#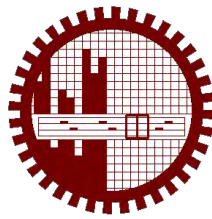 A Network Based Study on the Involvement of Organizations and Perception of Community in Cyclone Preparedness Programme of Selected Coastal Areas of Bangladesh

by

Tasnim Tarannum Isaba (0417152013)

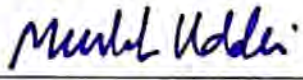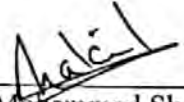MASTER OF URBAN AND REGIONAL PLANNING
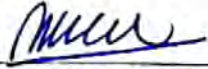
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March, 2021

The thesis titled **"A NETWORK-BASED STUDY ON THE INVOLVEMENT OF ORGANIZATIONS AND COMMUNITY PERCEPTION OF CYCLONE PREPAREDNESS PROGRAMME IN SELECTED COASTAL AREAS OF BANGLADESH"** submitted by Tasnim Tarannum Isaba, Student No. 0417152013, Session **April, 2017**, has been accepted as satisfactory in partial fulfillment of the requirement for the degree of MASTER OF URBAN AND REGIONAL PLANNING by Coursework and Thesis on March, 2021.

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It is hereby declared that this thesis or any part of it has not been submitted elsewhere for the award of any degree or diploma.

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Dedicated to my beloved family

ACKNOWLEDGEMENT

ABSTRACT

Cyclone is a recurrent disaster event in Bangladesh that affects millions of people and causes the destruction of property every year. After the cyclone Gorky (1990) and Sidr (2007), the country has formulated and developed institutional and policy frameworks for cyclone management. The organizational framework for cyclone management consists of multiple layers of organizations. Within this framework, Cyclone Preparedness Programme (CPP) is considered a model program for disaster management in Bangladesh. CPP has been working in the coastal areas of Bangladesh since 1972, focusing on early warning, evacuation, search and rescue, and rehabilitation. During catastrophic events like cyclone, organizations from different levels of authority and jurisdiction interact with each other to manage the destructive impacts. Effective communication and coordination are some of the fundamental factors that contribute to the success of disaster management networks. As the first-responder to cyclones, it is crucial to evaluate local people's views regarding the performance of cyclone management activities at the community level.

The need to consider inter-organizational linkages in the disaster management system is well-recognized. The study aims to explore the interactions among various organizations and analyze community perception regarding field-level activities of CPP. Data on organizational relationships are collected from documentation review, content analysis of newspapers, institutional survey, and key informant interviews. Social Network Analysis (SNA) is used to investigate the communication, coordination, and patterns of linkages among organizations. The study produced network diagrams for visualization and identified key organizations of the systems through the application of network analysis software. After analyzing the role of different actors, including CPP, a field visit is conducted in the coastal areas to understand the coastal community's perceptions. Galachipa upazila under Patuakhali district and Barguna Sadar upazila under Patuakhali district are selected as the study area. Participatory Rural Appraisal (PRA) tools such as Venn diagram, seasonal diagram, process map, pairwise ranking, and cause-effect diagrams are applied to analyze community perception. Using two different methods, i.e., SNA and PRA, the research investigates the disaster management networks at both organizational and community levels.

The study demonstrated that CPP is one of the most influential actors in the cyclone management system of Bangladesh. The network composition shows that majority of the

participating organizations are government organizations. The analysis of centrality measures, i.e., total degree, in-degree, out-degree, betweenness, and closeness centrality, identified the critical organizations of the systems. For the warning and response network, key organizations include the Ministry of Disaster Management and Relief (MoDMR) and CPP offices at Dhaka, upazila, and union levels. The centrality analysis suggests that CPP worked as a significant 'source' and 'receiver' of information that directly received information from other governmental organizations and transmitted them to upazila and union level organizations. Examining organizations' jurisdiction level revealed that local organizations played a crucial role in receiving factual information from the higher authority and disseminating them to the community. By generating network maps, SNA enabled the research to identify the network structure and the organizations located at the center of the network. The network density values showed that only around 17-28.5% of all possible connections are present in three networks.

Through PRA analysis, the research identified the existing practices of the cyclone warning dissemination, evacuation, and sheltering. The research viewed the cyclone management network from both organizations' and community's perspective and found some discrepancies between the interactions at policy and field level. Although local public authorities were identified as key actors of the networks, field observations found that CPP union office was most strongly connected to the community. Lack of communication and coordination with the local authorities was identified from the discussion with community members. The findings strengthen the proposition that all actors in the inter-organizational network are necessary for the prompt delivery of services at different stages of the cyclone. The outputs of both SNA and PRA help develop a holistic idea of the obstacles for effective coordination among organizations and the way forward. Both network analysis and field survey enabled the research to identify some issues, including the lack of coordination and a trust-based relationship among participating actors. The study insisted that the presence of a hierarchical, top-bottom cyclone management system doesn't allow the exploration of local challenges that impact the coastal community. The study proposes strategies to facilitate effective collaboration among the actors and consequent effective performance of the network. The findings of the research will help public authorities to formulate effective cyclone recovery and response plans. Policymakers can utilize the networks to develop an information system with existing organizational linkages that will improve coordination and communication at all stages of a disaster.

LIST OF ABBREVIATIONS

AFD	Armed Forces Division
BDRCS	Bangladesh Red Cross Society
BIWTA	Bang. Inland Water Transport Authority
BIWTC	Bang. Inland Water Transport Corporation
BMD	Bangladesh Meteorological Department
BWDB	Bangladesh Water Development Board
CBO	Community-Based Organization
CPP	Cyclone Preparedness Programme
DDM	Department of Disaster Management
DMC	Disaster Management Committee
DRR	Disaster Risk Reduction
FGD	Focus Group Discussion
IFRCS	International Federation of Red Cross and Red Crescent Society
IWM	Institute of Water Modeling
LGED	Local Government Engineering Department
MoDMR	Ministry of Disaster Management and Relief
NGO	Non-Governmental Organization
ORA	Organizational Risk Analyzer
PIO	Project Implementation Officer
PRA	Participatory Rural Appraisal
SNA	Social Network Analysis
UNDP	United Naitons Development Programme
UNO	Upazila Nirbahi Officer

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

1.1 Background of the Study

Disasters cause immense destruction every year around the world. Apart from causalities, such events hamper the lifeline system and cause widespread loss of life and property by damaging social and physical infrastructures (Haque and Jahan, 2016). Bangladesh is a disaster-risk hot spot due to its unique geographical location, soil characteristics, and heavy monsoon rainfall (Chowdhury, 2002; The World Bank, 2010; Shaw *et al.*, 2013). The country is located in the humid tropics of the Himalayas and along the Northern and Eastern shores of the Bay of Bengal, which is considered one of the most active areas for developing tropical cyclones (Haque and Blair, 1992; Paul, 2009).

Historical evidence shows that cyclones and consequent tidal surges regularly occur in Bangladesh, causing devastating loss of life, property, and economy (GoB, 2008; Paul, 2009; Alam and Collins, 2010). According to a study by BUET-BIDS (1993), globally, about one-tenth of the tropical cyclones occurred in the Bay of Bengal, and about one-sixth of tropical cyclones developed in the Bay of Bengal had landfall on the Bangladesh coast. From 1584 to 1991, about 53% of the world deaths ensued from cyclones in Bangladesh (Ali, 1999). Over the last 50 years, at least 30 cyclones hit the country. Among them, 1970, 1991, and cyclone Sidr in 2007 were some of the most severe cyclones in the history of Bangladesh (Ahamed, 2011). In November 1970, a major cyclone hit the coastal belt of Bangladesh with a wind speed of 223 km/hour and killed around 5,00,000 people. After Cyclone Gorky in 1991, material damage was about USD 2.4 billion, and human casualties numbered around 140,000 (Alam and Collins, 2010). Cyclone Sidr struck the southwestern coast of Bangladesh on November 15, 2007, killing 3,406 people with an estimated loss of USD 1.3 billion (GoB, 2008; Paul, 2009).

The Coastal Zone of Bangladesh, which is comprised of 19 districts with an area of 47, 201 sq.km., is particularly exposed to vulnerabilities from cyclones due to its geophysical and poor socio-economic conditions (GoB, 2005). Storm surge, an unusual rise in seawater associated with a tropical cyclone originating in the Bay of Bengal, has also caused significant devastation in the coastal region (Chowdhury, 1993; Alam *et al*., 2003; Islam, 2004). According to the Climate Risk Index 2011, Bangladesh is the top victim in the world due to climatic disasters during 1999–2009 (Harmeling, 2010). Scientific models indicate that the increased sea surface temperature (SST) associated with climate change will

intensify cyclones and increase storm surges by 2050 (Ali, 1999; IPCC, 2001a; The World Bank, 2010; Alam and Dominey-Howes, 2015).

With the increasing effects of cyclones in the coastal area of Bangladesh, institutional approaches were necessary for effective cyclone preparedness and response (Alam and Collins, 2010). The root cause of the massive loss of life in the 1970 cyclone was the failure of the public authorities to disseminate early warnings to the people at risk (ECPP, 2018). In this context, Cyclone Preparedness Programme (CPP) was established in 1972 as a collaborative venture between the Government of Bangladesh and the Bangladesh Red Crescent Society (BDRCS). The program was initiated to protect the lives of people in the coastal belt and off-shore islands of Bangladesh (Rashid, 1997; Amin, 2012; Habib *et al.*, 2012; Irfanullah and Miah, 2015; Khan, 2017). Since 1972, CPP has been working in Bangladesh, focusing on cyclone early warning system and pre-disaster evacuation to public cyclone shelters. It includes an early warning system activated by the Bangladesh Meteorological Department's (BMD) radar station. CPP essentially links national-level institutions to at-risk coastal communities through a network of trained and committed volunteers at the local level (BUET-BIDS, 1993; Paul *et al.*, 2010; CPP, 2013). At present, CPP is considered a model program of disaster risk reduction with approximately 55,260 volunteers across 7 zone, 13 districts, 37 Upazila, 322 Unions, and 3291 Units in Bangladesh (CPP, 2019; BDRCS, 2019). During the 1991 cyclone, CPP played a significant role in disseminating warnings and assisting people in evacuating to safe places (BUET-BIDS, 1993). The reduced death toll during cyclone Sidr compared to previous cyclones of similar magnitude can be attributed to CPP volunteers' efforts (Paul, 2009).

One of the most significant challenges in any large-scale destructive event is to have an effective communication network among different organizations, which can facilitate emergency response management (Huang *et al.*, 2010). It is vital for preparedness to know how various organizations work together in a disaster response system through collaborative networks (Comfort and Kapucu, 2006). Integrated disaster management requires the participation of all available actors (Kapucu *et al.*, 2010). Understanding network formation is the key to developing emergency response capacity and contributing to community disaster resilience (Wang, 2012). Kapucu (2005) has defined the term "network" as a "group of individuals or organizations exchange information, undertake joint activities and organize themselves, keeping their autonomy remains intact." Poor disaster management networks can be characterized by inadequate coordination and

communication flow among organizations in disaster scenarios, resulting in increased property loss and human life (Wang, 2012). Network analysis can be conducted to determine the pattern of relationships among different actors that interacted within a disaster management system. The basic idea is to consider the organizations as "nodes" and the relationship between them as "ties," forming a network-like structure (Wasserman and Faust, 1994; Zhao, 2014).

In the field of disaster research, network analysis is a widely applied tool to investigate the communication, coordination, and patterns of linkages among organizations (Wasserman and Faust, 1994; Luke and Harris, 2007; Zhao, 2014). Research works have addressed issues of communication networks during the disaster (Kapucu, 2005; Helbing *et al*., 2006; Butts *et al*., 2007; Smith and Simpson, 2009; Ran, 2011) and inter-organizational coordination in disaster response systems (Comfort *et al*., 2004; Comfort and Kapucu, 2006). Studies worldwide suggest that the development of strong networks leads to effective decision-making during disasters and empowerment of communities to foster collective behavior. Knowledge regarding the network formation and critical organizations related to the network is necessary to develop an emergency management system that can leverage the efforts to achieve the common goal collectively. Policymakers can also utilize this knowledge to examine and build the capacity of disaster management systems that must prepare for future disaster events (Gidron *et al*., 1992; Wang, 2012).

