of successfulness of a recovery measure to improve the community condition towards a safer community according to BBB. It was measured by peoples' perception
- A "PAVR score" quantifies the degree of contribution to Pre-Aila vulnerability reduction (PAVR), which was measured by expert judgment
- "Agreement with BBB" is the product of "effectiveness score" and "PAVR score" . It is represented by the integer value of each cell and the color as well.

Figure 4.3 The Matrix of Characterization and Categorization of Recovery Measure

Table 4.1 Typologies of Recovery according to the Safety Aspect of BBB

Typology/ Category	Definition	Cell value as off Figure 4.3
Retreat/new construction reality is required	When a sector/community at non-functioning or near non-functioning state, which is performing far below its normal pre-disaster level despite recovery (Kuromiya et al., 2006). The following conditions are in the state- "retreat/new construction reality is required" • Recovery measures failed to restore pre-disaster normalcy • People are more vulnerable than before	1~6
Struggle for reaching a normalcy	When a sector/community is struggling to reach normalcy with recovery efforts. If the following conditions prevail, the status of the sector/community can be referred to as "struggling to reach normalcy": • Recovery measures did not adequately consider DRR People are living in similar conditions to those pre-disaster or higher than pre-disaster vulnerability.	>6 to 12
Returning to normalcy with PAVR	When a sector/community has reached normalcy (pre-disaster status) or is evidently showing a trend toward reaching normalcy with recovery efforts (Kuromiya et al., 2006). If the following conditions prevail, the status of the sector/community can be referred to as "returning to normalcy with PAVR": • With recovery efforts the sector has been (or will soon be) performing as it had been before the disaster • Recovery measures moderately addressed disaster risk reduction (pre-disaster vulnerabilities) • People are living in conditions similar to those pre-disaster with less vulnerability	>12 to 20
A safer community with the attributes of BBB	When a sector/community's recovery efforts have established a new normalcy ensuring DRR and effective implementation of long-term measures to eliminate pre-disaster vulnerabilities. (This is an adoption of the BBB concept as defined by the UN (UNISDR, 2017) and explained by the BBB framework (Mannakkara & Wilkinson, 2014)). More details about the adoption are presented in Section 3.1.	>20 to 25

Typology/ Category	Definition	Cell value as off Figure 4.3
	If the following conditions prevail, the status of the sector/community can be referred as "a safer community with the attributes of BBB": • A new normalcy ensuring disaster risk reduction has been established • The sectoral condition is improved compared to the pre-disaster time • People are living in a safer community	

4.3 Characterization of Recovery Measures

4.3.1 Recovery of housing

Housing damage

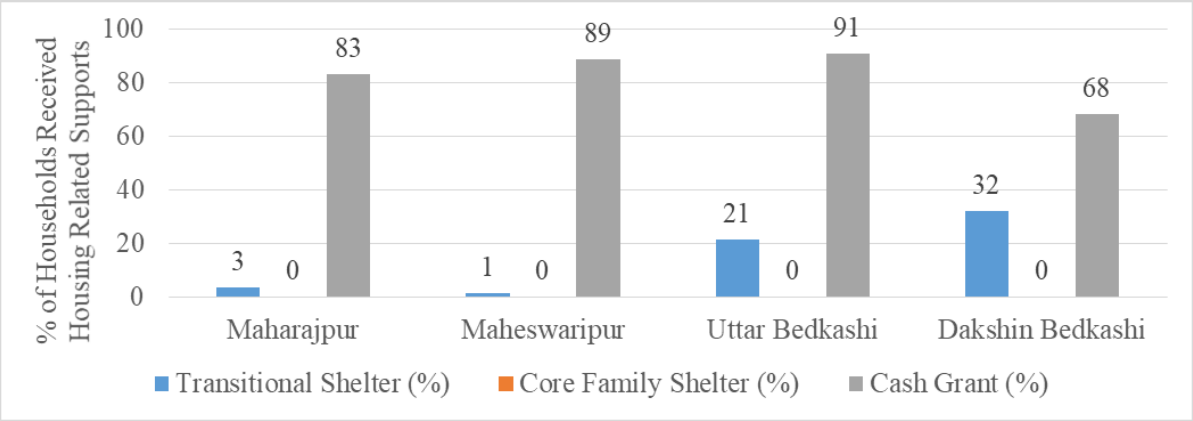
Cyclone Aila and the induced storm surges damaged 42,440 houses and forcefully displaced 27,310 families which is around 60% of total families in Koyra (Koyra Upazila Council, 2010). The storm surge also breached the coastal polders at 34 locations and damaged 81 km embankments which caused continuation of tidal flood for two to three years in Koyra. Housing was one of the lifeline for the local people and considered as a priority sector for recovery (Sadik, Nakagawa, Rahman, Shaw, Kawaike, Parvin, et al., 2018).

Recovery initiatives

Cyclone Aila forcefully displaced around 60% of the total families of Koyra (Koyra Upazila Council, 2010). People were mostly living on higher roads, embankments, and cyclone shelters. To enable self-recovery, the government provided 250 USD cash for the affected families, although it reached 68% to 91% (varied in different unions) of households in the study area (Figure 4.4). Humanitarian organizations initiated in-situ housing provision where different NGOs constructed different types of houses (Table 4.2). In the first phase, several NGOs (mostly Prodipan, Caritas and Islamic Relief) provided "emergency" or "transitional" type houses (Figure 4.4, Picture 4.1). Later, around 4% of households in Dakshin Bedkashi received provision of "core family shelters" from UNDP-led "Early Recovery Facility (ERF) Project" (Figure 4.4, Picture 4.1). While selecting beneficiaries NGOs followed a participatory process maintaining communication with NGO coordination mechanism at upazila.

		
(a) Displaced people living in temporarily built shelters on road-side[3]	(b) "Transitional Shelter" built by a NGO	(c) "Core family shelter" built by UNDP

Photo 4.1 Pictures of different Housing Provisions



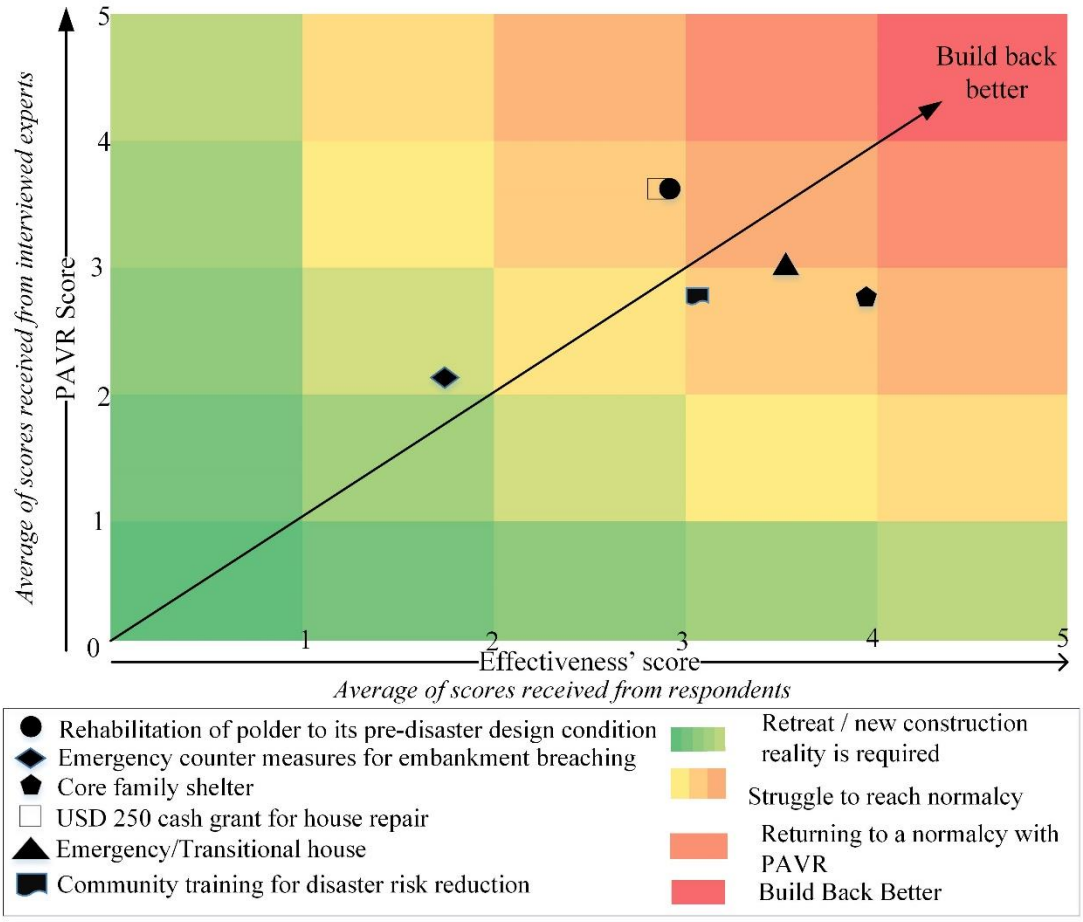
Note: Household who received transitional shelter or core family shelter, could also receive cash grant. Thus the sum of the three may become more than 100%

Figure 4.4 Distribution of Housing Related Supports

Characterization

Figure 4.5 characterizes the housing recovery with respect to: i) its contribution to PAVR and ii) effectiveness (Figure 4.5). All of the housing recovery measures were judged as less to moderately effective to improve the community condition towards a safer community. Experts also judged them as low to moderately contributing to PAVR.

[3] https://www.flickr.com/photos/dfataustralianaid/10673043475



Note:
Effectiveness' score quantifies the degree of successfulness which was measured by how long a measure was (would be) effective, by peoples' perception.
A PAVR score quantifies the degree of contribution to Pre-Aila vulnerability reduction (PAVR), which was measured by expert judgment

Figure 4.5 Characterization and Categorization of Housing Recovery Measures

Houses provided by NGOs were of mostly three types (Table 4.2). Such housing provision lacks DRR measures and created a sort of social conflict. At the time of selecting eligible candidates (beneficiaries) for receiving emergency or transitional shelters, both groups of implementing agencies (local NGOs) and local people were unaware of the coming provision of core family shelters. When the provision of core family shelter (CFS) arrived, local NGOs excluded people who had already received other housing provision (i.e. "emergency shelters" and "transitional shelters") from the selection process. While providing "emergency" and "transitional" houses to people the process failed to address the "transition to what" aspect (Kennedy et al., 2008) of BBB. People who had received "emergency" or"transitional" houses could not reconstruct their permanent houses. Therefore, people who received "emergency shelters" or "transitional shelters" felt unfortunate, and a victim of favoritism and political influence compared

with beneficiaries who received "core family shelters." Aila recovery in Koyra similarly led to social conflict due to the creation of new inequalities in the community by providing different types of houses to different people. This social conflict was a result of a lack of an effective mechanism for coordinating recovery projects and a lack of inadequate consideration of BBB attributes (i.e. "fairness and equity" and "transition to what") as suggested by Kennedy et al., (2008). None of the house provision were constructed considering any land use plan or reduction of place related vulnerability to storm surge. Therefore, **experts provided low to moderate score of "PAVR score" and local people also judged the effectiveness of such housing provision as "moderate".**

Table 4.2 Key Features of Different Types of Houses Constructed by NGOs

Housing Type	Design Feature	Implementing Agencies	PAVR features (from perception of experts and local people)
Emergency Shelter (Figure 4.1(a))	Timber frame, cement stump or timber post with isolated T-footing for foundation, bamboo mat wall, timber-framed pitch roof with corrugated iron (CI) sheet, earthen plinth and floor	Prodipan, Caritas, UNDP	Protection from a wind storm and the usual tidal flooding. Replacing traditional earthen wall to prevent the rapid collapse of houses during a tidal flood or storm surge.
Transitional Shelter (Figure 4.1 (b))	Timber frame, cement stump or timber post with isolated T-footing for foundation, bamboo mat wall, timber-framed pitch roof with CI sheet, earthen plinth and floor with foundations of brick masonry	Islamic Relief	
Core Family Shelter (Figure 4.1(c))	Reinforced brick column, with foundations of brick masonry, earth filled plinth, mezzanine floor, metal roof truss,	UNDP (Early Recovery Facility Project)	Protection from wind. The plinth level is above the tidal flood level. A storm surge might inundate the house but cannot wash away.

NGOs also organized several training programs on how to protect houses from cyclonic winds. People who were not provided housing by NGOs tried to build houses either following the training or design of neighbors' houses constructed by NGOs. However, such training could not provide definite information on design storm surge or design cyclone for their houses. People decided the plinth level of their houses on the basis of their own judgment on the maximum height of the tidal flood that they observed in the

last couple of years when the embankment was open. Thus, these safety measures (Table 4.2) cannot ensure safety from storm surges such as Aila nor even any flood due to breaches to the embankment by an extreme tide. Expert judged that such training were moderately contributing to PAVR. On the other hand, people found such training low to moderately effective in improving their community condition because such training were not continued regularly.

Despite the weakening of coastal polders (Sadik et al., 2017, 2018), houses have been constructed considering the coastal polder as a safety measure for storm surges. Despite recovery of coastal polder, embankment breaching is happening frequently. Experts judged that polders moderately contributing to PAVR and local people also though such polders are moderately effective.

Categorization

The mapping of housing recovery measures of Koyra (Fig. 4.5) shows that the recovery matches the condition of "struggle to meaning" class. The housing recovery initiatives so far implemented were of short-term to mid-term and low—moderately contributing to PAVR. The coastal polder (which is directly linked with the protection of settlements from tidal flood) has been rehabilitated to the pre-disaster condition without resolving the root causes of pre-Aila vulnerabilities (e.g. unsustainable growth of saline water shrimp farming, illegal breaching of embankments by shrimp farmers, lack of community participation, land zoning to regulate unsustainable growth of shrimp farming etc.) (Sadik et al., 2018). Consequently, the polder was weakened again and failed to prevent tidal floods in recent years. Similarly, most of the NGOs-provided transitional houses and self-constructed houses are becoming weaker, and peoples' capacity for regular maintenance and rehabilitation is limited. Therefore, the housing recovery has placed the community in a condition where pre-existing vulnerabilities are prevailing. The goal of BBB has not yet been achieved. This research further investigated the outcome of the recovery by the direct approach of measuring, by people's perception.

4.3.2 Recovery of local economy and livelihoods

The local economy was pre-dominated by shrimp farming and allied trading business. Rice farming, agricultural labor are the next dominating livelihood groups. After Cyclone Aila agricultural activities were suspended for two to three years due to continuing tidal

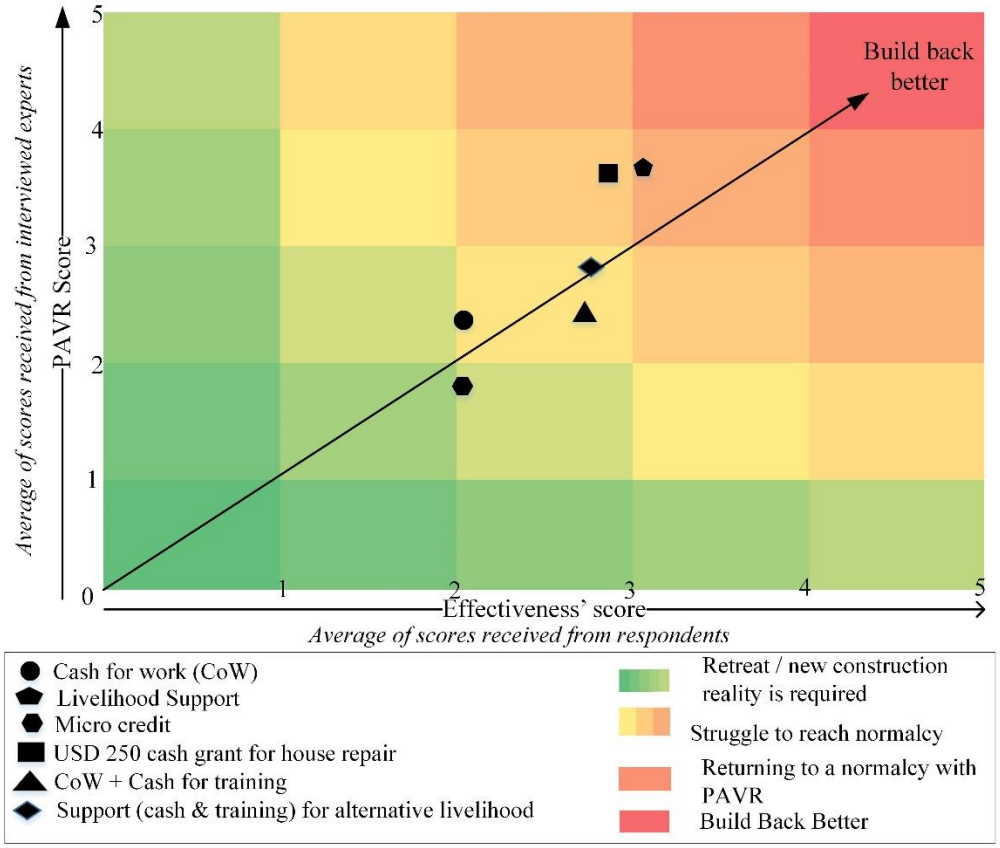
flooding. NGO and Government provided cash support, livelihood support and different training program.

Characterization

Local people believed cash support of 250 USD from the government and livelihood support (provision of net, boat, Rickshaw, van, agricultural inputs, etc) were low to moderately effective in improving their condition. Such supports were helpful but not enough to improve their condition by resolving PAVRs. For example, such support did not create any new income opportunity, neither resolved income uncertainty. Experts also judged that such supports were low-moderately contributing to PAVR.

"Cash for work" was another sort of cash grant support launched by the government. Under that program vulnerable groups (widows, aged, ultra-poor, etc) could earn money by working in road reconstruction and maintenance works. Since such program only allowed for vulnerable group and only for 40 days in a year, local people judged them as low effective in improving local economy (Figure 4.6). There was another similar program launched by NGOs, "cash for work and cash for training". Under that program heads of the highly affected family could get work in reconstruction activities (rural roads, embankments, etc) as unskilled worker during dry season when construction activities were running. During monsoon when no construction works were in progress, they had to join in different disaster preparedness training and were paid. NGOs ran such program for one year to support self-recovery. However, local people mentioned that program was helpful for surviving but not for improving their condition towards a safer community (Figure 4.6). Therefore, they evaluated such program by giving low scores. Experts also gave low scores to quantify contribution of such program in PAVR (Figure 4.6).

NGOs resumed their microcredit supports after few years of Cyclone Aila. Local people were evaluated microcredits as low effective measures for recovery because most of the cases people just spent that credit in grocery shopping or home repair. Since their options for investing microcredit in any productive sector were very limited, it increased their liability. Experts also thought micro-credit as low contributing to PAVR.



Note:
Effectiveness' score quantifies the degree of successfulness which was measured by how long a measure was (would be) effective, by peoples' perception.
A PAVR score quantifies the degree of contribution to Pre-Aila vulnerability reduction (PAVR), which was measured by expert judgment

Figure 4.6 Characterization and Categorization of Recovery Measures for Local Economy and Livelihoods

Categorization

The Figure 4.6 illustrates that depending on the position of economic recovery measures, the economic recovery shows the pattern of "struggle to reach normalcy" which has low agreement with the safety aspect of BBB. The root causes of economy related vulnerability as discussed in Chapter 2, e.g. highly dependency on nature, tradition agricultural practices, absence of hazard-based land-use plan, low diversity of livelihoods were not resolved by the implemented economic recovery measures. As a result, economic vulnerability is similar to that of pre-Aila period.

4.3.3 Recovery of WASH

Recovery initiatives

As described in the Chapter 2, Table 2.1, excavation of pond, installation of pond-sand filters, rain water harvesting system (RHS), and hand pump tube-wells were the major

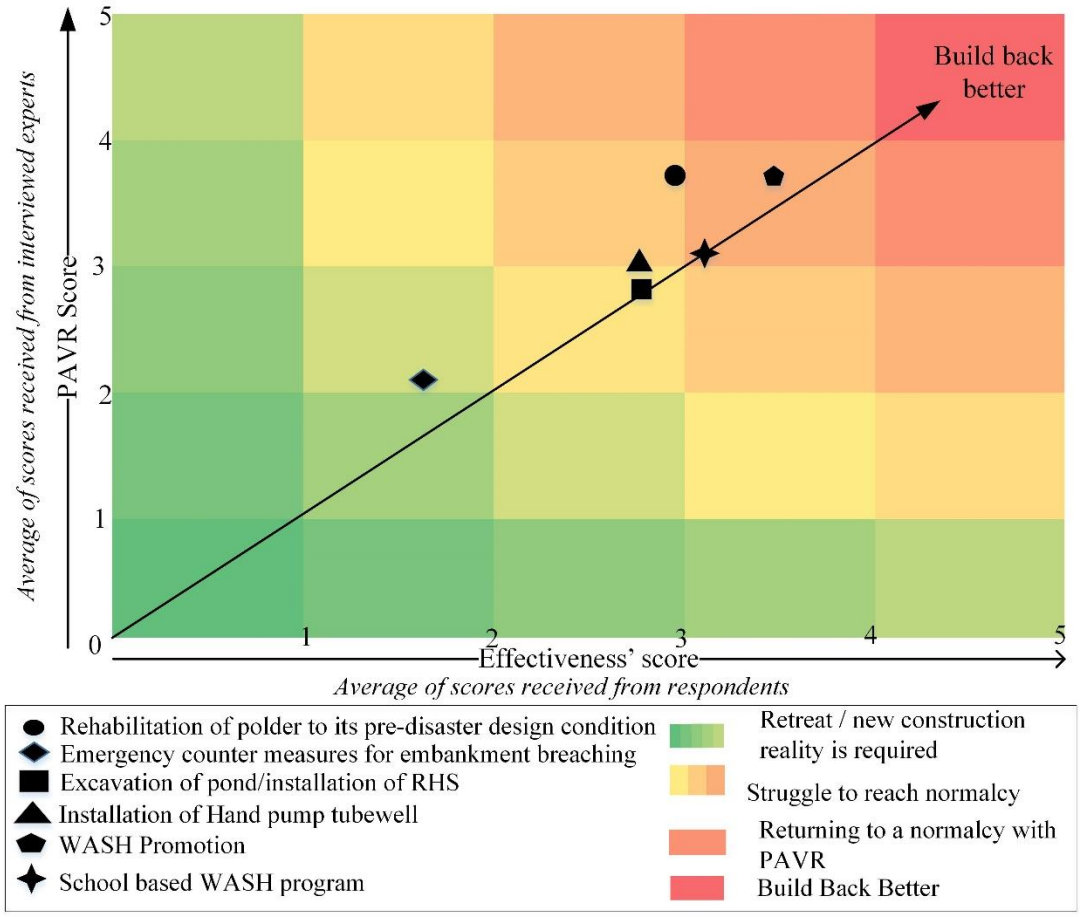
initiatives for recovery of water supply. Besides, NGOs launched several programs for sanitation and hygiene promotions e.g. sanitation campaign, training, school based programs, installation of bill-board, etc. Lack of appropriate technology in salinity rich (in ground water and surface water) area, availability of safe water, and land-use conflict (due to saline water shrimp farming) were major sources of vulnerability. Since tidal flood continued in the Aila affected areas of Koyra for a long time due to breaching of coastal polder, recovery of WASH also depended on recovery of coastal polder.

Characterization

Soon after prevention of tidal flood by recovering coastal polders, NGOs started excavating ponds, re-excavating old ponds and installed households level RHS (to 30~40% houses). Maintenance of RHS was difficult for most of the families due to lack of knowledge and financial capacities. Since saline water shrimp farming was pre-dominant in the study area, salinity started rising in the excavated ponds due to leaching from nearby shrimp farms. Management and maintenance of those ponds were another issue which local people felt very difficult. Therefore, local people felt the excavation of ponds as low-moderately effective in improving their community WASH condition (Figure 4.7).

NGOs also installed hand-pump-tube-wells (HTW) in several villages. Except Dakshin Bedkashi, HTW failed in most of the villages due to high salinity in shallow ground water. Moreover, those HTW are still exposed to storm-surge. People think if a storm-surge similar to Aila strike again, most of the HTW will be inundated. If embankment breaching which caused continuation of tidal flood for 2~3 years happen again, those HTW will not be functional during high-tide-flood. Accordingly, local people judged the installation of HTW as moderate effective (Figure 4.7). Since, the root causes of vulnerability were poorly addressed, expert also evaluated such initiative as a moderately contributing to PAVR.

On contrarily, local people perceived that WASH promotion activities were comparatively more effective than implemented hardware measures. Such promotion and school-based WASH program increased community awareness. However, such programs were project based, not launched regularly. At present, due to absence of such campaign people are not properly maintaining hygiene practices.



Note:
Effectiveness' score quantifies the degree of successfulness which was measured by how long a measure was (would be) effective, by peoples' perception.
A PAVR score quantifies the degree of contribution to Pre-Aila vulnerability reduction (PAVR), which was measured by expert judgment

Figure 4.7 Characterization and Categorization of WASH Recovery Measures

Categorization

As illustrated by Figure 4.7, WASH related recovery measures are distributed mostly in the category of "struggle to reach" which lack viable measures for PAVR. The low contribution to PAVR and low effectiveness eventually made the agreement of different measures with the safety aspect of BBB low as well. Neither the root causes of vulnerability nor the long-term viable measures for improvement were adequately considered in recovery planning.

4.4 Concluding Remarks

This part of the research characterized the implemented recovery measures related to housing, local economy and WASH from the safety perspective of BBB. Characterization of the recovery revealed that recovery initiatives were mostly successful

for the short to mid-term period. Those measures “low to moderately” contributed to PAVR. This research concludes that from the safety perspective of BBB, the overall recovery resembles the pattern of “struggle to reach normalcy,” which indicates the adoption of effective DRR measures for a successful recovery towards a safer community is yet to be achieved.