Since the local community suffers the adverse effects and plays the first responder's role in case of any disaster, it is crucial to assess their perception regarding risk reduction activities (Shaw, 2012; Bazarragchaa, 2012). Studies on people's perception of disasters have emphasized the need for community participation and community-based adaptive measures in disaster risk reduction (Mathbor, 2007; Parvin *et al*., 2008; Habiba *et al*., 2012). Analysis of community people's perception will allow understanding local perspective issues, weaknesses, and risk factors as identified by the community itself, all of which can hinder effective community disaster management (Cronin *et al*., 2004). Successful participation of the community in pre-disaster, consensus-building emergency planning processes can strengthen the organizational network and improve post-disaster action (Kapucu, 2008).

Disaster management for tropical cyclones in Bangladesh and the contribution of CPP have been addressed by various reports and research works (BUET-BIDS, 1993; Paul *et al*., 2010; Amin, 2012). But there is a knowledge gap regarding the role of different actors and

their mode of interactions. Considering the vulnerability of Bangladesh to tropical cyclones and the future probability of cyclones in the country, the inter-organizational relationships that emerge in response to cyclones must be considered. Although CPP is a community-oriented program, no research has yet been conducted focusing on the perception of local people regarding its activities. Previous studies on CPP have been conducted with a major focus on the volunteers, such as motivation for volunteerism, economic and social value of the volunteers, their issues and challenges, etc. (Amin, 2012; Khan, 2017).

In this context, this study attempts to contribute to disaster governance and planning of Bangladesh by assessing the dynamics and working mechanism of the organizations involved in managing cyclones. It also focuses on the community perception of CPP's role in enhancing the risk perception and response capacity of the coastal community.

1.2   Research Objectives and Possible Outcomes

The main purpose of the study is to assess the interactions exchanged among CPP, community, and other actors involved in cyclone management and local people's views regarding the activities at the field level. The study has been carried out with the following objectives-

1.   To study the linkages among CPP and other organizations involved in managing cyclones at different stages of disaster management
2.   To analyze the community's perception regarding various disaster management activities of CPP and the involvement of local people.

The network diagrams obtained from the first objective represent the mutual relationship among CPP and other relevant organizations and their role in disaster preparedness, response, warning dissemination, evacuation, and recovery phase. By analyzing the community's perception in the second objective, the study has explored local people's critical views regarding these interactions. The research outcome assists in identifying the challenges and formulate a guideline to enhance the communication and coordination level for an improved capacity of CPP in coastal areas.

1.3   Scope of the Study

The study offers a broad scope of knowledge on the application of network analysis in the context of Bangladesh. In the studies of disaster management and planning, the analysis of organizational networks can have significant implications. It can provide an assessment of

the capacity of the government and non-government sectors to become active participants in the cyclone preparedness, response, and recovery actions. By understanding the profile of different organizations in the network and examining the patterns of ties or linkages among them, the challenges and bottlenecks of the existing system can be identified. Then government authorities, disaster experts, and community can work together to enhance the capacity of multiple organizations, resulting in the effective performance of the networks. Findings of network analysis can influence the national and local decision-making processes. Knowledge of network formation and identifying key actors can help urban managers formulate effective disaster response and recovery plans and be better prepared for any disaster. Another significance of this study is that it has conducted research on cyclones, one of the most frequent disasters of Bangladesh. By analyzing vulnerable coastal people's perceptions regarding field-level cyclone management activities, the study provides an opportunity to view the networks from both organizational and community perspectives. These two networks have been compared to recognize the discrepancies between the expected roles of organizations and the roles that are truly practiced at the field level. Thus, the research has developed a composite framework consisting of two methods or approaches, i.e., network analysis and participatory-based methods. The network analysis tool can be used to study organizational involvement and management systems of any disaster, i.e., earthquake, fire, flood, building collapse, etc. The research provides excellent scope for analyzing the inter-organizational dimension of disaster management in Bangladesh.

1.4   Limitation of the Study

To pursue the study, people's perception has been analyzed for only two upazilas of two coastal districts. Further research works can be conducted by taking other coastal communities of Bangladesh to investigate the overall condition of local people's views regarding CPP activities. The study identified the organizations involved in managing a recent cyclone and formulated network diagrams to visualize the connections among CPP and relevant actors. A comparative analysis of inter-organizational networks can be found by considering disaster events held at different periods. More in-depth studies can be conducted to identify other factors related to institutional research, i.e., dynamic network analysis to study the evolution of the interactions exchanged among organizations and process factors that encouraged organizations to interact within the response system.

1.5   Organization of the Research

The research is divided into seven chapters. A brief description of the chapters is given below:

Chapter 1: This chapter introduces the main objectives of the study and background information behind selecting this task along with its justification. In addition, it also describes the scope of the study and limitations in conducting the research.

Chapter 2: This chapter deals with various literature related to cyclone disaster management in Bangladesh. It explains the concept of inter-organizational network analysis in disaster management. An integral part of the review is a brief description of the Cyclone Preparedness Programme, including its background, organizational structure, volunteers, and evolution since its establishment in 1972. It includes network analysis applications in an international context, and prospects of network analysis as an approach to visualize the linkages exchanged among different organizations in the context of cyclones in Bangladesh.

Chapter 3: It describes the methodological and procedural approach that is followed to conduct the research in order to fulfill its objectives.

Chapter 4: It contains the characteristics of the study area covering physical and socio-economic factors, history of cyclones, and a profile of CPP in the study area.

Chapter 5: This chapter focuses on the first objective of the research. Linkages among CPP and other relevant actors have been identified considering a recent cyclone event named 'cyclone Bulbul' (November, 2019). It reveals the actors, including CPP, involved at different stages of cyclone management and the patterns of interactions among them. Network diagrams have been formulated, and factors such as centrality measures have been analyzed to identify the key organizations of the system. Thus, it describes the characteristics of network structures.

Chapter 6: It focuses on the second objective of the research. After understanding CPP's role through literature review and analysis of networks in recent cyclones, this chapter examined the perception of coastal communities on CPP. Participatory Rural Appraisal (PRA) method has been applied to find out the view of local people regarding the institutional linkages, seasonal variation, and existing practice of evacuation and warning. After identifying the existing challenges in consultation with both CPP volunteers and local

people, they are discussed with CPP officials to develop a complete understanding of the current issues.

Chapter 7: This chapter concludes the research by discussing the significant findings of this research and their implications for disaster management in Bangladesh. It also includes strategies for improved communication and coordination among the organizations involved in the cyclone management network of Bangladesh.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter includes a review of literature relevant to the research topic. At first, the cyclone management system is explained along with the definitions of its components. Then previous research works in the field of cyclone management in Bangladesh are reviewed. This chapter also examines the literature on network analysis through the theoretical development of the concept and its applicability in the context of Bangladesh. Some case studies of recent major disasters are reviewed in terms of their methodology and key findings. The chapter also contains the historical background of cyclones and the legislative and institutional framework for cyclone management in Bangladesh. A brief description of the Cyclone Preparedness Programme has been included along with its background, objectives, organizational structure, field level activities, and evolution since 1972. Finally, the findings from the review are presented in the form of a summary.

2.2 Cyclone Disaster Management

ADB (2008) has defined disaster as "an event, natural or man-made, sudden or progressive, which impacts with such severity that the affected community has to respond by taking exceptional measures." In relation to the definition of disaster, disaster management has been considered as a dynamic process that involves many organizations working together to prevent, mitigate, prepare for, respond to, and recover from the effects of the disaster. Disaster management can be defined in the following way-

"An applied science which seeks, by the systematic observation and analysis of disasters, to improve measures relating to prevention, mitigation, preparedness, emergency response and recovery." (Carter, 2008)

Considering cyclonic events as regular catastrophic phenomena in the coastal areas of Bangladesh, cyclone disaster management is now a paramount concern (Rana *et al.*, 2010). Damage caused by cyclones occurs in three different ways- the inundation of the land by ocean water (referred as storm surge), the strong winds from the cyclone, and the heavy precipitation which can cause flooding (Rao *et al.*, 2006). Although it is not possible to stop cyclonic disasters, damages can be minimized using a range of management approaches, e.g., response, recovery, prevention/reduction, and preparedness (Hoque *et al.,* 2017).

There are various components of disaster management, and each component incorporates different types of activities (Figure 2.1). Definitions of these components in the context of cyclones are described as follows-

Figure 2.1: Disaster management cycle (Source : Wood *et al.*, 2013)

- **Preparedness:** The preparedness phase can be defined as the knowledge and capacities developed by governments, professional response and recovery organizations, communities, and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent, or current hazard events or conditions. Preparedness measures for cyclones may include the formulation of viable response plans, public education, the maintenance of resources, training of personnel as well as psychological preparedness (GoB, 2019; Morrissey and Reser, 2003; Carter, 2008).

- **Response:** Response measures are those which are taken immediately before, during, or after an incident to assist in the reduction of injured people, losses of properties, and environmental damage (GoB, 2019). Immediate search and rescue operations, supply of water, medicines, food, and other necessary items can be considered as response activities during cyclones (Alam and Collins, 2010; Tatham *et al.*, 2012).

- **Recovery:** Recovery is the process of restoring or improving livelihoods and health, as well as economic, physical, social, cultural, and environmental assets, systems, and activities, of a disaster-affected community or society. The recovery phase encomappses both rehabilitation and reconstruction (GoB, 2019). It is the process by which communities and the nation are assisted in returning to their proper level of functioning following a disaster (Carter, 2008). Depending on the level of damage, cyclone recovery may take from months to decades and require the assistance of government and humanitarian organizations (Sadik *et al*., 2018).

- **Rehabilitation:** It is the process of restoration of basic services and facilities for the functioning of a community or a society affected by a disaster. More specifically, actions taken in the aftermath of a disaster to bring the affected people back to normal life, such as- bringing back damaged infrastructure, restoration of livelihood, removal of debris, etc. can be termed as rehabilitative measures (GoB, 2019).

- **Reconstruction:** Reconstruction is defined as the medium-and long-term rebuilding and sustainable restoration of resilient critical infrastructures, services, housing, facilities, and livelihoods required for the full functioning of a community or a society affected by a disaster to avoid or reduce future disaster risk (GoB, 2019).

- **Resilience:** Resilience is defined as a system's capacity to absorb disturbance and re-organize into a fully functioning system. Disaster resilience includes not only the community's capacity to return to the state that existed before the disaster, but also to advance the community through learning and adaptation (Cutter *et.al*., 2008).

- **Mitigation:** The lessening or limitation of the adverse impacts of hazards and related disasters is termed mitigation (GoB, 2019). Mitigation of cyclone risk can be conducted through both structural and non-structural measures. Structural measures include the construction of cyclone shelters, killas, cyclone-resistant buildings, coastal embankment, etc., and non-structural measures include coastal afforestation, public awareness, etc. (Paul and Rashid, 2016).

2.3   Cyclone Disaster Management in South Asia

Tropical cyclones are devastating hazards causing losses through high winds, intense rainfall, terrestrial flooding, and storm surges (Peduzzi *et al*., 2012). Previous literature has shown that the number of fatalities caused by cyclones is particularly higher in the Indian

Ocean compared to other regions (Seo and Bakkensen, 2017). The Bay of Bengal is one of the most active areas for the development of tropical low-pressure systems. Although only 8-9% of the global cyclones are formed in the Bay of Bengal, they appear to cause 80-90% of the global cyclonic losses (Chowdhury, 2002; Paul, 2009). The annual distribution of cyclones revealed that the majority of the severe cyclonic storms appeared in the months of May, June, and October (BUET-BIDS, 1993; Rowshan, 1994). Cyclones formed in this region generally move in the northwest direction (NNW) and then curve in an eastward direction making landfall in Bangladesh or Myanmar (Figure 2.2) (Alam and Dominey-Howes, 2015).
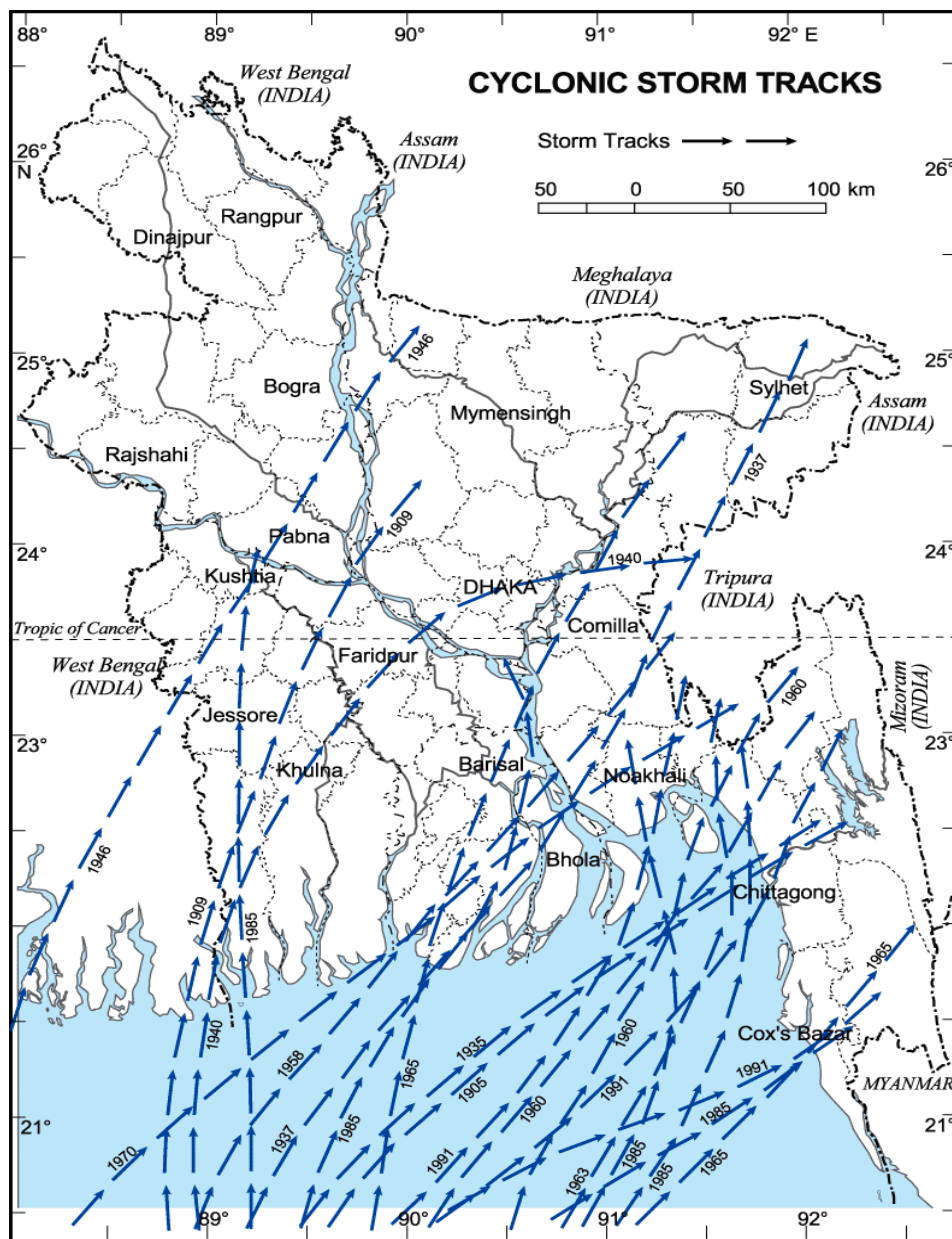
Figure 2.2: Tracks of cyclones in Bay of Bengal (Source: India Met Office)

In India, around 8% of the total area is prone to cyclones (Kar *et al.,* 2007). State-level disaster management authorities are responsible for preparedness, capacity building, and emergency response activities (Rao, 2017; WMO, 2015). At the local level, cyclone warnings are disseminated through radio, television, press release, and SMS-based cyclone alert. In October 1999, a cyclone affected 19 million people in Odisha, with a death toll of nearly 10,000 people. Lack of preparedness and contingency plans, lack of coordination among the authorities, and the inadequacy of Odisha's communication networks at the local level were identified as the reasons for weak response (Thomalla and Schmuck, 2004). Prompt compliance with early warning and evacuation orders was observed before cyclone Phailin (2014), leading to a minimum death toll (Walch, 2018). In recent cyclone Fani (2019), Odisha State Disaster Management Authority (OSDMA) deployed around 1,000 emergency workers and 43,000 volunteers to evacuate nearly 300,000 people to cyclone shelters (The New York Times, 2019).

In Sri Lanka, cyclone Roanu (2016) and cyclone Mora (2017) flooded more than fifteen districts, damaged houses, and caused the deaths of more than 300 people. The need for a proper institutional framework was identified after Indian Ocean Tsunami in 2004. Although disaster management is a shared responsibility, the involvement of the central government is very high (Siriwardana *et al.*, 2018).

In Bangladesh, tropical cyclones with high winds and storm surges hit the country in every three years (UNDP, 2010; Paul and Dutt, 2010; Saha and James, 2017). As seen from Table 2.1, Bangladesh has been struck by a number of cyclones since 1970. About 700 km coastline of the country is exposed to the cyclone, leading to high casualties, tremendous property damage, and disruption of development activities. In addition to the unique geophysical characteristics of the coastline, the socio-economic characteristics of the residents of coastal districts also contribute to their vulnerability to cyclones. Only about 5% of coastal houses are strong enough to withstand the onslaught of the storm surges (Chowdhury *et al.,* 1993). High population density, high poverty rate, the poorly constructed house can be attributed to increased cyclone vulnerability of coastal people (Pomeroy *et al.*, 2006; Paul, 2009).

Table 2.1: List of severe cyclones that occurred in Bangladesh in the last 50 years (1970 to 2019)

Date of Occurrence	Name of Phenomenon	Area of Landfall	Max. Wind Speed (km/hr)	Tidal Surge Height (ft.)	No. of death (approx.)
23.10.1970	Severe cyclonic storm	Barisal	163	_	
12.11.1970	Severe cyclonic storm (Bhola Cyclone)	Chittagong	223	10-33	500,000
28.11.1974	Severe cyclonic storm	Cox's Bazar	163	9-17	200
24.05.1985	Severe cyclonic storm	Chittagong	154	15	11,000
29.11.1988	Severe cyclonic storm	Khulna	160	2-14.5	5,708
29.04.1991	Severe cyclonic storm (Cyclone Gorky)	Chittagong	225	12-22	140,000
02.05.1994	Severe cyclonic storm	Cox's Bazar	220	5-6	400
19.05.1997	Severe cyclonic storm	Sitakunda	232	15	126
27.09.1997	Severe cyclonic storm	Sitakunda	150	10-15	
20.05.1998	Severe cyclonic storm	Chittagong	173	3	
15.11.2007	Severe cyclonic storm (Cyclone Sidr)	Khulna-Barisal coast	223	15-20	3,406
25.05.2009	Cyclonic storm (Cyclone Aila)	Khulna coast	70-90	4-6	113
16.05.2013	Cyclonic storm (Cyclone Mahasen)	Noakhali-Chittagong	100	_	17
30.07.2015	Cyclonic storm (Cyclone Komen)	Chittagong-Cox's Bazar	65	5-7	03
21.05.2016	Cyclonic storm (Cyclone Roanu)	Barisal-Chittagong	128	4-5	26
30.05.2017	Cyclonic storm (Cyclone Mora)		120		09
04.05.2019	Severe cyclonic storm (Cyclone Fani)	Odisha coast, Puri	250	5	42 (India), 17 (Bangladesh)
09.11.2019	Severe cyclonic storm (Cyclone Bulbul)	West Bengal	167	11	25 (Bangladesh)

(Source: Ahamed, 2011; BNUS, 2017; GoB, 2017; CPP, 2018; GDACS, 2019)

2.4 Previous Literature on Cyclone Management in Bangladesh

Numerous research works have been conducted focusing on its impacts on the community. The literature on cyclones has been divided into five categories depending on different aspects of cyclone management:

2.4.1 Cyclone Vulnerability and Adaptation: The vulnerability of the coastal population to cyclones and consequent storm surges have been addressed by many researchers (Haque and Blair, 1992; Ali, 1996; Huq *et al.,* 2010; Hoque *et al.*, 2019). Indigenous knowledge and cyclone prevention strategies can significantly reduce the vulnerability of population (Paul and Routray, 2011, 2013). Socio-economic factors, such as social status, political influences, and economic conditions exacerbate vulnerability, and multi-faceted disaster risk reduction strategies are required to target different vulnerability factors and their root causes (Kulatunga *et al.*, 2014).

2.4.2 Early Warning Dissemination: After the devastating cyclones of 1970 and 1990, the warning system of Bangladesh has undergone major improvements (Chowdhury *et al.*, 1993). The establishment of a well-structured warning system has contributed significantly to reduce the number of deaths in the later cyclones (Akhand, 2003; Paul, 2009; 2014; Neumann *et al.,* 2015). Studies have reported the presence of significant variation in two consecutive warnings and a lack of reliable forecast, which often created confusion among the people at risk (Paul *et al.*, 2010; Ahsan *et al.*, 2020). Cyclone warnings need to be more simplified and specific about the estimated time of landfall to support timely evacuation (Bern *et al.*, 1993).

2.4.3 Evacuation to Cyclone Shelters: Key variables responsible for a positive evacuation decision include hazard warning system, the credibility of the warning system, perceived personal risk, logistics for evacuation, and the socio-demographic characteristics of the population (Perry, 1979). During cyclone Gorky (1991) and Sidr (2007), repeated false cyclone warning, inadequate cyclone shelters, poor maintenance of shelters, distance to the nearest shelter, and fear of security of their households were mostly responsible for non-compliance to evacuation orders (Haque, 1995; Paul *et al.*, 2010). Socio-cultural reasons, such as superstitions and social customs for women in rural coastal areas, greatly influence evacuation decision-making (Paul and Rahman, 2006; Ahsan *et al.*, 2016)

2.4.4 Recovery and Community Resilience to Cyclones: In Bangladesh, post-disaster recovery is a non-linear and time-consuming process that requires multidimensional

approaches from both government and non-governmental sectors (Alam and Rehman, 2019). Studies have recognized the determining attributes of community resilience and recovery, such as- the role of informal institutions (Uddin *et al*., 2020), social networks and bonding (Islam and Walkerden, 2014;), the contribution of local government (Islam *et al*., 2017), and coordination with NGOs at the local level (Sadik *et al.,* 2017). Social safety nets for short-term recovery and livelihood diversification for long-term recovery have become vital in coastal Bangladesh (Mallick *et al*., 2011; Paul and Routray, 2011; Kamal, 2013). However, Mahmud and Prowse (2012) have investigated the nature and patterns of corruption in various cyclone recovery and relief efforts after cyclone Aila (2009).

2.4.5 Cyclone Preparedness and Mitigation: Researchers have addressed the establishment of community-based volunteers (CPP) as a significant contributing factor in early warning dissemination (Chowdhury *et al.,* 1993; Paul *et al*., 2010). Cyclone mitigation and risk reduction measures mainly include the construction of new embankments and roads, rehabilitation of existing embankments, plantation of trees along the coastal belt, and the development of an effective early warning system (Khalil, 1992, Akter, 2020).

2.5 Inter-organizational Network Analysis in Disaster Management

2.5.1 Historical Development of Network Analysis Concept

Network analysis has a long and complex approach in many research disciplines, including sociology, public health, stakeholder influence, disease modeling, policy development, anthropology, and disaster management (Sparrow, 1991; Rowley, 1997; O'Donnell *et al.*, 2001; Luke and Harris, 2007; Dube *et al.*, 2009). The concept of network analysis somewhat followed a step-wise development with new ideas building on existing works. Significant milestones in the development of the concept are depicted in Table 2.2.