A scientific paper (Sadik, Nakagawa, Rahman, Shaw, Kawaike, Parvin, et al., 2018) has been prepared including a part of this chapter and has been published in an academic journal.

Chapter 5 Assessment of Recovery Progress

5.1 Introduction

This chapter presents the final part of the Ph.D. research which was focused on measuring the recovery progress from the context of BBB. The researches presented in earlier chapters concluded that in the study area Aila recovery measures were poorly designed without adequate consideration of pre-existing vulnerability reduction (chapter 2). The diagnostic analysis (chapter 3) concluded that the recovery is poorly inclusive of PAVR measures. Similarly, the characterization of recovery measures (chapter 4) also found recovery measure showing low agreement with BBB. Such researches were conducted from recovery planning and implementation perspective, and examined the recovery by evaluating implemented recovery measures. In continuation to such attempts, this part of the research aimed at examining the recovery by evaluating the overall outcome. It examined how the final outcome of the recovery was, and how it progressed over time. Measuring the recovery progress is necessary for strengthening mid-course correction process, evaluation of recovery decision, policy implication, and preparedness for next disaster (Rathfon, Davidson, Bevington, Vicini, & Hill, 2013). With this motivation, this research aimed at measuring the progress of recovery of different sectors e.g. coastal polders, economy, water supply, housing, rural infrastructures, etc. with the objective of answering the following questions:

1. How is the present condition of the community with a comparison to pre-Aila time?
2. How is the present condition of the community with comparison to "resilient community" which is theoretically the outcome of "build back better" (Mannakkara & Wilkinson, 2014, 2016)
3. How has the recovery been progressing over time?

Since Bangladesh is maneuvering its development process towards disaster resilient development with focus on pre-disaster preparedness, this research would aid decision making process informing progress, outcome and overall gaps in recovery. The methodological approach adopted for this research would also guide disaster researchers and planner for conducting mid-way evaluation of disaster recovery in developing countries where integrated database of pre-disaster baseline condition and post disaster monitoring are insufficient.

5.2 Methodology for Measuring Recovery Progress

5.2.1 Approach

Generally measuring the progress requires a wide range of time series data of multi-disciplinary indicators and supported by a very detail survey and pre-disaster census data (Horney, Dwyer, Aminto, Berke, & Smith, 2017; Tatsuki, 2007). Lack of pre-disaster census data and during-recovery integrated monitoring data in developing countries often discourages measuring recovery progress. International humanitarian organizations involved in disaster recovery in developing countries often conduct monitoring and evaluation of their own projects only on ad-hoc basis. Similarly, in Bangladesh, at the time of Aila recovery NGOs conducted their own evaluation on ad-hoc basis as a requirement of their donors (e.g. Walton-Ellery 2009; De Silva and Shafie 2014). Such, evaluations were limited to their project related activities only and did not provide detail data. Even those evaluations did not evaluate outcome of the recovery and perception of local people. Therefore, in absence of any comprehensive and integrated data base, it was very difficult to measure recovery progress. For this research we therefore adopted a synthetic approach build on peoples' perception. The data collection survey included institutional survey, expert interview, and focus group discussion.

5.2.2 Field survey method

Study area

The study area covered four unions (administrative sub-unit of an upazila) of Koyra upazila (Figure 5.1) considering two criteria: i) severely affected by Aila, ii) prioritized area for recovery programs.

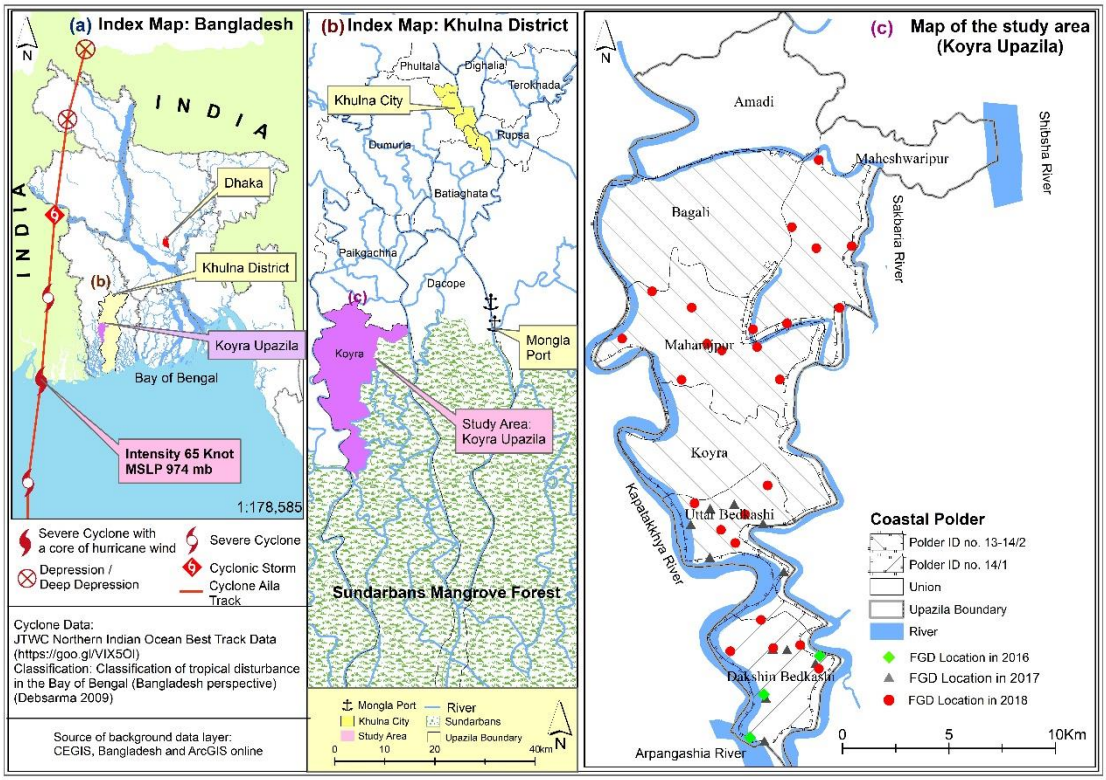


Figure 5.1 Map of the Study Area and Location of FGDs

Institutional survey and expert interview

The institutional survey was conducted to identify institutions involved in Aila recovery. Since the number of institutions were not recorded in any database or in local government offices, snowball technique (Goodman, 1961) was applied. In such manner, a total of 12 institutes were visited which helped to identify13 NGOs involved in Aila recovery (see 2.2.1 for further detail). Institutional survey helped to identify different recovery initiatives implemented by different institutes in different sectoral recovery.

Focus group discussion

A series of informal focus group discussion (FGD) was conducted in the study area in 2016–2018 with local people. First in 2016 four FGDs were conducted to understand the overall storyline of the Aila and to construct questionnaire for assessing recovery progress. Thereafter in 2017–2018 a total of 35 FGDs were conducted in 35 villages of four unions of Koyra (Figure 5.1). FGDs were conducted with local people who were direct and indirect beneficiaries of recovery programs. Villages were selected purposively considering accessibility, abundance of settlers, evidence of implemented recovery programs (e.g. newly constructed houses, reconstructed roads, reconstructed embankments, etc.). Numbers of participants varied depending on location and time of

conducting FGD. Maximum number of participants was 28 found in Shree-Rampur of Maheswaripur and lowest number was 7 found in Gazipara village of Dakshin Bedkashi. The FGDs were administrated by a pre-developed, and pre-tested questionnaire.

The questionnaire consisted of one basic question about recovery – "how was/is the condition of a sector in following five time period: before Cyclone Aila, immediately after Aila (on 26 May 2009), one year of Aila (2010), three years of Aila (2012), five years of Aila (2014) and at present (2017/2018)" (Figure 5.2). These flagged years corresponded to years when different major recovery programs (e.g. emergency response and relief, rehabilitation of embankment, reconstruction of housing projects, etc.) were ended. Thus it helped the participants of FGD to remember the past. From the experience of field testing of questionnaire it was understood that local people could easily correlate past condition to any major recovery events like completion of polder rehabilitation, completion of a road reconstruction, etc.

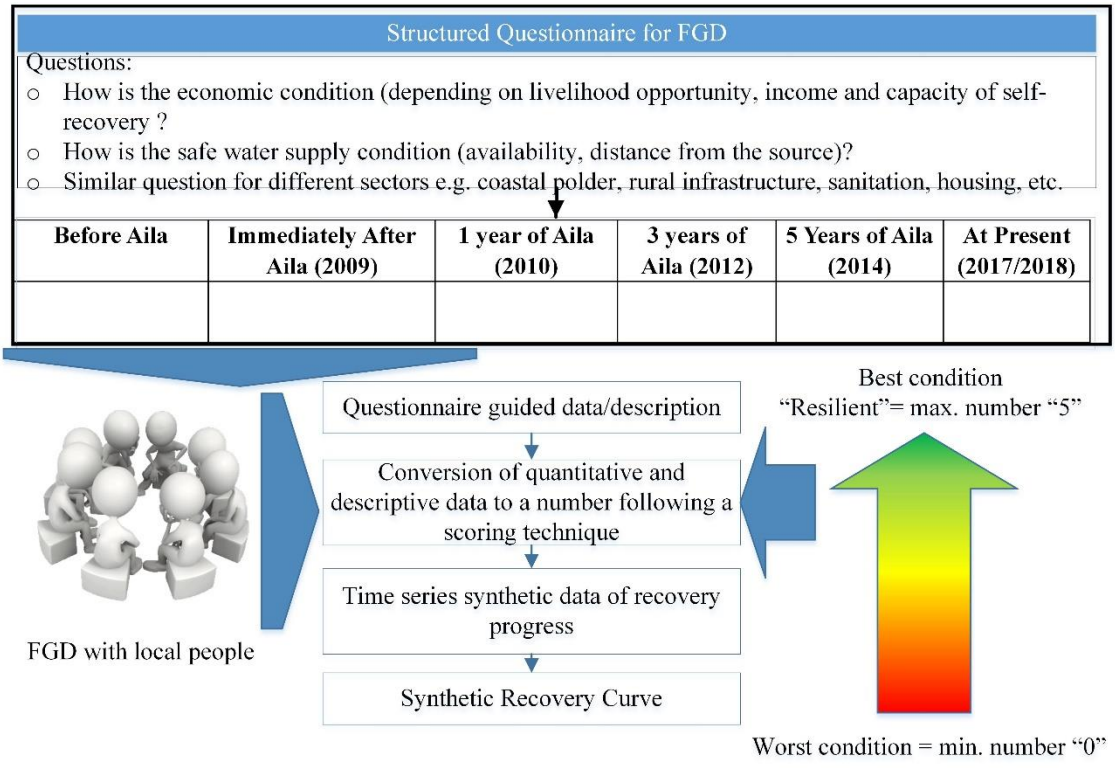


Figure 5.2 Overall Methodology of Measuring Recovery Progress

5.2.1 People's perception-based scoring technique for measuring recovery

A people's perception-based scoring technique (Animesh K. Gain et al., 2015; Giupponi et al., 2013) was followed for measuring recovery progress. While conducting the FGD

following the questionnaire, a numerical scale ranging from minimum number "0" to maximum "5" with description was introduced to facilitate answering the question about a sectoral condition. Scoring scales adopted for assessing sectoral recovery are presented in Table 5.1 to 5.6. During the FGD, the translated Bangla version of the descriptive scale was introduced to the participants to facilitate the discussion. As the discussion evolved, people came to an agreement to define prevailing sectoral condition corresponding to different years. A score to elicit the prevailing condition of a sector was decided at site while conducting FGDs on the basis of the discussion with participants, elicited information, perception of local people and the scoring scale (Table 5.1-5.6).