Table 2.2: Major milestones in the development of network analysis concept

Serial No.	Year/ Century	Work description on network analysis
1	18th Century	European mathematician Leonhard Euler used a visual representation of a network of bridges and rivers in Konigsberg. He invented graph theory as one of the foundations for network analysis.
2	1800 to Early 1900s	Comte and Simmel provided early ideas for studying social connection and social structure. Eiler Sundt studied the formation of social circles among the Norwegian farmers.

3	1920-1929	John Guare's plays, *Six Degrees of Separation* showed one of the first demonstrations of the network approach to discover essential characteristics of the natural world. Educational psychologists published a number of studies reporting on characteristics of social ties such as influence, interaction, and companionship.
4	1934	Psychiatrist Jacob L. Moreno developed a new way of representing relationships on paper, called a "sociogram," which was a drawing with points representing people connected by lines representing interpersonal relationships.
5	1959	Network analysis became more evident in the fields of sociology and anthropology. Mathematicians Paul Erdos and Alfred Renyi proposed one of the first formal network models. They found that the larger the size of the network, the fewer connections between network nodes were needed.
6	1970	Sociologist Mark Granovetter proposed a network model that accounted for some basic truths about human social ties. It helped to develop a realistic model of network structure.
7	1977	The professional association for social network analysis was founded- The International Network for Social Network Analysis (INSNA). Development and availability of software packages, including UCINET and Pajek was one of the major successes.
8	20th Century	Large and growing literature on the importance of social network theory and methods to the application of disaster research is seen. This work includes the study of communication networks during disaster, effects and importance of social support during and after disasters, and the importance and multifaceted effects of social networks on disaster relief and management.

(Adopted from Luke and Harris, 2007; Almquist et al., 2017)

In recent years, the increasing number of organizations in the institutional setup of countries has made the network analysis concept more necessary. Network analysis thus provides disaster management with a new way of answering important questions related to organizational relationships during disasters and emergency response activities.

2.5.2 Application of Network Analysis in the Disaster Events of Different Countries

After catastrophic events, the formal structure of operation, including the functioning of existing support networks, communication networks, and other infrastructures are often disrupted, as seen from previous incidents of South-Asia Tsunami (2004), Hurricane Katrina (2005), the Great Japan Earthquake (2011), etc. (Almquist *et al.*, 2017). At times of emergencies, collective action is required among public, private, and nonprofit organizations towards mitigating the adverse consequences (Waugh, 2004; Wang, 2012).

Inter-organizational networks in emergencies play a vital role in facilitating the flow of information across organizational boundaries (Kapucu, 2005). Therefore, network analysis

can be conducted to determine the pattern of relationships among different organizations that interacted within a disaster response system. Social Network Analysis (SNA) is a well-developed area of organizational sociology that provides tools and concepts for analyzing organizations as networks. SNA is employed in existing disaster management systems for studying the coordination among stakeholders and detecting potential communication risks in times of disasters. Thus, it can reveal the characteristics, composition, and structure of existing networks (National Research Council, 2009).

Recently there has been growing literature on the importance of network analysis and its application in disaster research. Research works have addressed issues of communication networks during the disaster (Kapucu, 2006; Butts *et al.*, 2007; Smoth and Simpson, 2009; Ran, 2011), the importance of social networks on disaster relief management (White *et al.*, 2009; Hamra *et al.*, 2012), the evolving network of a disaster-hit community (Misra *et al.*, 2012) and inter-organizational coordination in disaster response systems (Comfort and Zagorecki, 2004; Comfort and Kapucu, 2006).

The inter-organizational response to major catastrophic events has been recognized by many researchers. Kapucu (2005) has explored the inter-organizational network in response to the *World Trade Center attack (2001)* and found that interactions among the organizations are limited and have primarily occurred between organizations of similar type from the same jurisdiction. FEMA and New York City Government/Mayor have been identified as most influential in response operations.

Findings from *Hurricane Katrina (2005)* have revealed a moderate level of interaction among the responding actors. The inter-organizational network of the hurricane involves a smaller portion of nonprofit organizations, while a significant share of the response network belongs to the public organizations (Comfort and Haase, 2006; Kapucu *et al.*, 2010).

An inter-organizational network study on *ChiChi Earthquake (1999) and Typhoon Marakot (2009)* in Taiwan has revealed that public organizations have possessed a central role in the disaster response system. In contrast, nonprofit and private organizations have worked with their own close groups instead of connecting with the core response network. According to the study, the major proportion of the transactions has been involved in emergency response, damage assessment, and fund-raising activities (Wang, 2012).

In response to the *Haiti earthquake (2010)*, there are many isolates in the response network that are not connected to any other organizations. Water, Sanitation, and Hygiene (WASH)

and UNICEF, closely followed by World Food Programme (WFP), are among the top key entities (Scheinert and Konstantinova, 2011).

In the *Tohoku-Oki Great Japan disasters (2011),* it has been seen that in contrast to the plans which have designated primary responsibilities in disaster response to the public authorities, private and nonprofit organizations have consisted nearly half of the organizations responding to the massive event. The overall, as well as separate centralization measures of the networks, are very low, which indicates a highly-decentralized network of response organizations during the first three weeks of the disasters (Comfort and Okada, 2011; Comfort *et al.*, 2013).

World trade center attack (2001)

Hurricane Katrina (2005)

Typhoon Marakot (2009)

Haiti Earthquake (2010)

Figure 2.3: Network diagram of major disasters in the 20th century (Source: Kapucu, 2005; Comfort and Haase, 2006; Wang, 2012)

Social network analysis of *Australian floods (2010-2011*) has identified local authorities, political personalities, social media volunteers, media reporters, and people from nonprofit, humanitarian, and community associations as influential players during the Queensland flood (Cheong and Cheong, 2011). Results from a Twitter-based emergency management-related organizational analysis of *Colorado Wildfire (2017)* have denoted that federal agencies like FEMA, Centers for Disease Control and Prevention, Department of

Homeland Security, etc. are among the most critical players in this network (Almquist *et al.*, 2017).

Although these studies may differ in terms of their methodology and coverage (Table 2.3), findings from the studies have signified that networks emerging in response to disasters consist of a large number of organizations varying in their scale, size, extent, and scope.

Table 2.3: Methodological review of network analysis for major disasters

Disaster	Data collection	Data analysis	Reference(s)
World Trade Center Attack (2001)	Interviews with selected public and nonprofit managers were conducted. A stratified random sampling method was used to construct a sample of organizations.	Used the UCINET 6.0 social network analysis program and measured the length and number of pathways.	Kapucu, 2005
Hurricane Katrina (2005)	Content analysis of news reported in the *Times Picayune,* the major New Orleans newspaper that continued publication throughout the disaster.	Used UCINET to characterize the response network and identified centrality values.	Comfort and Haase, 2006; Kapucu *et al.*, 2010
Typhoon Marakot (2009)	Document review, content analysis of news articles in the *United Daily* and semi-structured key informant interview.	Identified organizations involved and the evolution of their interactions.	Wang, 2012
Haiti Earthquake (2010)	Data from UNOCHA situation report and interviews with key managers.	Data analyzed using UCINET and ORA software to identify networks across the period of the first three weeks following the earthquake.	Scheinert, and Konstantinova, 2011
Great Japan Disaster (2011)	Content analysis of news articles reported in the Yomiuri newspaper over a period of three weeks and validation through a semi-structured interview.	Data analyzed using ORA software to identify key organizations in earthquake, tsunami, and nuclear explosion.	Comfort *et al.*, 2011
Australian Flood (2010-11)	Content analysis from Twitter with 1684 tweets.	Identified important and effective players during Queensland flood through social network analysis (SNA).	Cheong and Cheong, 2011
Colorado Wildfire (2017)	Online organizational activities observed from Twitter.	Employed dynamic network logistic regression modeling approach to uncover the mechanisms.	Almquist *et al.,* 2017

2.5.3 Applicability of Network Analysis in the Disaster Management Sector of Bangladesh

In Bangladesh, limited research works are available that have applied social network analysis in evaluating the relationships among different social entities. Available research works are conducted mainly in the sectors of public health and rural network assessment (Gayen and Raeside, 2010; Emch *et al.*, 2012; Rotberg, 2013; Uddin *et al.*, 2017).

Considering the high vulnerability of Bangladesh to both natural and human-induced disasters, network analysis can be established as a methodological tool to examine the patterns of interactions among organizations at different levels of disaster management. Previous experiences from cyclone Sidr (2007), cyclone Aila (2009), Rana Plaza collapse (2013), etc., showed a lot of mismanagement in their emergency response and post-disaster activities. For example- findings from cyclone Aila have revealed that there was negligence as well as bribery and misuse of resources in the post-disaster interventions (Mahmud and Prowse, 2012). The organizational framework of the disaster management system of Bangladesh places significant responsibility of emergency response and rehabilitation on upazila, union, municipality, ward level disaster management committees (DMC) (SOD, 2019). During cyclone Sidr (2007), union DMC was mostly found inactive. A post-disaster survey by JICA revealed that about 80% of people have no perception about the union DMC, and some UP members don't even know about the existence of such a committee in their union (JICA, 2008). Therefore, actual response operations often do not match with the actions mentioned in the policies. Studies on individual systems will only focus on the performance of individual processes and structures, thus failing to address the connections and cascading effects on the overall system. An integrative approach to analyze the interdependencies in interconnected systems is essential for effective disaster response (Fan *et al.*, 2018).

Cyclones are recurrent events of Bangladesh. In this context, conducting multi-organizational network analysis is crucial since it will assist in finding areas of improvement for effective cyclone disaster management. Data sources (primary and secondary), data analysis tools, etc., can be readily available to analyze. By identifying the fundamental role and linkages of local organizations, they can be systematically guided for better performance. The chain of command can be determined during an actual disaster event, and the possible discrepancies can be examined.

2.6   Legislative Framework of Cyclone Disaster Management in Bangladesh

Disaster management in Bangladesh has gone through significant reform since independence in 1971. Since the devastating flood in 1988 and cyclone in 1991, the conventional disaster management model focusing on relief and rehabilitation has been converted into a more holistic model, where the processes of hazard identification and mitigation, community preparedness, integrated response efforts, and recovery are planned for and undertaken continuously within a risk management context (GoB, 2010; Habib *et al.*, 2012; GoB, 2019).

Bangladesh has developed National Plan for Disaster Management (NPDM) (2016-2025), which provides a government-wide framework for the effective integration of disaster management planning and programming focusing on risk reduction and resilience approach across agencies and sectors in Bangladesh. Currently, Disaster Management Act (2012), National Plan for Disaster Management (2016-2025), Standing Order on Disasters (2019), and other DRM-related laws and codes constitute the center of Bangladesh's national disaster management regulatory framework. Disaster Management Act (2012) provides the legal mandates for government agencies and non-government actors. Standing Order on Disasters (SOD), first developed in 1997, the revised in 2010, and later on 2019, clearly outlines the responsibilities of public representatives, ministries, agencies, and non-governmental organizations related to cyclone disaster management.

2.7   Institutional Framework of Cyclone Disaster Management in Bangladesh

The government has established an elaborate disaster management committee that ranges from National Disaster Management Council at the national level to Union/Ward Disaster Management Committee at the field level, as shown in Figure 2.6.

National Level Organizations:

National Disaster Management Council (NDMC): NDMC is the highest committee to deal with crisis which includes the Prime Minister as Chairperson. NDMC is responsible for policymaking and formulation of strategies for disaster risk reduction and emergency response management. After cyclone formation and direction are confirmed, meetings of government officials of IMDMCC and NDMC are conducted to ensure that preparedness measures are taken as listed in the SOD.

Ministry of Disaster Management and Relief (MoDMR): MoDMR is the central national agency for disaster risk reduction. It maintains coordination with NDMC, IMDMCC, and other ministries that have disaster management related mandates.

Department of Disaster Management (DDM): DDM provides technical assistance at national and local levels, including the city corporation, municipality, district, upazila, and union on risk analysis and production of risk reduction actions plan and their implementation. It also communicates with different governmental organizations, development partners, aid agencies, NGOs, and voluntary agencies and ensures coordination and cooperation among the organizations on all disaster risk management related issues (GoB, 2019).

Bangladesh Meteorological Department (BMD): In weather forecasting, BMD is responsible for the monitoring of sea conditions, provision of weather information to concerned authorities, and issuance of cyclone warnings using the government warning signal system. Storm Warning Center (SWC) of BMD disseminates the signals to the radio, television, MoDMR, AFD, and CPP offices (BMD, 2007; GoB, 2010).

Armed Forces Division (AFD): AFD also plays a vital role in managing large-scale natural or man-made disasters of Bangladesh. During Cyclone Sidr (2007), Army, Navy, and Air Force together immediately launched a massive search and rescue and early relief operation (GoB, 2008).

Regional and Local Level Organizations:

Disaster Management Committees (DMCs): Disaster management committees at city corporation, district, municipality, ward, upazila, and union are responsible for the operation and coordination of preparedness, response, rescue, and recovery activities in disaster-affected areas. Functions of District Disaster Management Committee headed by District Commissioner, Municipality/Municipality Ward Disaster Management Committee headed by Mayor/ Councilor, Upazila Disaster Management Committee headed by Upazila Nirbahi Officier (UNO) and Union Disaster Management Committee headed by Chairman are particularly important as per the regulations of SOD (GoB, 2019).

Cyclone Preparedness Programme (CPP):

Cyclone Preparedness Programme is run by two bodies at the national level - i) Policy Committee headed by the Honorable Minister, MoDMR, and ii) Implementation Board

(CPPIB) headed by the Secretary, MoDMR. CPPIB meetings are held twice a year or when the cyclone warning signal number exceeds 4. After warning signals are sent to communities, CPP mobilizes its local volunteers, who immediately began implementing a community-based warning system utilizing megaphones and other devices (GoB, 2019).

2.8 Cyclone Management in Bangladesh through Cyclone Preparedness Programme

Cyclone Preparedness Programme, a unique institutional arrangement with more than 55,000 volunteers, is the most vital organization for field level disaster response activities in Bangladesh. The goal of CPP is to minimize loss of lives and properties in cyclonic disasters by strengthening the capacity in disaster management of the coastal people of Bangladesh.

2.8.1 Formation of CPP

From 1960-1965, nine cyclones hit the coastal areas of Bangladesh, killing over 50,000 people. The concept of cyclone preparedness activities was first developed in 1965 when Bangladesh Red Crescent Society (BDRCS, then called Bangladesh Red Cross) requested the International Federation of Red Cross and Red Crescent Society (IFRCS, formerly known as the League of Red Cross) to support the establishment of a warning system for the coastal people of Bangladesh. In 1966, IFRCS and Swedish Red Cross started a pilot scheme for cyclone preparedness. Activities under the pilot scheme included the provision of warning equipment such as transistor radio, siren, etc., and training of local Ansars as the backbone of the warning and dissemination activities. The strategy was to use the prevailing structure at the village level instead of creating a new and parallel structure. From 1966, the Cyclone Warning System was operational in 299 locations and supported by 473 team leaders.

After the devastating cyclone of 1970, the United Nations General Assembly (UNGA) mandated the IFRCS to take the lead role in establishing and improving the pre-disaster planning programme of Bangladesh. With the support of the IFRCS, Bangladesh Red Crescent Society undertook an extreme evaluation of the existing programme and developed a new strategy. Cyclone Preparedness Programme (CPP) was established with the Swedish Delegate of IFRCS and five employees of BDRCS in June, 1971. Initially, CPP was established in five districts (Chittagong, Coxs Bazar, Noakhali, Barisal, Patuakhali) with 20,430 volunteers in 195 Unions of 28 Upazilas (sub-districts) and a

wireless High Frequency (HF) network linking 22 coastal stations to the headquarter in Dhaka.

In June, 1973, following the establishment of a new programme management structure, the International Federation decided to withdraw field level activities of CPP and requested the government to take over the responsibility of the project. Considering the importance of the programme and the interest of coastal people, the government came forward and took responsibility of the programme by deciding to continue it with effect from July 01, 1973. As a result, CPP appeared as a joint venture between the Government of Bangladesh and the Bangladesh Red Crescent Society (BDRCS). Since 1972, the CPP operational areas have expanded, and currently, the CPP covers 13 districts in the coastal areas. As a well-recognized and proven method of saving lives, CPP is part of the National Disaster Management Plan and a BDRCS core activity in Disaster Risk Reduction (DRR) of Bangladesh (Rashid, 1997; Amin, 2012; Habib *et al.*, 2012; Irfanullah and Miah, 2015; Khan, 2017).

2.8.2 Organizational Structure and Management Committee

The Head office of CPP is located at Bara Mogbazar, Dhaka. Under the head office, there are seven zonal offices. Each zonal office has some Upazila offices, each Upazila office is divided into some Union offices, and lastly, each Union office is divided into some units.

Unit Committee: At the unit level, ten male and five female volunteers are recruited from the respective unit with the popular support of the villagers. Unit members elect one of their members as Unit Team Leader and another one as Deputy Unit Team Leader. This committee has five groups named as- Warning Signal, Shelter, Rescue, First Aid, and Relief. Each group consists of two male and one female volunteer. Unit Team Leader holds the post of 'warning signal' and is the chairman of the unit committee. Each unit serves 1 to 2 villages with an approximate population of 2 to 3 thousand.

Union Committee: All the unit team leaders of a union elect a Union Team Leader and a Deputy Union Team Leader in the respective union. Union Team Leader is the chairman of the union committee, and all unit team leaders are members of the union committee.

Upazila Committee: Upazila committee consists of upazila team leader, Deputy Upazila Team Leader, and all the union team leaders of a upazila under the leadership of upazila officer.

2.8.3 CPP in Standing Order on Disasters (SOD 2019)

Standing Orders on Disasters (SOD) specifies the functions of each concerned Government Ministry, Division, Department, and Agency, including the specific function of the Cyclone Preparedness Programme (CPP). Table 2.4 lists the various actions to be taken at different stages by CPP Head Office and field-level office according to SOD (2019).

Table 2.4: Roles and responsibilities of CPP Head Office and Field Offices as per SOD (2019)

Type of Functions		CPP Office	
		CPP Head Office, Dhaka	**CPP Field Office**
A) Risk Reduction Functions		• Integrate DRR into policies, plans, and programs of CPP • Coordinate with national level committees • Arrange training for CPP staff and volunteers • Send proposals to ministry for area expansion of CPP • Prepare a database of CPP volunteers and publicize it • Make people aware of safety of vulnerable population.	• Appoint a Focal Point to participate in all the Disaster Management Committee meetings at the local level • Participate in the preparation of local level disaster risk and vulnerability assessment maps and risk reduction action plans of the DDM.
B) Emergency Response Functions	1. Emergency Response Stage	• Arrange cyclone drill each year before the cyclone season • Appoint volunteers and complete their training by April • Update unit, union, and upazila level committees • Establish union and upazila offices and regularly hold meetings • Provide signal dissemination materials to the team leaders and ensure their use • Establish wireless communication between the CPP Head office and upazila office and between upazila office and union office • Instruct local DMCs to assist in the selection of shelters and inform people of the evacuation plans • Create awareness about cyclone signals and undertake preparedness measures through posters, films, meetings, dramas, etc. with the assistance of DDM • Ensure non-stop communication with BMD.	• Regularly arrange cyclone drills in disaster-prone areas • Complete the recruitment and training of volunteers • Make all volunteers aware of the emergency evacuation of vulnerable population groups • Examine the actual stock and condition of the equipment allotted to the volunteer team leader and undertake necessary repairs/replacement • Test the wireless communications system and keep it active to maintain communication with CPP Head office and upazila and union offices • Undertake awareness activities so that different warning signals are understandable for people • Mark the shelter places, Mujib Killas, and elevated ground, and make them usable, and conduct campaigns to make people aware of the evacuation plan.

	2. Alert/Warning Stage	• Establish a control room in the CPP Head Office and regional offices • Establish close communications with the BMD and DMIC • Send special weather bulletins from BMD to regional offices • Instruct the CPP volunteers to listen to daily radio news • Establish communications with union team leaders through radio or liaison volunteers • Inform the Chairman of the CPP Implementation Board and members about updated information on the cyclone • Delivery warning messages to concerned authorities.	• Establish a control room and maintain communications with upazila, union, and CPP Headquarters • Maintain close contact with the BMD and other concerned offices and collect information about the cyclone • Request the local authorities to call emergency meetings • Mobilize CPP volunteers according to contingency planning • Make the people aware about the cyclone warning • Provide the final warning signal to communities using mega-phones, signal lights, and flashlight • Inform the concerned organizations about the actual situation of the disaster.
	3. Disaster Stage	• Coordinate with concerned governmental and non-governmental agencies for CPP activities • Make sure that the development officials and volunteers can perform rescue and first aid services based on need • Instruct the Assistant Director/Deputy-Director to maintain wireless communications with the district headquarters and union group leaders and transmit the damage and loss report.	• Keep the wireless in operation and maintain communication with CPP Head office • Conduct rescue work in coordination with union and upazila authorities • Assist the local administration in distributing humanitarian assistance.

	4. Rehabilitation, Reconstruction, and Recovery Stage	• Instruct all union office leaders to send the preliminary damage and loss report of their respective area to the Development Officer
		• Instruct field level officers to perform the following duties:
		  – Assist in vaccination, prevention, and other healthcare activities;
		  – Participate in rehabilitation activities;
		  – Assist in coordination with the activities of non-governmental agencies.
			• Collect data on damage and loss due to the cyclone, prepare reports and send them to CPP Head Office, Union DMC, upazila, and district administrations
			• Assist the local administration in the burial of dead bodies and animal carcasses
			• Assist in inoculation-vaccination drives and other health measures
			• Participate in the rehabilitation programme with NGOs and other agencies.

(Source: GoB, 2019)

2.8.4 Command Area and Expansion of CPP

The command area of CPP includes 355 unions of 41 upazilas in 13 coastal districts adjacent to the Bay of Bengal (Figure 2.4).
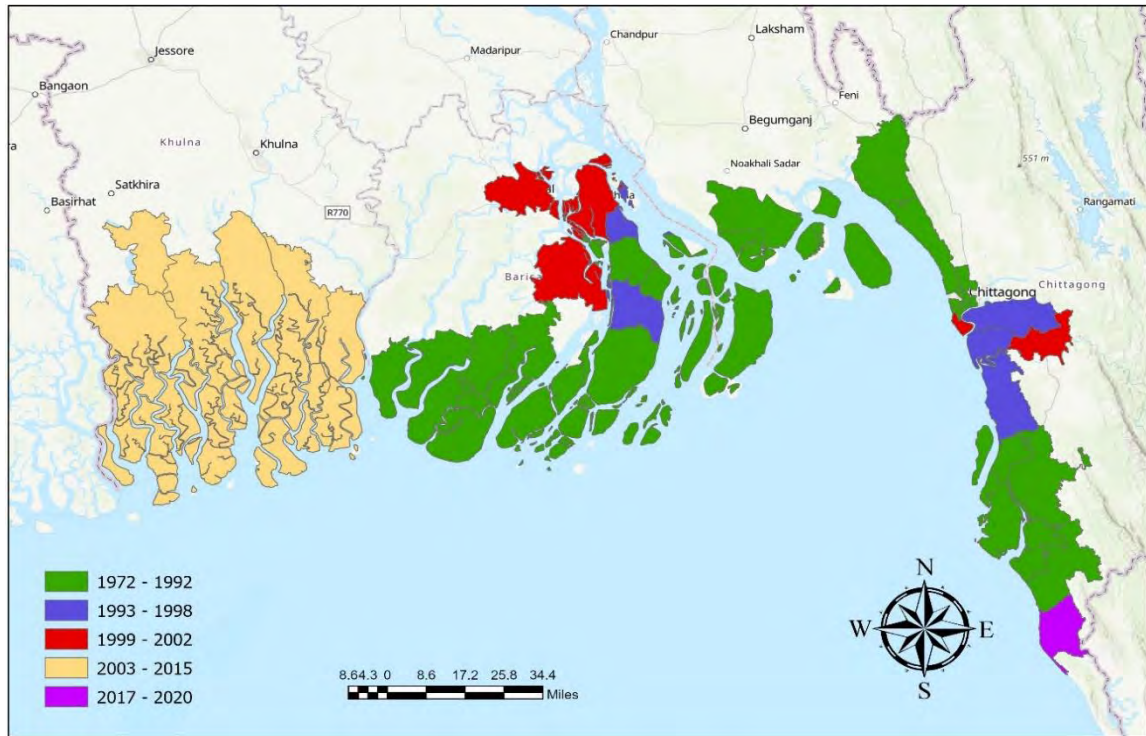
Figure 2.4: Expansion of CPP Command Area (Source: Prepared by Author, 2020)

Expansion of CPP areas was done after major cyclones in 1991 and 2007. After cyclone Sidr (2007), five upazilas and around 5,000 volunteers were included as per the request of the local people with support from the Comprehensive Disaster Management Programme (CDMP). According to the decision of the Policy Committee, CPP was expanded at Dacope, Koyra, Assasuni, Shamnagar, and Mongla upazilas under the districts of Khulna, Satkhira, and Bagerhat districts after cyclone Aila (2009). After the completion of the CPP II (Enhancement of CPP) project in 2013, a report was prepared based on a participatory approach and sent to the Prime Minister's office. Based on the joint recommendation, 393 units were formally included. From January, 2019, one new upazila (Ukhiya) and six new disaster-prone districts were included under CPP (Chandpur, Faridpur, Shariatpur, Madaripur, Jhalkathi, and Gopalganj). Recently CPP activities have been expanded to Cox's Bazar area for Rohingya refugees (CPP, 2019).