Table 5.1 Numerical Scale to Quantify Condition of Coastal Polder in Different Years of Recovery

Scenario of condition of coastal polder	Corresponding score
Coastal polder to prevent Aila similar disaster: • It is proven to be effective during spring tide in monsoon • It has been planned considering land regulation and land use plans • The height of the embankment is above the surge level of Aila • There was no breaching of embankment since it had been reconstructed • Effective monitoring and maintenance plan to ensure reliable function	5
Improved coastal polder to prevent tidal flood • The embankment has been recovered with new design • It can prevent tidal flooding • However, it will be overtopped during a cyclone event like Aila • Effective monitoring and maintenance plan to ensure reliable function • Practice of illegal breaching has been resolved	4
Moderate condition • The polder was restored to pre-disaster design condition • It can prevent regular tidal floods • No breaching of embankment at present • However, there is no monitoring system to prevent illegal breaching • At some places it becomes weak which could be breached during monsoon	3
Weak condition	2

• It can prevent regular tidal flood • Spring tide breaches and overtops the embankment several places • At present, it is open at several places • Eroding river banks at several places	
Very weak condition • It fails to protect the village from flooding from regular tide • Embankment breaching is very frequent • Embankment is open at several places • Eroding river bank at several places	1
Not functioning • The embankment is washed away • Out of order	0

Table 5.2 Numerical Scale to Quantify Housing Condition in Different Years of Recovery

Scenario of housing reconstruction	Corresponding score
Reconstruction of 0% Houses	0
Reconstruction of 20% Houses	1
Reconstruction of 40% Houses	2
Reconstruction of 60% Houses	3
Reconstruction of 80% Houses	4
Reconstruction of 100% Houses	5

Table 5.3 Numerical Scale to Quantify Local Economic Condition in Different Years of Recovery

Scenario of local economic condition	Corresponding score
Resilient economy (best condition): • Diversified, sustained, and certain livelihood opportunity • Very efficient safety net programs to ensure no population living below the poverty line • >80% has strong economic condition to deal with future Aila similar cyclone • Even if a future Aila similar disaster would suspend livelihood activities, it can be promptly resumed • Income activities are insured to recover disaster damage	5
Good economic condition: • >60% has strong economic condition to deal with future Aila similar cyclone • Livelihood opportunity is diversified	4

Scenario of local economic condition	Corresponding score
• If livelihood activities are suspended by a disaster like Aila, it can be resume within a short period • A safety net is available to promote post-disaster recovery	
Moderate economic condition: • 40% has economic condition to deal with future Aila similar cyclone • There is a safety net for people living in poverty • In post disaster situation, people can survive without aid but cannot enable self-recovery	3
Low economic condition/struggling: • Only 20% has economic condition to deal with disaster • 80% People can just meet up the daily needs • Income opportunity is little diversified • Social safety nets are insufficient • At the time of disaster humanitarian aid would be mandatory	2
Poor economic condition/living in poverty: • Despite hard working it is very difficult to meet up daily needs • In a certain time of a year, it is impossible to meet up daily needs • Livelihood opportunities are very limited • At the time of disaster, emergency humanitarian aid is mandatory to survive	1
Living in emergency/retreat (worst condition): • Population is living in emergency humanitarian aid • All livelihood activities has been suspended	0

Note: The notion -"local economic condition" was explained to the local people as their overall perception on local economy depending on their livelihood opportunity, employment opportunity, and self-recovery capacity after a future similar disaster. Any established index-based method was not adopted deliberately to make the process easier. Rather, it was aimed to know their cognitive response out their local economic condition on the basis of their self-evaluation. Thus their self-evaluation of their economic condition would also reflect their awareness on economic preparedness for a future disaster.

Table 5.4 Numerical Scale to Quantify Condition of Rural Infrastructures in Different Years of Recovery

Scenario of condition of rural infrastructure (roads)	Corresponding score
Improved and Resilient road network and condition: • Improved road (Bituminous) network covers each villages and households. Maintenance works are regular • Condition of each roads allows motorized transports to run • Cyclone shelters and village growth centers are well connected with villages by improved road network with capacity of functioning during disaster	5
Good condition and function of road network • All villages are covered by good road network (Bituminous road) and houses are connected with the road network by at least by earthen roads. • Maintenance works are regular • Most of the roads connecting growth centers with villages are of bituminous surface and allows motorized transports to run • Cyclone shelters were connected with at least by a road functional all the year	4
Moderate condition of road network and function • Villages are connected with growth centers at least by earthen roads/walking roads • Road condition allows at least non-motorized transports to run. Maintenance works are not regular. High demand of rehabilitation and maintenance work • Cyclone shelters are connected with villages by at least earthen roads	3
Low condition of road network and function • Most of the roads are not in condition to allow even non-motorized vehicles • Urgent need of road reconstruction • There are some settlements and villages which are not connected with cyclone shelter by road networks	2
Very low (poor) condition of road networks and function • Road network does to reach to each villages. There are few villages remain out of the network • Roads are vulnerable to heavy rains and river erosion • A large number of roads are not functional during monsoon	1
Road networks are not Functioning • Most of the roads are damaged and non-functional. Urgent need of new construction and reconstruction	0

Table 5.5 Numerical Scale to Quantify Condition of Safe Water Supply in Different Years of Recovery

Scenario of water supply condition	Corresponding score
Resilient safe water supply condition: • Safe water supply is always available and reliable safe water sources are available at household level • Water sources are protected from Aila similar disaster	5
Good condition of safe water supply • Reliable safe sources are located within 1km distance • Safe water is available all the year • Some sources are not protected from Aila similar disaster	4
Moderate condition of safe water supply • Reliable safe water sources are located at 1~2 km distances • Or, safe water sources are located within 1 km but safe water is available only for 8~10 months • Most of the sources not protected from Aila similar disaster	3
Low condition of safe water supply/struggling • Reliable safe water sources are located at 2~4 km distances • Or, safe water sources are located within 2 km but safe water is available only for 6~8 months • Majority of the sources are not protected from Aila similar disaster	2
Poor condition of safe water supply • Reliable safe water sources are located at 4~6 km distances • Or, safe water sources are located within 4 km but safe water is available only for 4~6 months • Except few, almost no sources are protected from Aila similar disaster	1
Living in emergency/retreat (worst condition) • Safe water sources are not available in neighborhood (within 6km)	0

Table 5.6 Numerical Scale to Quantify Condition of Sanitation and Hygiene in Different Years of Recovery

Scenario of sanitation and hygiene practice	Corresponding score
Resilient sanitation and hygiene condition: • 100% sanitation and hygiene coverage • Toilets are protected from cyclone disaster like Aila • Appropriate sanitation and hygiene technology are readily available • Community is well informed about sanitation and hygiene • High level of awareness for sanitation and hygiene	5

Good condition and practice of sanitation and hygiene: • 80% coverage of sanitation and hygiene coverage • Appropriate sanitation and hygiene technology are readily available • Community is well informed about sanitation and hygiene • Good level of awareness for sanitation and hygiene	4
Moderate condition of sanitation and hygiene • 60% coverage of sanitation and hygiene coverage • Sanitation and hygiene technology are moderately available but not always appropriate for saline and cyclone prone region • Community is informed about sanitation and hygiene but not practiced due to moderate level of awareness	3
Low condition of sanitation and hygiene • 40% coverage of sanitation and hygiene coverage • Sanitation and hygiene technology are somewhat available but not always appropriate for saline and cyclone prone region • Community is not very much informed about sanitation and hygiene. • Community do not practice sanitation and hygiene • Tidal flood and other natural disaster are making difficulties to practice sanitation	2
Poor condition of sanitation and hygiene • 20% coverage of sanitation and hygiene coverage • Appropriate sanitation and hygiene technology are not easily available • Community do not practice sanitation and hygiene	1
Living in emergency/retreat (worst condition) • • Existing technologies for sanitation and hygiene are not functional • Appropriate technology for sanitation and hygiene are not available • Disaster dysfunctions the practice of sanitation and hygiene • Community do not practice sanitation and hygiene	0

5.2.2 Construction of synthetic recovery curve to illustrate recovery progress

Following the scoring technique of quantifying prevailing sectoral conditions, FGDs allowed to construct time series data of prevailing conditions of different sectors from at the time of Aila hit to present. Quantification of the condition of different sectors in different years within recovery period illustrates the progress of recovery. Thus people's perceptions allowed to construct a synthetic data to measure the progress of recovery as it evolved.

From the time series data of recovery progress, synthetic recovery curves were constructed for different sectors. A synthetic recovery curve illustrates recovery progress dated from 2009 to 2017/18. Similar approach of using people's perception in quantitative analysis can be found in vulnerability assessment (Dutta, Wright, Nakayama,

& Sugawara, 2013; Dutta, Wright, & Rayment, 2011). Another example of application of similar approach is found in analyzing the impact of sea level rise, to prioritize flood impact issues impact of adaptation measures by people's perceptions in Australia and Japan (Dutta et al., 2013). Similar approach of quantitative assessment using perception can also be found in resilience assessment (Parvin & Shaw, 2011; Sadik & Rahman, 2010).

5.3 Aila Recovery Progress in Koyra

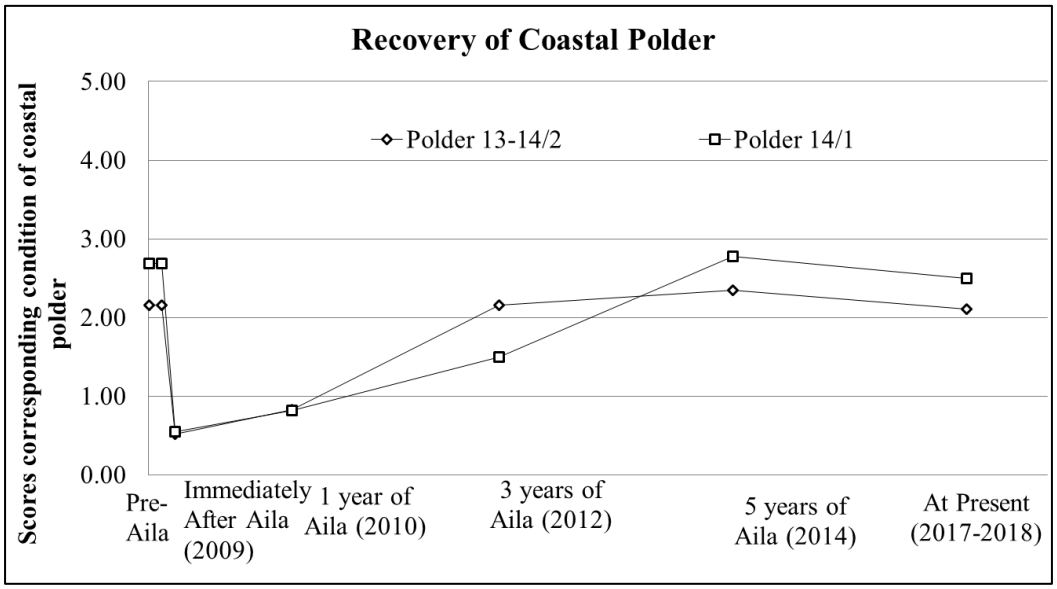
5.3.1 Recovery of coastal polders

Koyra upazila was protected by two polders – polder 13-14/2 and 14/1 (Figure 5.1) which were constructed in 1967–late 1970 to protect agricultural land (mostly rice) from flooding due to high tide (Shah Alam Khan, 2008). With the trend of developing shrimp aquaculture in the country after 1980s (Akber, Islam, Ahmed, Rahman, & Rahman, 2017), rice fields had been gradually converted to saline water shrimp aquaculture ponds. In absence of effective maintenance and monitoring system for coastal polders, shrimp farmer started installing illegal pipes beneath the embankment to irrigate their shrimp ponds with saline water from river. No major maintenance work since the construction of those polders, development of river bank erosion, illegal activities on embankment (construction of housing, livestock shelter, unplanned tree plantation, etc.) and illegal breaching had weakened the embankment. Before Cyclone Aila, the condition of coastal polder was weak. This weakening condition of coastal polder is reflected in the synthetic recovery curve constructed by peoples' perception (Figure 5.3).

When storm surge struck the coast, embankment was breached at 34 places and overtopped as well. The synthetic recovery curve illustrates that the coastal polder reached to a state of almost malfunctioning according to peoples' perception (Figure 5.3).

After one year, Bangladesh Water Development Board (BWDB) could commenced emergency repair of the embankment only at a few places which gave a little sign of recovery (Figure 5.3). Afterwards, BWDB attempted urgent recovery of polder. With exception to few places, BWDB could restored the polder 13-14/2 to its previous design condition by three years of Aila. But restoration of polder 14/1 delayed. It was 2013-14 when it was possible to commenced urgent restoration of polder 14/1. These urgent restoration works were not event effective in preventing illegal breaching and erosion of river banks. Since the maintenance strategy and plans of polders were not revised, those

earthen embankment started weakening. Therefore, the present condition of the earthen embankment is even worse than before Aila (Figure 5.3).



Note: Scores corresponding to each polder is the average of scores received in FGDs conducted within that polder areas. In case of Polder 13-14/2, it is average of 23 FGDs. In case of Polder 14/1, it is average of 12 FGDs, because it covers mostly Dakshin Bedkashi union and a part of Uttar Bedkashi union. Whereas, Polder 13-14/2 covers three unions.

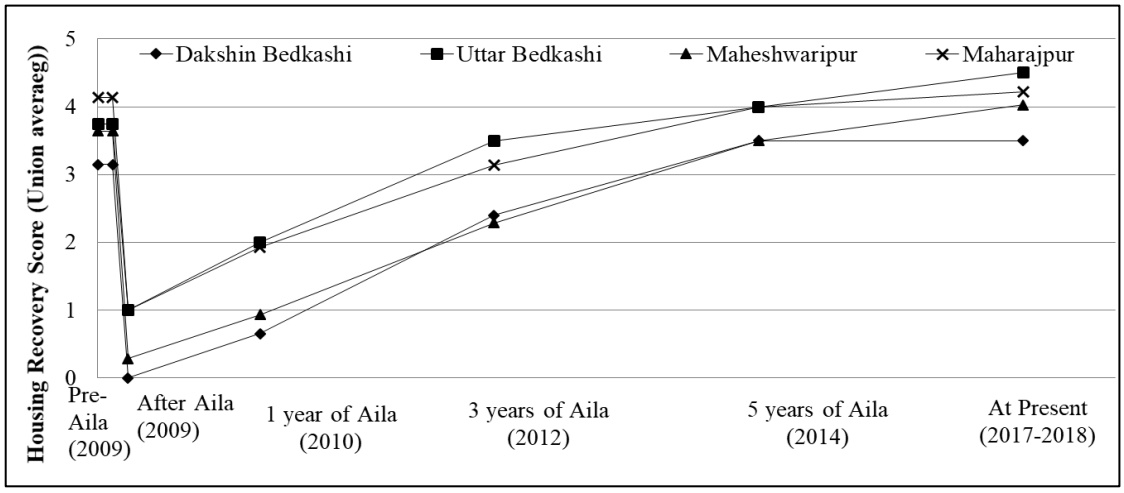
Figure 5.3 Synthetic Recovery Curve of Coastal Polder

5.3.2 Recovery of housing

Figure 5.4 to 5.6 illustrate the progress of housing recovery in four unions of Koyra. To illustrate the recovery with respect to BBB three criteria were selected – i) number of houses constructed considering DRR measures against cyclonic wind similar to Aila, ii) number of houses constructed considering DRR measures against tidal flood (if embankment breaching happen), iii) number of houses constructed considering DRR measures against storm surge similar to Aila. Table 5.7 describes the observed DRR measures adopted by the community.

After Cyclone Aila, people started constructing their houses after 6 months to 1 year (depending on location). Since damages were higher in Dakshin Bedkashi and Uttar Bedkashi and both of the area were inundated for a long time, only 10%-15% houses were reconstructed after one year. Around 50%-70% households could complete reconstruction of their houses when BWDB could prevent the area from regular tidal inundation by completing emergency repair of coastal polder in 2012. Finally, in 2014

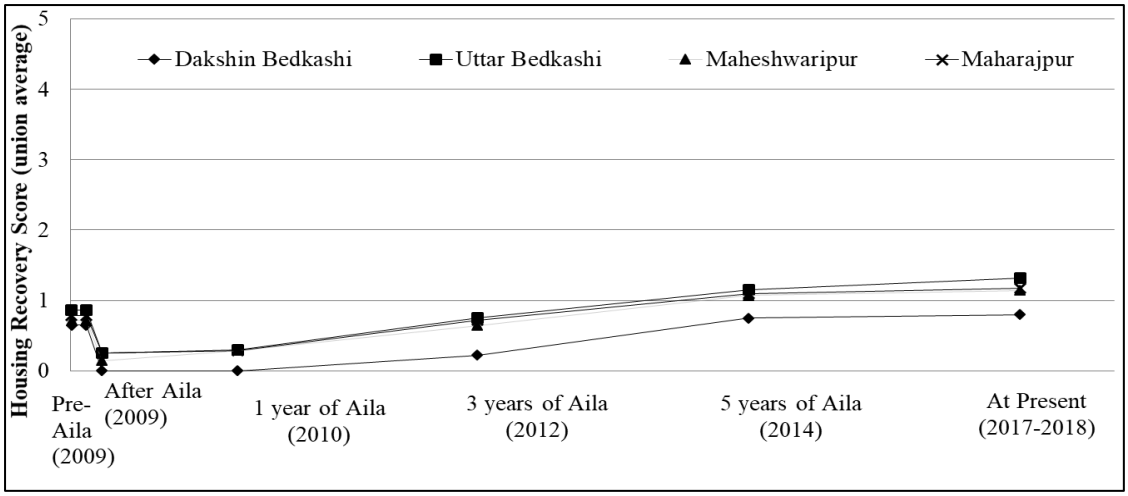
BWDB could completely rehabilitated the polder to its pre-design condition. Thereafter, NGOs started providing in-situ housing provision support to local people. NGOs (with funding from development partners) started constructing in-situ "transitional shelters" and "emergency shelters" (with cost recovery from beneficiaries) (see Table 4.2 for definition of emergency and transitional shelter). While constructing those houses, NGOs adopted protective measures against cyclonic winds and tidal floods. People who constructed their houses by themselves tried to follow that practice to some extent. In 2013, under the "ERF" project, "core family shelter" type in-situ houses (see Table 4.2 for definition of core family shelter) were provided to 265 families (UNDP et al., 2013). In between 2013 to 2015, the rest of the people reconstructed their houses.



Note: scores corresponding to a union are the average of scores received from FGDs conducted in that union. Thus a score represent the overall condition of that union prevailing in a particular year.

Figure 5.4 Synthetic Recovery Curve of Housing considering DRR for Tidal Flood

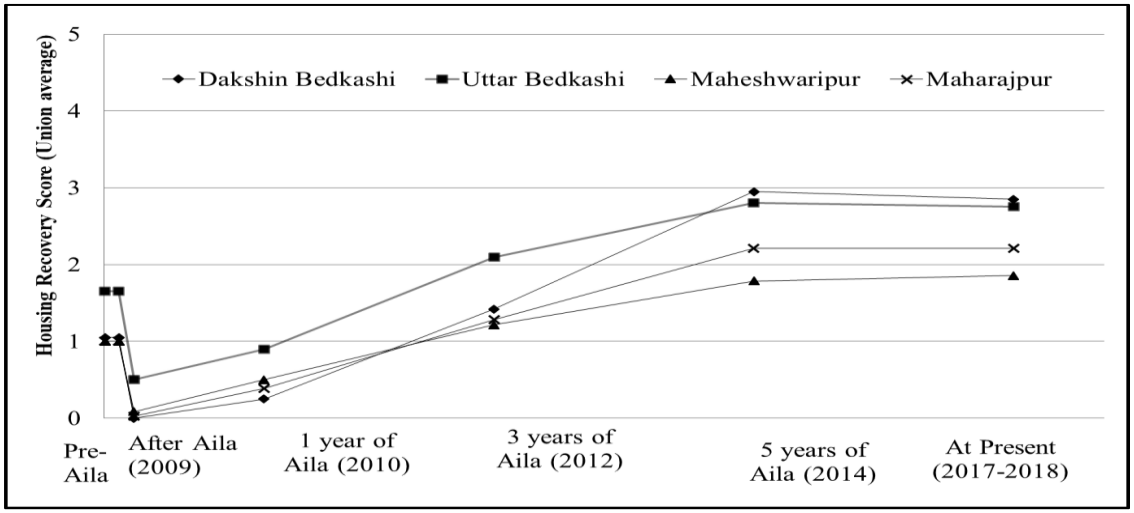
Figure 5.4 illustrate recovery of housing with respect to DRR measures for tidal flood (when embankment is breached or open). The figure shows a general improvement trend of adopting DRR measures e.g. raising of plinth level of houses. The survey says situation is better in Uttar Bedkashi and Maharajpur because local economic conditions are better in those two unions. Moreover, in those two unions farmers could resume rice cultivation earlier than other two areas which help the locals to start income earning.



Note: scores corresponding to a union are the average of scores received from FGDs conducted in that union. Thus a score represent the overall condition of that union prevailing in a particular year.

Figure 5.5 Synthetic Recovery Curve of Housing Protected from Storm Surge

Figure 5.5 illustrates progress of recovery considering adoption of DRR measure for storm surge. The DRR measures against storm surge which were observed during the field survey are listed in Table 5.7. Surprisingly, the trend of adopting any measure against storm surge is very insignificant which suggests people are still living in pre-existing vulnerabilities.



Note: scores corresponding to a union are the average of scores received from FGDs conducted in that union. Thus a score represent the overall condition of that union prevailing in a particular year.

Figure 5.6 Synthetic Recovery Curve of Housing considering DRR for Wind Storm

Figure 5.6 illustrates the progress of recovery with respect to adopting DRR measures against wind storm of a cyclone event. Observed DRR measures are listed in Table 5.7. A trend of adopting DRR measures has been found. The Figure 5.6 shows a remarkable improvement. The pre-disaster condition was achieved by two-three years after Aila and reached its highest level five years after Aila. However, after five years, it showed a slight downward trend in two unions. Local people mentioned that houses that had been reconstructed after Aila including those provided by NGOs (except CFS) were becoming weaker due to a lack of maintenance and the expiring lifetime of some housing materials. Specially, houses made with CI sheets were weakening faster due to salinity (according to local people).

In contrary to the trend of adopting DRR against tidal flood, Dakshin Bedkashi shows a better trend than other unions. This might be the impact of involvement of a number of NGOs. In Dakshin Bedkashi and Uttar Bedkashi NGOs provided in-situ housing provisions which were constructed adopting DRR measures. NGO provided houses acted as examples to follow and influenced the community to adopt such DRR measures as well.

Table 5.7 Adopted DRR measures for Housing Improvement

DRR Measure	Perceived Functions
• Building a house in an area free from storm surge risk. • Raising the plinth level of house above the surge level similar to Aila • Constructing a house on stilt to make it safe from storm surge similar to Aila	Protected from a storm surge like Aila
• Raising of plinth level of houses above the tidal flood	Protection from tidal flooding during spring and neap during the post-cyclone period tide (if the embankment is extensively damaged by storm surge)
• Replacing the earthen wall of house	Prevent rapid collapse of houses during inundation by a storm surge or tidal flooding
• Replacing thatched roof of house	Protection from heavy rain and strong winds

DRR Measure	Perceived Functions
• Construct a house adopting special technique for roof fitting	Protection from heavy winds/cyclonic winds
• Construct house using concrete pillar / isolated concrete T-footing	Protection from cyclonic winds/heavy winds

In general Figure 5.4 to 5.6 depict that there is an improvement in three criteria of housing recovery with respect to BBB. Although there are general signs of returning to a better condition than before, the goal of BBB (i.e. a safer houses against cyclone hazards including storm surges) has not yet been achieved. Specially, the safety aspects of BBB i.e. adoption of structural measures for improving safety (of housing) against cyclone hazards including storm surges, long-term effectiveness of measures, etc. are insufficient. The adopted DRR measures are very traditional and there is no scientific evaluation which would certify the adopted measures would be effective against a cyclone. The root causes of the housing-related vulnerabilities i.e. absence of a risk-based land-use policy for housing, weak housing structure, absence of safety measures for storm surges, growth of isolated housing in vulnerable areas, etc. (Sadik et al., 2018) still prevail.

5.3.3 Recovery of local economy and livelihood

Local economy in Koyra was predominantly an agricultural economy. Shrimp farming and its related businesses, and rice cultivation were dominating economic activities. Koyra upazila was categorized as a "very hard-to-reach area" due to high poverty, and poor condition of water supply and sanitation (R. Ahmed & Hassan, 2012). Which was somewhat reflected in the focus group discussions. The synthetic recovery curve constructed to illustrate the economic recovery is shown in Figure 5.7.

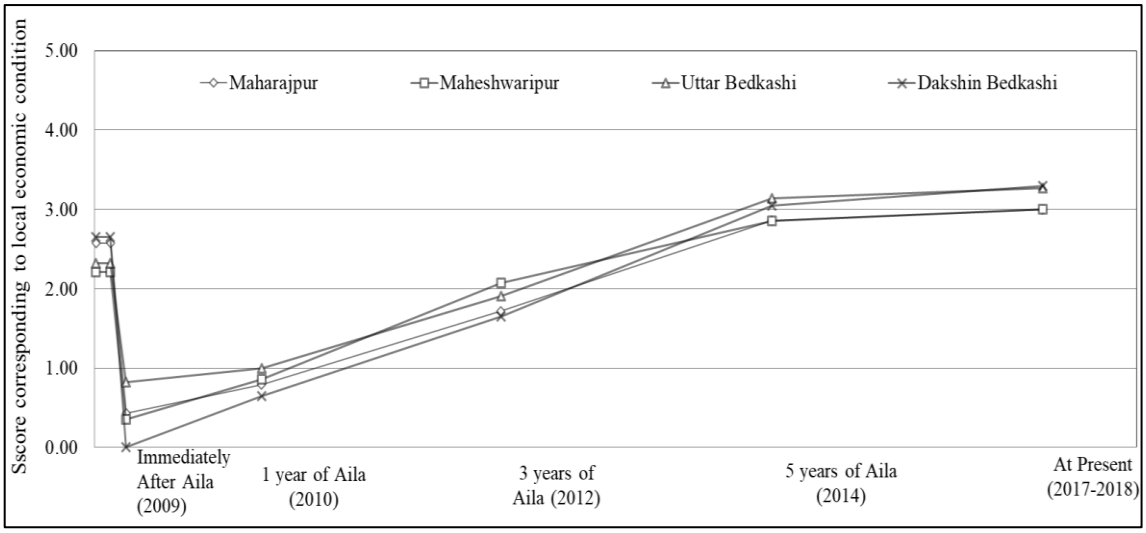


Figure 5.7 Synthetic Recovery Curve of Local Economic Condition

The "economic conditions before Aila" of four unions vary from 2.21 to 2.65 which correspond to in between low and moderate economic condition (Figure 5.7). Cyclone Aila caused drop of the economic condition below the threshold of "poor condition". The worst condition, "0" corresponding to "living in emergency" reached in case of Dakshin Bedkashi. Dakshin Bedkashi was entirely inundated by storm surge. That inundation continue for almost 3 years due to delaying in rehabilitation of coastal polders. Among the four unions, condition was little bit less severe in case of Uttar Bedkashi. After one year of Aila, the economic condition slightly improved towards the margin of "low economic condition" due to delivery of emergency aid by the government and international humanitarian organizations. However, the score remained below "1". The little trend of recovery appeared due to intervention of NGOs and Government. Aila suspended all agricultural activities due to flooding to the entire upazila. People could not resumed the activities until the coastal polder had been rehabilitated in 2012-2013. During that period, people adopted several strategies to survive which included migration to other places for seeking income opportunity, switching of livelihood, and living with humanitarian aid. Rice farmers opted fishing and fish culture as a recovery strategy. Agricultural labor opted to work as day labor in re-construction works. UNDP launched a special one year program of "cash for work and cash for training" under the umbrella of the Early recovery facility project of multi-donor fund (Sadik, Nakagawa, Shaw, et al., 2017; UNDP, 2011). Under that program, local people could work in reconstruction of roads, housing or other infrastructures as a day labor. In rest six months, when construction activities are not possible due to monsoon rain, local people could earn by

attending in different training programs related to livelihood and disaster preparedness. All of these kind of programs were continued from 2012 to 2014. However, it was in 2014 when local people could resumed their agricultural activities which resulted significant improvement of their economic condition. Fig. 5.7 shows that in 2014 the economic condition reached to a level somewhat better that pre-Aila condition. After 2014, the trend of developing economic condition became very mild.