2.8.5   CPP Volunteers

The programme has 55,515 trained and devoted volunteers, including 18,505 female volunteers (28%). The number and location of the volunteers are shown in Appendix A. There are some criteria set by CPP to recruit new volunteers. A volunteer must be a permanent resident of the concerned unit, focusing on their sense of belongingness to the area. There are some other requirements in terms of education (at least class VIII pass), age (within 18-30 years), acceptance by local people, and financial solvency (CPP, 2013). In 1991 and 1997 cyclones, 23 CPP volunteers died while informing communities about the cyclone status and evacuation order. During cyclone Sidr, three volunteers died while they were disseminating the early warning signal (CPP, 2019).

2.8.6   Funding and Budget

In the beginning, IFRCS used to provide the operational cost of CPP (equipment, training, transport, etc.), and the administrative costs (remuneration of staff, electricity/ telephone bills, rent, etc.) were covered by the government. After 2006, there was a decrease in donor funds, and IFRCS was unable to support the operational cost. Due to a long-time gap, the government came forward to assist volunteers for their training and equipment supply. The government budget for CPP was around BDT 4 crores until 2015, which increased to BDT 23 crores in 2018 (Figure 2.5) (CPP, 2019).
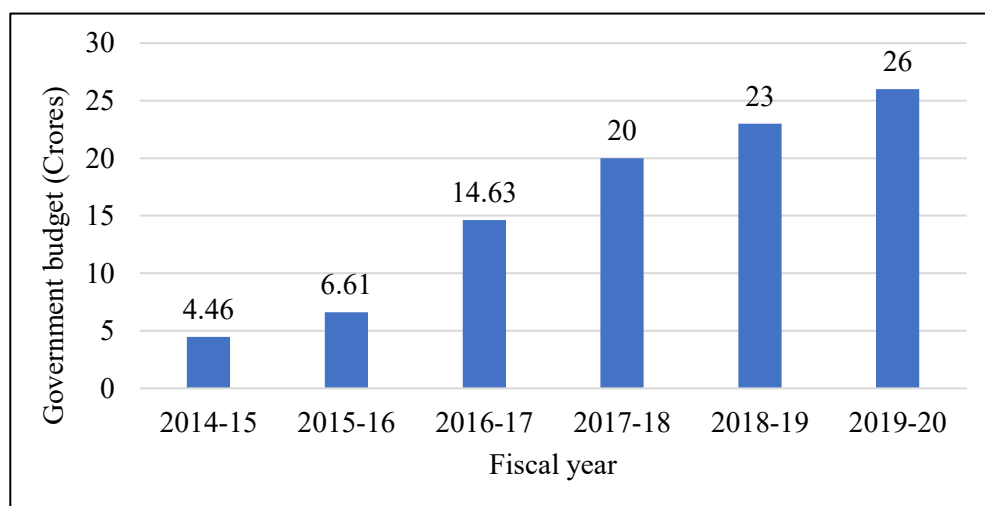
Figure 2.5: Government budget for CPP (Source: CPP, 2019)

2.9   Summary

Network analysis can be conducted for the disaster events of Bangladesh to generate a comparative study of inter-organizational networks. Due to the increasing frequency of

disasters in recent years in Bangladesh, an effective organizational network at all levels of governance should receive due attention from the policymakers. Inability to do so will adversely affect the emergency management process resulting in increased causalities and destruction of properties after disastrous events. In this chapter, a review of literature related to cyclone preparedness, warning, evacuation, and institutional arrangement for cyclone management was conducted. From the review, it was observed that Bangladesh has a long history of experiencing and managing cyclones. Since 1972, the country has developed a well-structured institutional framework for cyclone disaster management. The review of case studies from other countries revealed that most cyclone-prone countries put importance on timely warning dissemination and evacuation to significantly reduce the number of fatalities. Non-compliance to evacuation order, mismanagement of emergency operations, corruption, lack of coordination, etc., were observed in Bangladesh. However, a distinct government body like Cyclone Preparedness Programme, which has a strong network of around 55,515 volunteers in 13 coastal districts, generates a unique world-wide model for cyclone management. CPP mainly focuses on community bonding and participation of local people. Working with both national and local level organizations at different stages of a disaster, it maintains horizontal and vertical connections with a number of other relevant actors.

CHAPTER 3: METHODOLOGY

3.1   Selection of Study Area

The Coastal Zone of Bangladesh covers 19 districts with an area of 47, 201 sq. km, which is about one-third of the total area of the country. Out of 19 districts, 12 districts (i.e., Satkhira, Khulna, Bagerhat, Pirojpur, Barguna, Patuakhali, Bhola, Lakshimpur, Noakhali. Feni, Chittagong, and Cox's Bazar) are considered as 'exposed' directly to vulnerabilities from disasters due to its geophysical and socio-economic conditions (CZP, 2005). This region has experienced at least 20 severe cyclonic storms since 1970 (Paul, 2010). Cyclones generally occur in early summer (April-May) or the late rainy season (October-November).

The main purpose of the research is to analyze the linkages of CPP and other actors in different activities and coastal people's perception regarding field level cyclone management activities. Therefore, the study area of this research is selected considering three factors- inclusion in the CPP command area, the past occurrence of cyclones, and the level of CPP activities in the area.

Selection of Districts

Currently, CPP is active in 40 upazilas of 13 coastal districts in Bangladesh (CPP, 2019). Among them, Patuakhali and Barguna districts are considered high-risk areas for cyclones and have been identified as the worst affected districts by the government during previous cyclones (SCS, 2008; Barua *et al.*, 2016). These two districts were also affected during the recent cyclones, including cyclones Fani and Bulbul (May, 2019). In Patuakhali, at least 17 villages were inundated due to cyclonic tidal surges, and around 30,000 people were moved to cyclone shelters in Barguna district (The Daily Star, 2019).

Selection of Upazilas

The level of CPP activities in different upazilas of these two districts is measured using two ratios- no. of CPP units/ area of the upazila (sq. km) and no. of volunteers/ population. Upazila with the highest and lowest value of CPP units/area ratio and volunteers/population ratio have been chosen as the study area. Therefore, Galachipa upazila under Patuakhali district with the lowest ratios (least active) and Barguna Sadar upazila under Barguna district with the highest ratios (most active) have been selected as study area (Table 3.1).

Table 3.1: Selected upazilas under Patuakhali and Barguna districts

District	Patuakhali			Barguna		
Upazila	Dashmina	**Galachipa**	Kalapara	Amtoli	Pathorghata	**Barguna Sadar**
Area of the upazila (sq.km)	351.87	**1268.37**	491.81	720.75	387.36	**453.38**
Population of the upazila	123388	**361518**	237831	270802	163927	**261343**
No. of CPP units	78	**135**	158	115	103	**146**
No. of CPP volunteers	1170	**2025**	2370	1725	1545	**2190**
CPP units/ sq.km	0.222	**0.106**	0.321	0.160	0.266	**0.321**
Volunteer/ population ratio	0.009	**0.006**	0.010	0.006	0.009	**0.008**

(Source: BBS, 2011; CPP, 2019)

3.2 Involvement of Organizations in Cyclone Management System

3.2.1 Data Collection

To have a better understanding of the inter-organizational linkages, the study employed different data collection methods. Data was collected using both secondary and primary methods through documentation review, content analysis of news reports, and semi-structured interview of key informants

- **Secondary Data Collection**

Documentation Review

The study reviewed and utilized documents published by government organizations, academic institutions, and non-profit organizations. The documents include national policies and regulations, i.e., Standing Order on Disasters (2010 and 2019), special reports on previous cyclones, research project reports, and journal articles. Multiple publications were collected from the CPP head office at Dhaka, which helped to understand the historical background, contribution, and current role of CPP. These documents provide knowledge and information about the institutional and policy framework of cyclone management in Bangladesh. Besides, they supplement the understanding of organizational interactions that occur at different stages.

Content Analysis of Newspapers

Content analysis of newspaper articles, also known as the 'Archival method' is a well-known and widely used method for the collection of network data (Burt and Linn, 1977; Wasserman and Faust, 1994; Comfort and Haase, 2006; Kapucu *et al.*, 2011; Comfort *et al.*, 2013; Varda, 2017). The study reviewed the news reports published in major newspapers of Bangladesh and abroad to analyze the composition of the disaster management system during cyclone Bulbul (November, 2019). News reports on cyclone Bulbul published in recognized newspapers of Bangladesh available online, i.e., The Daily Star, Dhaka Tribune, New Age, as well as international reports, i.e., BBC, The Guardian, were reviewed. The articles collected to study the warning and response system were published between November 06, 2019 and November 20, 2019 considering the two-week time period for emergency response and rescue as followed in the previous research (Wang, 2012; Comfort *et al.*, 2013). For early recovery and long-term rehabilitation, generally, a period of 3 months to 5 years is considered (Shaw and Sinha, 2013). In this study, a period of 1 year was considered since the cyclone occurred around a year ago. For this purpose, articles published from November 21, 2019 to November 21, 2020 were reviewed for recovery and rehabilitation. In the case of preparedness and risk reduction activities, no definite time period was considered. Apart from the warning, response, recovery, and rehabilitation stage of the cyclone, the remaining parts of the year were regarded as the normal phase. Through the review, a collected data was prepared which was used to identify the organizational actors, besides CPP, that were involved at different stages of the cyclone. The list of organizations was used in key informant interviews for validation and identification of the inter-organizational linkages.

- **Primary Data Collection**

Key Informant Interview

Interviews are useful for collecting contextual information and for describing complex interactions that were not reported in newspapers (Marshall and Rossman, 2006). This research conducted interviews with 20 key informants from organizations that were engaged in warning, response, recovery, and rehabilitation activities during and after cyclone Bulbul. The interviews were conducted from December, 2019 to April, 2020. The interviewed organizations were primarily selected from the organizations identified during the review of documents and newspaper articles. After the primary selection of

organizations, this study adopted a 'snowball sampling technique' for the key informant interview (Wang, 2012; Sadik *et al.*, 2018). The process of institutional survey and key informant interview is shown in Figure 3.1. While some organizations were visited in person, many of the key informants were interviewed by phone due to the pandemic situation in 2020. Appendix A.1 shows the representatives of the organizations that were interviewed in the process.