The present economic condition is “moderate”. Locals were claiming that around 40% people may not need emergency aid if a similar disaster strike again. However, they also informed that almost none have capacity of self-recover their economic condition if a similar disaster strike again.

The synthetic recovery curve (Figure 5.7) shows that there is a distinct improvement of economic condition in-terms of increasing income opportunity and certainty. Their income opportunity is more diversified that before. Breaking the traditional trend, now farmers sometime work as a day labor or earn money by fishing or driving a three wheeled van (a common public transport in rural areas of Bangladesh). However, how much these changes are contributing in reduction of their pre-existing vulnerability is important. Pre-existing economic vulnerability included unsustainable agricultural practices, unsustainable shrimp framing, growth of shrimp farming in paddy suitable areas, high dependency on nature, etc. (Sadik, Nakagawa, Rahman, Shaw, Kawaike, & Fujita, 2018; Sadik, Nakagawa, Rahman, Shaw, Kawaike, Fujita, et al., 2017). These vulnerabilities still prevails. The chapter three of this thesis estimates that inclusiveness of pre-Aila vulnerability reduction (PAVR) measures in recovery is poor.

5.3.4 Recovery of water supply

Figure 5.8 illustrates the recovery of water supply condition with respect to BBB. High salinity in surface and ground water, lack of appropriate technology, water quality and availability were the pre-existing vulnerabilities. Pre-Aila condition of water supply was “low” to “moderate” (see Table 5.5 for definition). The impact of Aila on water supply was very severe as it is illustrated in Figure 5.8. In Maheswaripur which was pre-dominantly a highly water scarce area, water supply sector was almost non-functional due to inundation of all surface water ponds (used for drinking purpose) and damage of roof-top rainwater harvesting system. In other area the condition become “poor” as well. The situation in Dakshin Bedkashi is little bit better because deep aquifer based hand-

pump-tube wells were free of salinity and somewhat functional only in low tide time. Since Aila damaged coastal embankment, during high tide most of the HTW were inundated.

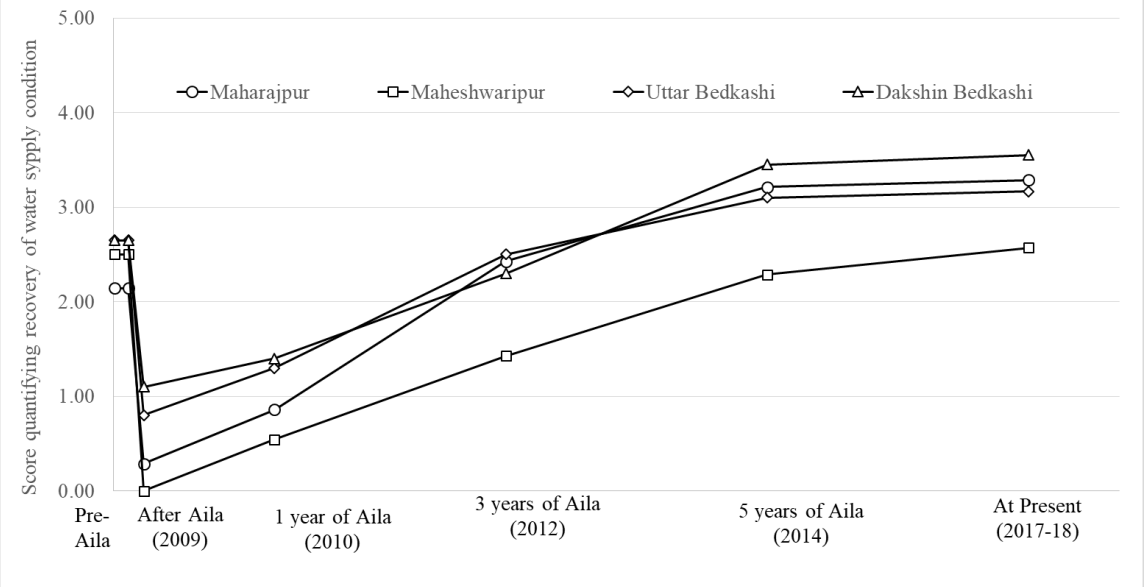


Figure 5.8 Synthetic Recovery Curve of Water Supply

After cyclone impact, water supply condition slowly improved with the help of government and NGOs. However, to reach the pre-disaster condition it took almost 3 years. Maheshwaripur was exceptional. Since most of the ponds were inundated by storm surge, it took more than 4 years to recovery. NGOs provided home-based RHS but not every household could receive those facilities. Even after rehabilitation of inundated ponds, salinity rises in pond water due to leaching from nearby salinity water shrimp farming ponds. There is a desalinization plant but it serves only population of 1-2 villages. Except, Maheswaripur, situation improved in other unions. However, pre-Aila vulnerabilities like lack of appropriate technology, exposure to storm surge and tidal flood, rising of salinity in pond due to saline water shrimp farming, etc. are there.

5.3.5 Recovery of sanitation and hygiene

Figure 5.9 depicts the recovery of sanitation and hygiene by the synthetic recovery curve. It shows that the improvement of sanitation and hygiene practice is remarkable. Local people were mostly thanking to NGOs for their overall sanitation supports and hygiene promotional activities. However, they had to for almost three years when tidal flooding was continuing due to damage of coastal polders.

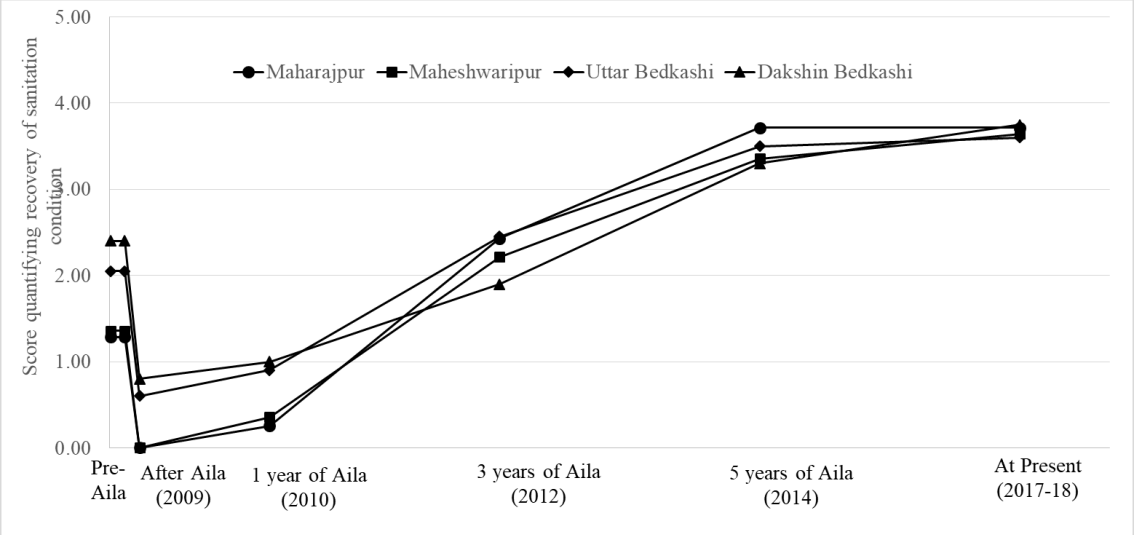


Figure 5.9 Synthetic Recovery Curve of Sanitation and Hygiene

The recovery curve (Figure 5.9) shows some differences in recovery pattern of different unions. According to local people, villages where NGOs involved and where safe water is available recovered better. The figure also shows after five years of Aila, the recovery curves become flat. People were explaining that most of the NGOs went back after completing their programs. Due to absence of any regular sanitation campaign and supports, ignorance to hygiene and sanitation started developing again. Moreover, sanitary toilets provided by NGOs are weakening structurally and people have limited capacity (financial) for proper maintenance. Nevertheless, flooding due to frequent breaching of embankment has also impacts on sanitation practice.

5.3.6 Recovery of rural infrastructures

Figure 5.10 illustrate how the recovery of rural infrastructures mostly rural road communication progressed. Since the storm surge of Aila breached the coastal embankment and inundated almost the entire area, it severely damaged the rural roads. The rural communication was suspended for one to several years (depending on location and impact and recovery of coastal polders). However, the local government started emergency repair of damaged roads after six to one years (depending on area and recovery of coastal polders). However, that initiative could not resume the rural communication. Because complete prevention of tidal flooding was possible after 3 years by rehabilitating coastal polders. NGOs also involved in recovery of rural roads. Finally, when the rehabilitation of coastal polder was completed, the government reconstructed rural roads.

Figure 5.10 shows a little improvement of rural communication. However, the recovery initiatives could not resolve the root cause of pre-existing vulnerability which have been discussed in detail in Chapter two and three. Local people were also mentioning that there was no new road to increase road network and to increase connectivity of cyclone shelters. In general the prevailing rural road infrastructural condition is "moderate" (read Table 5.4 for definition).

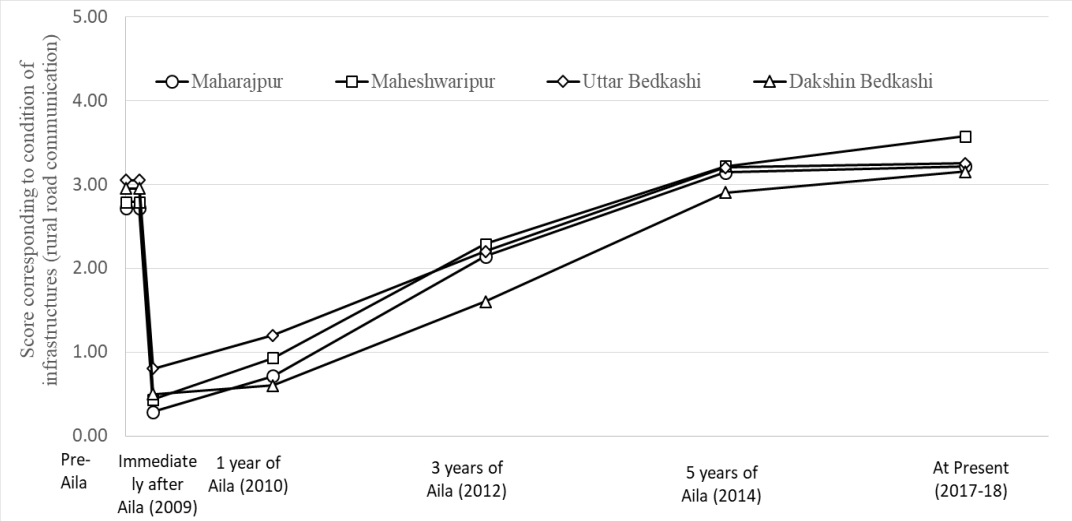


Figure 5.10 Synthetic Recovery Curve of Infrastructure

5.4 Concluding Remarks

One of the aims of this research was to develop a methodology to assess recovery progress which can be applied in data-scarce environment. This research hereby presents a new approach of assessing and examining the recovery from peoples' perception which can be applied in any area having similar data availability related difficulties. Moreover, this methodology can be applied for mid-term evaluation of recovery. Nonetheless, this people perception based methodology can be applied to know the community's feedback about ongoing recovery even in data rich environment.

The results evidently show that there is a trend of improving conditions of different sectors. With some exception, most of the cases water supply, infrastructures, coastal polders, sanitation, housing, etc. have improved than before. However, that progresses are not remarkable and conditions of different sectors are still far away from the goal of BBB. Along with the findings of researches presented in Chapter 2 and 3, this part of the research evidently suggests that the pre-existing vulnerabilities are still prevailing and the community is living with vulnerabilities similar to pre-Aila period.

Chapter 6 Conclusion and Recommendation

6.1 Conclusion

This research aimed at examining the Cyclone Aila recovery in Bangladesh with respect to BBB. The key challenge to reach this aim was developing a methodology for such kind of research especially for a case where data are limited. This research thereby developed a composite methodology and administered the methodology to examine the Cyclone Aila recovery in Bangladesh with respect to BBB. The composite methodology included four major tasks– i) understanding the recovery mechanism in Bangladesh, ii) quantifying the inclusiveness of Aila recovery to pre-Aila vulnerability reduction iii) characterizing and categorizing Aila recovery measures with respect to BBB, and iv) assessing the progress of Aila recovery with respect to BBB. Accordingly the research concludes the following:

Recovery mechanism in Bangladesh: coordination of humanitarian aids

With reference to the matrix of recovery initiatives developed by institutional survey this research concludes that except livelihood support and disaster preparedness, NGOs activities were mostly limited to providing short-term measures. Thereby it suspects the principle of BBB could not be achieved by this recovery. After examining the newly developed coordination structure for harmonizing humanitarian aid this research finds a gap in coordination of NGOs and humanitarian organization at local level. It also finds that the existing practice of local-level coordination is becoming less effective due to undesirable competition among NGOs, humanitarian organizations and development partners.

Inclusiveness of Aila recovery with respect to Pre-Aila vulnerability: diagnostic analysis

This research developed a composite methods of diagnostic analysis to quantify the inclusiveness of recovery with respect to pre-existing vulnerabilities by expert judgment and people's perception. The diagnostic analysis reveals that short-term recovery measure with less contribution to PAV were prioritized in Aila recovery. Viable and long-term recovery measures like hazard-based land-use planning, expanded road networks, improved coastal embankments, technologically advanced agricultural

practices, linking of social capital, improved early warning system, coordination and harmonization of NGO efforts at a local level, and increasing capacities of health institutions were not considered. Therefore, root causes of PAVs are still prevailing. The diagnostic analysis and thereafter quantification of inclusiveness of recovery estimates that the degree of inclusion of viable PAVR measures within Aila recovery is poor.

Characterization and categorization of recovery measures with respect to BBB

This part of the research proposes another new approach of characterizing recovery from the safety perspective of BBB. It characterizes the Aila recovery by two criteria – i) effectiveness of a measure to improve the community condition towards a safer community and ii) contribution of a recovery measure to PAVR. Depending on these two criteria this research also proposes four categories of recovery – i) retreat or new construction reality is required, ii) struggle to reach a normalcy similar to pre-disaster time, iii) returning to the normalcy with PAVR, and iv) Build back Better.

According to the analysis, most of the Aila Recovery measures are showing "low-moderate" agreement with the safety aspect of BBB. Which suggests community are still living with pre-existing vulnerability. Moreover, depending on the quantification of "agreement with BBB goal", recovery of different sectors (e.g. housing, local economy, WASH) falls into the category of "struggle to reach normalcy". It concludes that the safety aspect of BBB is yet to be achieved by the Aila recovery and eventually it may not result any increased preparedness to future disaster.

Assessing the progress of Aila recovery

This research proposes an approach of assessing recovery progress by people's perception which is applicable to a data-scarce environment. However, it can also be applied in any case to know the feedback from the local people. The technique includes a qualitative quantification of sectoral condition in different milestone years (starting from the day of disaster impact to present) which ultimately produces synthetic recovery curve. The synthetic recovery curve illustrates recovery progress and pattern over the years.

With application of this developed methodology, synthetic recovery curves of different sectoral recovery (e.g. coastal polders, housing, local economy, water supply, sanitation and hygiene and infrastructure) in Koyra have been constructed. The synthetic recovery

curves show a trend of improving a sectoral condition compare to pre-disaster situation. However, the curves also evidently illustrate that the achievement is still far away from the goal of BBB. The prevailing condition of different sectors suggest pre-existing vulnerabilities are still hidden which is undermining the overall progress of recovery.

6.2 Recommendations and Future Research Direction

Promote long-term and viable DRR measures, and investment on DRR

This research thereby strongly recommends that at the time of identifying viable DRR measures, root causes of pre-existing vulnerabilities should be carefully considered. Due to undesirable competition among local NGOs and pressure from donors, implementing NGOs often overlook identifying DRR measure considering root causes of the vulnerability and risk and select readily available DRR measures. Such practice ultimately does not ensure DRR. Moreover, NGOs and humanitarian organizations mostly provide short-term recovery and DRR measures due to limited resources. Therefore, this research advocates for taking a departure from humanitarian aid based DRR strategy to investment-based DRR strategy. Besides, further research should be carried out to prepare an inventory of area specific long-term viable DRR measures implemented in different area by different NGOs and GOs. Such document can be treated as a pre-planned document at the time of recovery.

Aid harmonization and coordination of NGOs

This research thereby recommends to review the coordination structure, strengthen the UNO office with resources for effective coordination. The findings also recommend that international NGOs and DPs should work out on how to reduce the competition among local NGOs. Since NGOs are delivering humanitarian aids, competition among them is not desirable. To this end future research is needed to find a suitable mechanism for NGO coordination at local level including monitoring of aid effectiveness at local level.

Linking recovery principles of Sendai framework with sustainable development goals

Bangladesh has fulfilled the criteria of graduating from the list of least developed countries (LDC) of UN to become developing country along with Nepal, Myanmar, Lao, etc. (UN-CDP, 2018). Which implies a new dimension to national strategy for DRR for each eligible countries. Eventually, the priority of DRR in such countries will be

widening to include saving economic loss, preventing damage, better preparedness, etc. In such political changing environment, linking Sustainable Development Goal with local DRR measure is important. Further research should be done to visualize those links and to develop methodological and operational framework to monitor such links. Such research would help countries which are on the way to their development goal.

Developing and implementing hazard map-based land use plan

Hazard-based land use planning is one of the six basic principles of BBB as proposed by Mannakkara and Wilkinson (2014) in their BBB framework. Along with the principle- "improvement of structural design," land-use planning shapes the risk reduction aspects of the BBB (Mannakkara & Wilkinson, 2014). One of the critical sources of housing, coastal polder, economy, WASH, etc related vulnerabilities in Koyra before Cyclone Aila was the absence of risk-based land use planning (E. Alam and Collins 2010; Mallick and Islam 2014; Sadik et al., 2017, 2018). Unfortunately, such land use planning ensuring no growth of settlement in highly vulnerable areas, zonation for saline water shrimp farming, road network for evacuation route was not considered in Aila recovery. For ensuring community safety such hazard map-based land use plan is necessary. In such case hazard maps showing disaster risk zones, cyclone shelter, evacuation routes, etc. should be available at community level. There are several initiatives of developing hazard maps (Barua, Akhter, & Ansary, 2016; Fujita, Shaw, & Nakagawa, 2017; MoL, 2011) and the research is continuing to find a best technology to produce a best hazard map (JST-SATREPs, 2018). However, similar researches should be carried out to decide hazard-map dissemination mechanism, implementation of hazard maps and implementation of land use policies.

Reconciliation of our housing practices in coastal Area: shift for isolated housing provision to developing safe cluster villages on elevated lands

In-situ reconstruction of houses was the core of housing recovery in Koyra, which did not take any location-specific vulnerabilities into account. Rising the plinth level (to a high tide level) only cannot ensure safety from a storm surge. The housing recovery should be well connected with the reconstruction of roads, infrastructure, cyclone shelters, and coastal polders. Thus, the in-situ housing reconstruction without those connections would end up inheriting pre-existing vulnerabilities, which in fact happened in the Aila recovery case in Koyra. For a developing country like Bangladesh, ensuring the

connection of roads, cyclone shelters, infrastructure, etc. to each house; and the safety of each house are difficult. The growth of isolated settlements after Aila further challenged disaster management practices (M. Z. Islam, Kolade, & Kibreab, 2018). The north-eastern part of Bangladesh faces a similar situation due to deep monsoon flooding and people traditionally developed their villages on elevated lands (BHWDP & CEGIS, 2012). This practice looks promising for the coastal area as well. It would be easier to ensure protection of a small village developed on a higher platform rather than ensuring protection to each scattered settlement on low lying areas. In such case, when a storm surge would strike the area, agricultural lands would be flooded but villages on elevated land would be flood free. Although housing relocation is the greatest challenge for implementing such concept in coastal areas, a post-disaster recovery could be considered an opportunity to initiate such relocation. Relocation of settlements to a safer area following a new hazard-based land use planning was a key principle in the Great East Japan earthquake recovery (Nakabayashi, 2014) and typhoon Morakot recovery in Taiwan (Wen et al., 2017). Unfortunately, such opportunity was not taken in Aila recovery. Hazard-based land use planning for housing is a missing link in the Aila recovery in Koyra.

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Paper Based on the Thesis

- **Scientific Journal:**

Sadik, M. S., Nakagawa, H., Rahman, R., Shaw, R., Kawaike, K., & Fujita, K. (2018). A Study on Cyclone Aila Recovery in Koyra, Bangladesh: Evaluating the Inclusiveness of Recovery with Respect to Predisaster Vulnerability Reduction. International Journal of Disaster Risk Science, 9(1), 28–43.

Sadik, M. S., Nakagawa, H., Rahman, M. R., Shaw, R., Kawaike, K., Parvin, G. A., & Fujita, K. (2018). Humanitarian Aid Driven Recovery of Housing after Cyclone Aila in Koyra, Bangladesh: Characterization and Assessment of Outcome. Journal of Japan Society for Natural Disaster Science, 37(Special), 73–91.

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- **Peer Reviewed Book Chapter:**

Sadik, M. S., Nakagawa, H., Rahman, M. R., Shaw, R., Kawaike, K., Fujita, K., & Parvin, G. A. (2019). Recovery of Coastal Polder after Cyclone Aila in Koyra, Bangladesh. In People at Risk (accepted). Disaster Research Training and Management Center, Dhaka University

- **Peer Reviewed International Conference Proceeding:**

Sadik, M. S., Nakagawa, H., Rahman, M. R., Shaw, R., Kawaike, K., & Fujita, K. (2017). Theoretical Analysis of Cyclone Aila Recovery Mechanism at Place: Are They Living in a vulnerability Cycle. In 6th International Conference on Water and Flood Management (4-6 May 2017) (pp. 251–260). Dhaka, Bangladesh, Bangladesh: Institute of Water and Flood Management, Bangladesh University of Engineering and Technology

- **Research Monologue:**

Sadik, M. S., Nakagawa, H., Shaw, R., Rahman, M. R., Kawaike, K., Parvin, G. A., & Talchabhadel, R. (2018). Measuring Progress of Recovery from People's

Perception: A Study on Cyclone Aila Recovery in Koyra, Bangladesh. Annuals of Disaster Prevention Research Institute, 61(B), 637–646

Sadik, M. S., Nakagawa, H., Shaw, R., Rahman, M. R., Kawaike, K., & Fujita, K. (2017). A Study on the Humanitarian Aid Driven Cyclone Aila (2009) Recovery in Koyra Upazila of Bangladesh. Disaster Prevention Research Institute Annuals, 60(B), 746–756

Appendix I: Questionnaire for Expert Interview

Research Theme: Diagnostic Analysis of Implemented Recovery Measures from the context of pre-disaster vulnerability reduction

Concept Note

As a part of the doctoral research, the assessment of expert opinion targets at evaluating the Aila recovery from the context of its impact on pre-disaster vulnerability reduction. Reduction of pre-disaster vulnerability is a major outcome of a successful recovery which prevent the community from falling in a repeated vulnerability to a similar disaster. With this motivation, the expert opinion assessment has been designed which will help to determine the contribution of the ongoing Aila recovery in reducing pre-disaster vulnerabilities. To this end, an evaluation table has been attached with this note. This evaluation will ultimately help to describe the typology of the implemented recovery measures from a context of pre-disaster vulnerability reduction.

Guidance on filling in the attached table

- The assessment process requested by that table is a score based evaluation where experts are quested to put their opinion in terms of a score ranging from '0' to '5'. The Table consists of five columns.
- The first column represent different clusters of recovery measures which were designed following the cluster approach of UNDP led Early Recovery Facility.
- The second column describes pre-Aila vulnerabilities faced by the local community which have been identified through literature review and focus group discussion with local peoples.
- The third column contains important recovery measures implemented by different agencies (NGOs and GOs).
- The fourth and fifth columns are to be filled in by experts. Experts' opinion on the relationship of a particular measure to pre-disaster vulnerabilities are to be given in fourth column. If an expert finds a recovery measure is significantly related to pre-disaster vulnerability then the corresponding score would be '5'. On the other hand, if a particular measure is not related to pre-disaster vulnerability then the score would be '0'. Depending on the degree of the relationship, an expert can choose any score in between '0' to '5'.
- The fifth column is for experts' opinion on potential impact of a recovery measure on overall reduction of pre-disaster vulnerability. A measure might be significantly related to pre-disaster vulnerability but its impact on reducing overall vulnerability might be different. Depending on the degree of possible contribution of a particular measure to vulnerability reduction, expert can give his/her opinion in terms of scores in between '0' to '5'.