Visited 8 organizations and interviewed 16 key informants

Interviewed 4 key informants from 4 organizations through phone interview
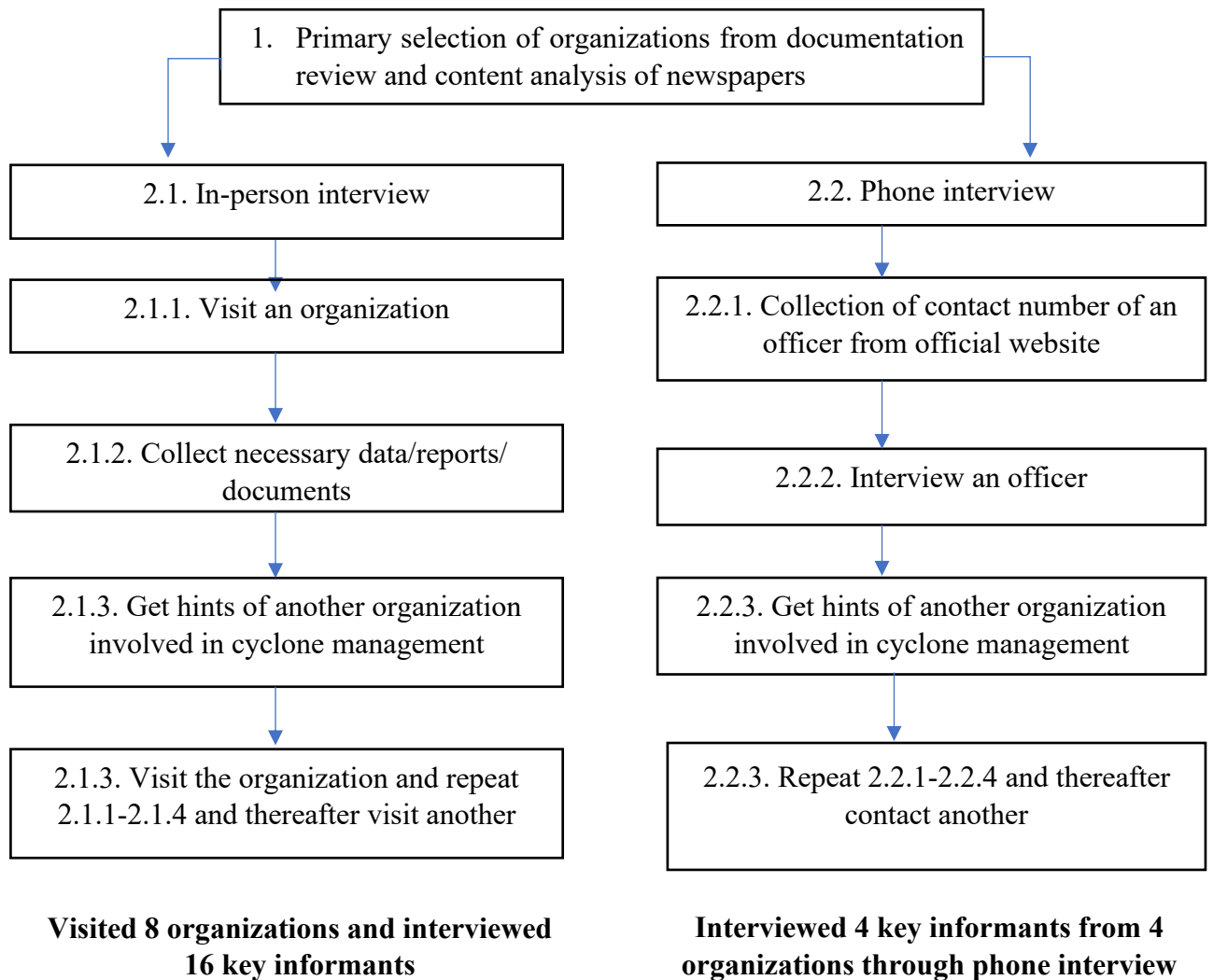
Figure 3.1: Flow chart of the institutional survey and key informant interview

To collect the viewpoints of diverse actors involved in the system, organizations of different jurisdictions and types were interviewed. By directly talking with the decision-makers who participated in the cyclone management system, this research understood the organization's activities, decision-making process, and the factors that influenced the process. Interview with field-level practitioners, i.e., CPP union volunteers, Upazila

Nirbahi Officer, Union Parishad Chairman, etc., enabled the researcher to explore the organizational involvement and existing challenges of the field level activities.

The interviews focused on two areas of inquiry. First, the key informants were asked to explain the essential roles and responsibilities of their organization during and after cyclone Bulbul. Secondly, they were asked to provide the names of the organizations they had interacted with during the process. This way, the linkages they had with different organizations were identified. Appendix A.2 includes the checklist for key informant interviews.

3.2.2 Network Analysis

In complex and turbulent situations, organizations frequently develop formal and informal relationships in order to achieve common goals. In such an environment, understanding the dynamics of inter-organizational networks and patterns of interactions is crucial for policymakers (Gidron *et al.*, 1992). A well-planned network involving multiple organizations can contribute significantly to the resilience of communities exposed to risk. In this study, network analysis was used to identify the relationship patterns among the organizations that interacted within the disaster management system (Wasserman and Faust, 1994).

3.2.2.1 Operational Definitions

- **Actor:** Actors are discrete individual, corporate, or collective social units. Network analysis is concerned with understanding the linkages among these social entities and the implications of these linkages (Wasserman and Faust, 1994).

- **Node:** An individual item, either material or immaterial, such as a real-world item (person, place, tool), a concept or belief (process, procedure, system), or any other unit of interest (a word, event, geological era). A collection of nodes and their attributes is called node set (Altman *et al.*, 2018).

Figure 3.2: Node and links in a network

- **Link/Tie/Edge:** A connection or relation between any two nodes. Any given node may have zero to many links (Altman *et al.*, 2018).

- **Network:** Network is a representation of the links between the nodes. A network consists of a finite set or sets of actors and the relation or relations defined on them. The presence of relational information is a critical and defining feature of a network (Wasserman and Faust, 1994; Kapucu, 2006; Altman *et al.*, 2018).

- **Network Analysis:** Network analysis, derived from graph theory, attempts to describe the structure of relations (links) between given entities (nodes) and applies quantitative techniques to produce relevant indicators and results for studying the characteristics of a whole network and the position of individuals in the network structure (Shih, 2006). Social network analysis (SNA) is the study of complex human systems through the mapping and characterizing of relationships between people, groups, or organizations. It is the process of identifying the relationships and attributes of members, key actors, and groups that social networks comprise (National Research Council, 2009). Relationships can be represented not only as graphs that can be visually inspected but also in the form of matrices, which allow mathematical and computational methods to be employed that summarize and find patterns (Wasserman and Faust, 1994).
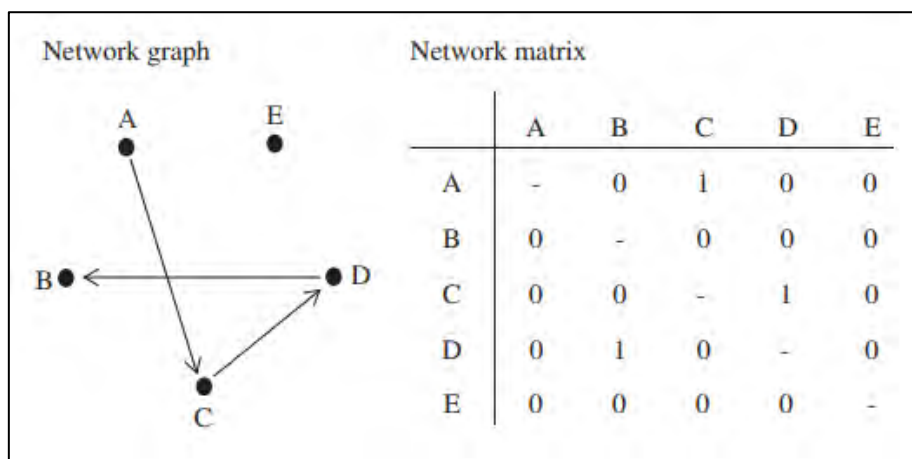
Figure 3.3: A simple graph and matrix (Source: Shih, 2006)

Figure 3.3 shows a simple case for the interactions exchanged among five organizations (labeled A, B, C, D, and E). The graph shows that organization A communicated with organization C, D, and B in sequence; but did not interact with organization E. Based on the graph, the asymmetric matrix of this interaction can be built, where the rows and columns index the organizations in the graph. In the matrix, there is a 1 in the $(i,j)^{th}$ cell (row i, column j) if there is a directed link from i to j, and a 0 in the cell otherwise (Shih, 2006).

- **Network Density:** The density of a network is the proportion of possible links that are actually present in the network. It is calculated as the ratio of the number of actual links to the number of possible links. The possible score of density ranges from 0 to 1. Figure 3.4 shows a group with high density and a group with low density. All points are included in the networks in both graphs; however, the information in the low-density graph can flow through only one route, whereas information in the high-density graph can flow from and to a number of different actors. In an open response system where a large number of organizations are involved, the score of density tends to be low, which does not necessarily imply the low effectiveness of the network (Wasserman and Faiust, 1994; Haythornthwaite, 1996; Wang, 2012).
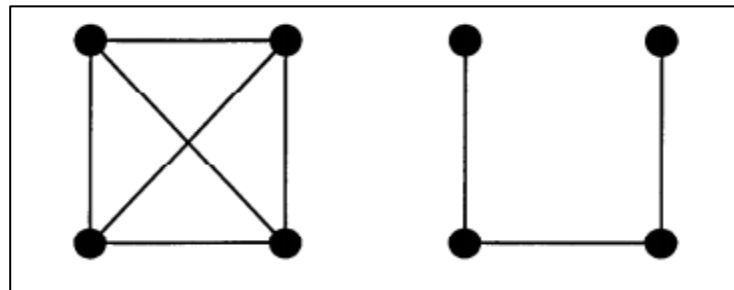
Figure 3.4: A high density and a low-density network (Source: Haythornthwaite, 1996)

- **Network Diameter:** Diameter is a measure used to evaluate the distance between the nodes in a network. Wasserman and Faust (1994) defined diameter as "the length of the largest geodesic between a pair of nodes." The diameter measure reveals how far apart the farthest two nodes in the network are. The maximum diameter of a network could be the number of nodes minus 1, and if the network is completely connected, its diameter is 1.

- **Centrality Measure:** Centrality measures identify the most prominent actors who are extensively involved in relationships with other network members (Figure 3.5). Centrality indicates one type of ''importance'' of actors in a network (Hawe *et al.*, 2004).

- **Degree Centrality:** Degree centrality is the measure that evaluates actors in the network by the number of ties that actors possess (Wasserman and Faust 1994). It refers to the number of interactions that a given organization exchanged with other organizations (Wang, 2012).