Note: It is understandable and logical that all of these implemented recovery measures (as mentioned in column 3 of table 1) were important and had different purpose to support the affected community differently. However, my focus is only to identify the measures which are related to pre-disaster vulnerability. If a measure is not related to a pre-disaster vulnerability, it does not mean that measure is not important.

1. Major Cluster	2. Pre-Aila Vulnerabilities	3. Implemented/Planned Recovery Measures in Post Aila Period	4. Relation with Pre-disaster vulnerability Reduction	5. Potential impact on pre-disaster vulnerability reduction
			(Score 0 to 5; 1 = no relation/no impact, 5 = significant)	
Emergency Response	• Highly vulnerable to cyclone and storm surge, • Lack of capacity to deal with post-disaster situation.	Emergency Relief Support (F & NFI), Health Support		
		Emergency WS & Sanitation		
		Small Scale Mitigation Cash for Work		
Physical Safety	• Damage of 70km embankment with 36 breaches. • Root causes were: o Poor maintenance, limitation of fund for operation & maintenance, o river bank erosion o illegal breaching by shrimp farmers, weakening of polder due to saline water shrimp farming	Emergency counter measure to repair few breaches		
		Emergency Repair of 20km Embankment		
		Rehabilitation of 2.9 km embankment (to the pre-disaster design condition) with slope protection and afforestation		
		Rehabilitation of a Polders (improvement of design & heights + both way regulators, no land-use based plan/land-use zoning)		
Water and Sanitation	• Lack of Appropriate technology for salinity and arsenic contaminated area, • limited capacity to maintain Pond and Pond Sand Filter, Siltation in ponds	Re-excavation / construction of Ponds		
		Installation of Deep Tube-wells		
		WASH Promotion		
Housing	• Scattered growth of settlements along the river and low lying areas • Housing Structures are Poor. • Land-use based planning, disaster risk based settlements plans were not considered.	Housing Material distribution		
		Cash Grant (5000 BDT - 20,000 BDT) for House repair		
		Transitional Shelter (a new kaccha house with a raised plinth level, and few structural improvement)		

1. Major Cluster	2. Pre-Aila Vulnerabilities	3. Implemented/Planned Recovery Measures in Post Aila Period	4. Relation with Pre-disaster vulnerability Reduction	5. Potential impact on pre-disaster vulnerability reduction
			(Score 0 to 5; 1 = no relation/no impact, 5 = significant)	
		Core Family Shelter (a New House made of concrete/brick structure, roof made of GI Sheet and sanitation facilities. However, not placed considering Hazard map/land-use plan)		
Shelter	Not enough shelter. The condition was not friendly to women, patients and disables. Not well connected by road network. Limited scope for livestock shelters	Construction of Cattle Shelter/Killah		
		Repair of Cyclone Shelter		
		Construction of New Multipurpose Cyclone Shelter		
Disaster Preparedness and Early Warning	• Sea ports based warning system. • Warning Dissemination was not effective. • People had less Trust on Warning. • Limited Emergency Fund for taking emergency counter measures (protecting embankments, etc) Cyclone Shelters were not equipped with water storage and adequate sanitation facilities. • Lack of preparedness for emergency response	Improvement of Warning Dissemination mechanism by training of volunteers, local DDM professionals, raising awareness of local community		
		Introducing Mobile Based (SMS/Interactive Voice Response) services for disaster warning		
		Allocation of Budget/Resources (to local government) in pre-disaster period for taking preparedness of emergency response (relief, cash grant, cash for work)		
Education	• Low literacy rate. • Lack of educational institutes and facilities. • Lack of disaster education.	School Repair		
		Construction of new schools		
		Distribution of essential furniture, recreational & educational materials		

1. Major Cluster	2. Pre-Aila Vulnerabilities	3. Implemented/Planned Recovery Measures in Post Aila Period	4. Relation with Pre-disaster vulnerability Reduction	5. Potential impact on pre-disaster vulnerability reduction
			(Score 0 to 5; 1 = no relation/no impact, 5 = significant)	
		School based Sanitation, food and nutrition Program (for students)		
Poverty / Livelihood	• Poverty • Conventional shrimp farming based economy • Non mechanized & traditional agricultural/fishing/shrimp-farming practices • Losing of income opportunity from Sundarbans Forest based Livelihoods • Lack of knowledge, financial capacity and scope to start alternative livelihood	Micro-credit		
		Livelihood Support: Cash/Boat/Net/Rickshaw Distribution		
		Distribution of Seeds/Agricultural input/Juvenile Fish		
		Training on Livelihoods		
		Cash for work + Cash for Training (NGO driven training program on livelihood, DRR, etc. during No work period)		
		Cash for Work (40 days / 60 days program)		
		Safety Nets for ultra-poor		
Environment	• Deforestation, • lack of waste management, • Pressure on Sundarbans	• Plantation along the Embankments		
Disaster Awareness	• Less knowledge & information on disaster. • No systematic structure for organizing regular training programs	Community Training for DRR and CCA Awareness		
		Mass Awareness and Campaign		
		School Based Resilience Awareness for Children		
Rural Infrastructure	• Inadequate road network	Emergency Repair earthen Roads (under cash for work scheme / volunteer labor)		

1. Major Cluster	2. Pre-Aila Vulnerabilities	3. Implemented/Planned Recovery Measures in Post Aila Period	4. Relation with Pre-disaster vulnerability Reduction	5. Potential impact on pre-disaster vulnerability reduction
			(Score 0 to 5; 1 = no relation/no impact, 5 = significant)	
	• Poor rood condition and network made difficulties in evacuation and emergency response operation • Most of the rural roads were earthen and not of modest design, easily eroded by tidal flood • Upazila administrative buildings were in poor condition, storm surge water entered ground floor in several buildings.	Construction of new roads (conventional LGED design: earthen & Herring bond brick)		
		conversion of bund of shrimp farming pond/agricultural land to rural roads		
		Rehabilitation and Construction of Upazila Administration Infrastructures		
Disaster Governance	• Coordination of emergency response. • Lack of policy preparedness for disaster response and recovery. • Lack of capacity and resources of local government of emergency response. • Upazila level/Union Level disaster management committees are not functional	Establishing Early recovery Facility (by UNDP) for national level coordination		
		Introducing NGO coordination meeting at UNO office		
		Development of Guideline for Emergency Preparedness for NGOs		
		Development of Disaster Management Plan		
		Training for Local Disaster management Professionals/ UNOs,/government officials		
Social Organizations and Networks	• Lack of adequate community organizations. • Lack of capacity, knowledge and institutionalization of local volunteers.	Formation of local committee and volunteer groups and capacity building by training		
		Building NGO-community partnership		

1. Major Cluster	2. Pre-Aila Vulnerabilities	3. Implemented/Planned Recovery Measures in Post Aila Period	4. Relation with Pre-disaster vulnerability Reduction	5. Potential impact on pre-disaster vulnerability reduction
			(Score 0 to 5; 1 = no relation/no impact, 5 = significant)	
	• Lack of linking between local communities and knowledge centers (universities, government institutes, research centers, etc)	Increase consultation between community and local government		

Information about the Expert	
Name	
Area of expertise	
Affiliations	

Appendix II: Questionnaire for Household Survey

(Translated in English)

ID no:	**Date:**

1. General Information

Village		**Name :**			
Union		**Sex:**	**Male**	**Female**	

2. What kind of supports have you received?

(put a tick on relevant boxes, multiple answer is possible)

NGO				**Government**		
Emergency Relief	WASH	Transitional House	Core Family Shelter	Cash Grant (3000BDT)	Cash Grant (20K-30K BDT)	Cash for work

3. Was there any recovery need not recognized by the GO/NGO?

Yes		**No**	

If yes, what were/are those needs?

Sl. No	**Needs**

Major Cluster	**Implemented Response and Recovery Measures**	How helpful/effective it was	How was the outcome / degree of success	How was the timeliness
		Highly(5)/ some extend(4)/ moderate(3)/ low (2)/ least(1)/not helpful (0)	Highly successful (5)/poorly successful, longevity for few month (1)/not successful, failed (0)	Received Timely (5) / within acceptable time limit (4) / after a short suffering (3) / After a long suffering (2) / after the need was over (1)/never (0)
Emergency Response	Emergency Relief Support			
	Cash for Work			
Physical Safety	Emergency counter measure (e.g. ring dike) to embankment breaches			
	Rehabilitation of embankment (to the pre-disaster design condition)			
	Full-fledged-recovery of Polders (height rising, erosion protection, etc.)			
Water and Sanitation	excavation / construction of Ponds for rain water harvesting			
	Installation of Deep Tube wells			
	WASH Promotion			
Housing	Cash Grant (3000 BDT - 20,000 BDT) for House repair			
	Transitional Shelter (a new house with roof made of CI sheet, wall made of bamboo/CI sheet, a raised plinth level, and few structural improvement)			

Major Cluster	**Implemented Response and Recovery Measures**	How helpful/effective it was	How was the outcome / degree of success	How was the timeliness
		Highly(5)/ some extend(4)/ moderate(3)/ low (2)/ least(1)/not helpful (0)	Highly successful (5)/poorly successful, longevity for few month (1)/not successful, failed (0)	Received Timely (5) / within acceptable time limit (4) / after a short suffering (3) / After a long suffering (2) / after the need was over (1)/never (0)
	Core Family Shelter (a New House made of concrete/brick structure, roof made of CI Sheet and sanitation facilities. However, not placed considering Hazard map/land-use plan)			
Shelter	Construction of Cattle Shelter/Killah			
	Repair of Cyclone Shelter			
	Construction of New Multipurpose Cyclone Shelter			
Disaster Preparedness and Early Warning	Improvement of Warning Dissemination mechanism. Training of Volunteers, local DDM professionals, raising awareness of local community			
	Introducing Mobile Based (SMS/Interactive Voice Response) services for disaster warning			

Major Cluster	**Implemented Response and Recovery Measures**	How helpful/effective it was	How was the outcome / degree of success	How was the timeliness
		Highly(5)/ some extend(4)/ moderate(3)/ low (2)/ least(1)/not helpful (0)	Highly successful (5)/poorly successful, longevity for few month (1)/not successful, failed (0)	Received Timely (5) / within acceptable time limit (4) / after a short suffering (3) / After a long suffering (2) / after the need was over (1)/never (0)
	Allocation of Budget/Resources (to local government) in pre-disaster period for taking preparedness of emergency response (Cash for work/food for work/emergency relief)			
Education	School Repair and distribution of furniture, book, recreational material			
	Construction of new schools			
	School based FOOD & Nutrition, sanitation Program (for students)			
Poverty / Livelihood	Micro-credit			
	Livelihood Support: Cash/Boat/Net/Rickshaw/Seeds/Agricultural input/Juvenile Fish Distribution			
	Cash for work + Cash for Training (NGO driven training program on livelihood, DRR, etc. during No work period)			
	Training & Cash for Alternative Livelihood			

Major Cluster	**Implemented Response and Recovery Measures**	How helpful/effective it was	How was the outcome / degree of success	How was the timeliness
		Highly(5)/ some extend(4)/ moderate(3)/ low (2)/ least(1)/not helpful (0)	Highly successful (5)/poorly successful, longevity for few month (1)/not successful, failed (0)	Received Timely (5) / within acceptable time limit (4) / after a short suffering (3) / After a long suffering (2) / after the need was over (1)/never (0)
Environment	Environment: Plantation			
Disaster Awareness	Community Training for DRR and CCA Awareness			
	Mass Awareness and Campaign			
	School Based Resilience Awareness for Children			
Rural Infrastructure	Emergency Repair earthen Roads (under cash for work scheme / volunteer labor)			
	Construction of new roads (conventional LGED design)			
	Construction of new earthen roads (along the available bund of shrimp farming pond/agricultural land)			
	Rehabilitation and Construction of Upazila Administration Infrastructures			
Disaster Governance	Establishing Early recovery Facility (by UNDP) for national level coordination			

Major Cluster	**Implemented Response and Recovery Measures**	How helpful/effective it was	How was the outcome / degree of success	How was the timeliness
		Highly(5)/ some extend(4)/ moderate(3)/ low (2)/ least(1)/not helpful (0)	Highly successful (5)/poorly successful, longevity for few month (1)/not successful, failed (0)	Received Timely (5) / within acceptable time limit (4) / after a short suffering (3) / After a long suffering (2) / after the need was over (1)/never (0)
	Introducing NGO coordination meeting at UNO office			
	Development of new plans and policy			
	Training for Local Disaster management Professionals/ UNOs,/government officials			
Social Organizations and Networks	Formation of local committee and volunteer groups and capacity building by training			
	Building NGO-community partnership			
	Increase consultation between community and local government			