High degree centrality means that the node is at the center of the network as a whole or near the center of a local cluster in the network (Oshima *et al.*, 2012). In directed

networks, degree centrality can be distinguished between in-degree and out-degree centrality (Knoke and Burt, 1983). The in-degree centrality ($C_{D,\,in}$) and out-degree centrality ($C_{D,\,out}$) of a given node are formally defined as-

$$C_{D,in}(n_i) = \sum_{j=1}^{l} r_{ij,in}; \quad C_{D,out}(n_i) = \sum_{j=1}^{l} r_{ij,out},$$

where r_{in} and r_{out}, respectively, denote one of the inward and outward connections of node i, and l indicates the number of nodes within the network. In-degree centrality of a node i is the sum of the number of nodes j in the network (1 to l) that connect inwardly (from node j to node i); out-degree centrality of a node i is the sum of the number of nodes j in the network (1 to l) that connect outwardly (from node i to node j) (Shih, 2006).
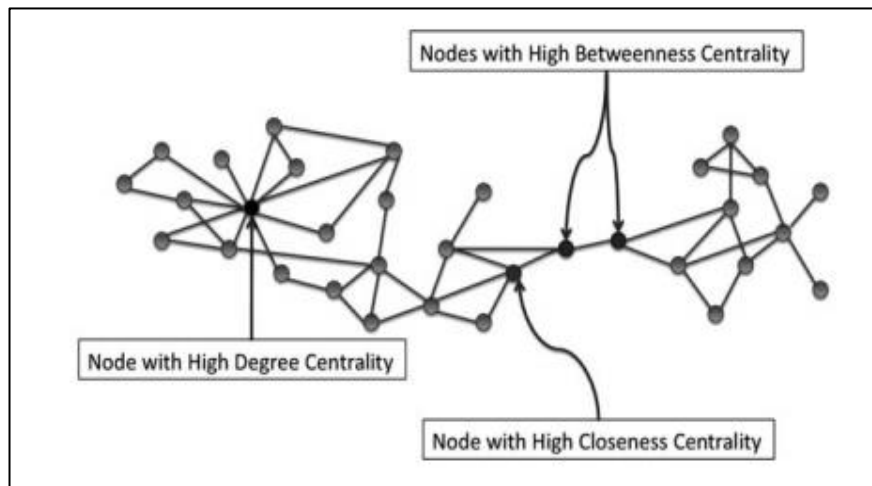
Figure 3.5: Three types of centrality in a network (Source: Oshima *et al.*, 2012)

- **Closeness Centrality:** The measure focuses on how close an actor is to all the other actors in the set of actors. Nodes with high values of closeness centrality are likely to receive information more quickly than others, as there are fewer numbers of intermediaries to reach them (Wasserman and Faust, 1994; Cheong and Cheong, 2011). The closeness centrality (C_C) of a node is defined as-

$$C_C(n_i) = \frac{1}{\sum_{j=1}^{l} d(n_i, n_j)}.$$

Here, the count $d(n_i, n_j)$ denotes the shortest path between nodes i and j. Closeness centrality of a node i is the inverse of the sum of the geodesic distances from node i to all the other nodes in the network (1 to l) (Shih, 2006; Oshima *et al.*, 2012).

- **Betweenness Centrality:** It measures the extent to which a particular node lies between the various other nodes in the set of nodes (Scott, 2000). This betweenness centrality is another global measurement that elaborates the ability of a given node to control interactions between pairs of other nodes in the network. Greater betweenness centrality of an actor also depicts that more actors are dependent on that actor to communicate with other actors (Freeman, 1979; Kapucu *et al.*, 2010).

The betweenness centrality (C_B) of a node is defined as-

$$C_B(n_i) = \sum_{j}^{l} \sum_{k}^{l} \frac{g_{jk}(n_i)}{g_{jk}}, \quad j \neq k \neq i,$$

where g_{jk} denotes the number of shortest paths (paths with minimal number of nodes) between nodes j and k, and $g_{jk}(n_i)$ denotes the number of shortest paths linking the two nodes that pass through node i. Betweenness centrality of a node i is the sum of the node i's estimated probabilities of standing along any shortest path that all pairs of nodes (nodes j and k, excluding node i) in the network have selected (Shih, 2006; Oshima *et al.*, 2012).

3.2.2.2 Data Preparation

It was decided that the linkages will be visualized for three phases of the cyclone: during the disaster phase (warning and emergency response), post-disaster phase (relief and recovery), and normal phase (preparedness and risk reduction). Three matrices of interactions were created to represent the link and communications among organizations. In Microsoft Excel, the matrices were prepared with the name of organizations compiled from both primary and secondary data collection methods. In network theory, these types of matrices are called the 'Adjacency Matrix.' Table 3.2 shows a sample of the adjacency matrix prepared in the research. The rows and columns of the matrix are composed of the same set of organizations, with the row titles representing 'source' and column titles representing 'targets.' Here, the value 0 means no interaction, and 1 means there is an interaction between the two nodes.

An attribute database for the organizations was also created, which contained the following information: the name of the organization, the type of organization, and the level of jurisdiction. All the organizations were classified as belonging to either the governmental sector, NGOs, or joint organizations. The organizations were also divided into four

jurisdiction levels- international, national, regional, and local. Three matrices and the respective attribute tables are shown in Appendix B.

Table 3.2: Adjacency matrix

	Target Organizations					
		MoDMR	BMD	CPP Head office	CPP Zonal office	CPP Upazila office	CPP Union office
Source Organizations	**MoDMR**	0	1	1	1	1	0
	BMD	1	0	1	1	1	0
	CPP Head office	1	1	0	1	1	1
	CPP Zonal office	0	1	1	0	1	1
	CPP Upazila office	0	1	1	1	0	1
	CPP Union office	0	0	1	1	1	0

3.2.2.3 Visualization and Analysis of Networks

Network visualization using modern network software presents network information in a graphic format and allows researchers to view various graphical depictions of networks. These may include data extraction tools, link analysis, statistical techniques, and graph theory techniques using different programs.

This study analyzed and visualized the organizational network of three phases of cyclone Bulbul using the network analysis software ORA, developed by the Center for Computational Analysis of Social and Organizational Systems (CASOS), Carnegie Mellon University. Another software called 'Gephi' was also used for the analysis of structural properties of the network. The network diagrams illustrated a visual representation of linkages and mutual relationships among different organizations that were involved in the cyclone management system. The network analysis results also revealed the interaction patterns present within the systems. Network measures examined include degree centrality, closeness centrality, betweenness centrality, and network density (Wasserman & Faust, 1994). The results were used to identify the characteristics of the networks and their consequent impact on the behavior of the participant organizations.

3.3 Community Perception of Field Level Cyclone Preparedness Programme

After identifying the interactions that CPP and other organizations had with each other, the study assessed the community perception about field level cyclone management activities. The vulnerable coastal community and CPP local volunteers are the ones who have to face the cyclone, suffer its impacts, and take immediate actions to save lives. Therefore, it is crucial to understand their perception of the performance and activities of CPP at the local level.

3.3.1 Focus Group Discussion (FGD)

For FGD, Galachipa Sadar union and Ratandi Taltoli union from Galachipa upazila and Barguna Sadar union and Noltona union from Barguna upazila were selected. These unions were chosen from the upazilas based on previous cyclone experience, accessibility condition and availability of CPP volunteers. Six FGDs were held from 11 December to 15 December, 2019 with the participation of both CPP volunteers and community people who had recent cyclone experiences. The number of participants in the FGDs varied from 6-10 participants depending on the availability of the participants in respective areas. The focus groups involved CPP upazila, union and unit volunteers, team leaders, representatives from community-based organizations (CBO), educational and religious institutions, NGOs, cooperative societies, etc. Two FGDs were held in each upazila with only female respondents.

Some Participatory Rural Appraisal (PRA) techniques which have been applied to know the view of local people are described below:

Venn Diagram

Venn diagram is one of the commonly used PRA methods to study the institutional relationships within a community. This method uses circles of various sizes to represent the institutions and individuals. The diagram also illustrates the direction and intensity of the interaction between institutions and community using different depth arrows (Kumar, 2002). In this study, participants were asked about their involvement in field-level cyclone management activities. The list of field level activities of CPP during emergency response, rescue, relief, and rehabilitation stages were compiled from the documents of Standing Order on Disasters (2010, 2019). The information on the involvement of other field-level

organizations was also collected. In this way, the existing linkages that the coastal community had with CPP volunteers and other organizations were identified.

Process Map

Process maps are generally made to depict the step-by-step process of a production operation (Kumar, 2002). In this research, it was used to focus on the sequence of activities of warning dissemination and evacuation, and sheltering to understand the way local people perceived them. The entire process of warning dissemination and evacuation, and sheltering was discussed to have an in-depth understanding of the process followed during cyclone Bulbul. The sequence of activities and responsible actors were identified through discussion with CPP volunteers who directly carried out the procedures and community members who the volunteers assisted during those processes.

Seasonal Diagram

The seasonal diagram is a PRA technique used for temporal analysis across annual cycles, with months or seasons as the basic unit of analysis (Kumar, 2002). This research used the seasonal diagram to identify and understand the seasonal variation of different activities of CPP, covering both the peak and off-peak seasons for cyclone formation. Season and month-wise variation of CPP activities were discussed with CPP volunteers and community people to recognize the level of activities throughout the year.

SWOT Analysis

A SWOT matrix was developed by the researcher to evaluate the strengths, weaknesses, opportunities, and threats of the study area. Strengths and weaknesses are the internal factors of the area where opportunities and threats are external factors.

Pairwise Ranking

A checklist was prepared with the activities performed by CPP at the local level based on its roles and responsibilities mentioned in SOD (2010,2019). Participants were asked about the specific actions that were practiced during the warning, response, relief, and preparedness phase of cyclone Bulbul. The researcher matched the existing practice with the prepared checklist to find out non-compliance with SOD (Appendix C). Based on the comparison of their responses and the checklist, the researcher was able to identify the problems that exist in the current practice. Then the participants were asked to rank the

identified challenges. Thus, the study compared all the identified problems of the study area through a pairwise ranking matrix. The ranking of problems was obtained from the frequency distribution.

After identifying and ranking the problems through focus group discussion, some strategies were proposed to address these challenges. These proposed strategies were also ranked using the pairwise matrix.

Cause-Effect Diagram

The cause-effect diagram visually presents the cause, effects, and interlinkages, which help to have an in-depth understanding of a particular topic (Kumar, 2002). In the study, the root causes of the identified problems and their effects on the performance of field-level cyclone management activities were identified from focus group discussion with CPP volunteers.

3.3.2   Implementation of Proposed Strategies

The researcher went to CPP upazila office on 13 December, 2019, and CPP Head Quarter on 15 March, 2020 to discuss the identified challenges and proposed strategies. The Director (Operation), Deputy Director (Operation) at CPP Head Quarter located at Mogbazar, Dhaka, and Deputy Director (Barishal Zonal Office) were interviewed during these visits. At first, the existing scenario of the field level cyclone management activities and the causes of the problems as identified by the participants of the FGDs were shared with them. Then they were asked to provide their insights and suggestions regarding the proposed strategies. Based on the discussion, the implementation status of some of the proposals was recognized. Besides, some challenges at the top administrative level were identified were responsible for limiting the functionality of CPP.

3.4   Recommendations for Effective Coordination and Communication in Cyclone Management of Bangladesh

Finally, based on the inter-organizational network and discussions with the community and key informants, the research proposed a few recommendations to address the existing challenges and enhance coordination and communication at all levels. All information and finding are gathered and presented by network maps, tables, and other illustrations to prepare the final report of the research. Figure 3.6 shows the methodological procedure to carry out the research

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                        │        Area         │
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Analysis of Interorganizational Network	Community Perception of Field Level Cyclone Management
Data Collection	**Data Collection**

Secondary Data Collection

- Documentation Review
- Content Analysis of Newspapers

Primary Data Collection

- Key Informant Interview by snowball sampling

Data Preparation

Visualization and Analysis of Networks formed for different stages of Cyclone Management

Primary Data Collection

- Focus Group Discussion

Application of PRA techniques

- Venn Diagram
- Process Map
- Seasonal Diagram
- SWOT Matrix
- Pair-wise Ranking
- Cause-Effect Analysis

Identification of Challenges and Proposed Strategies

Discussion with CPP Officials on Implementation of Proposals

Recommendations for Effective Coordination and Communication at all levels of Cyclone Management

Figure 3.6: Flow chart of the methodological framework

CHAPTER 4: STUDY AREA PROFILE

4.1   Introduction

Galachipa upazila under Patuakhali district and Barguna Sadar upazila under Barguna district are the study areas for this research. Galachipa, the biggest upazila in Patuakhali district in terms of both area and population, became a thana in 1873 and was upgraded to upazila in 1983. It is said that the name of the upazila might have derived from the name of a prominent person of the Magh community of this locality named "Gala-u". Barguna Sadar, the second-largest upazila of Barguna district became a thana in 1904 and was upgraded to an upazila in 1984. Despite having different opinions regarding the origination of the name, the general belief is that the upazila has derived its name from the word "Baragun" which means big rope to pull boats against the strong river current (BBS, 2011).

4.2   Area and Location

Galachipa upazila occupies an area of 1268.37 sq. km. It is located between 21º48´ and 22º21´ north latitudes and between 90º15´ and 90º37´ east longitudes. The upazila is bounded on the north by Bauphal upazila and Patuakhali Sadar upazila, east by Char Fasson upazila of Bhola district and Dashmina upazila, south by the Bay of Bengal and on the west by Amtali upazila of Barguna district and Kalapara upazila (BBS, 2011).
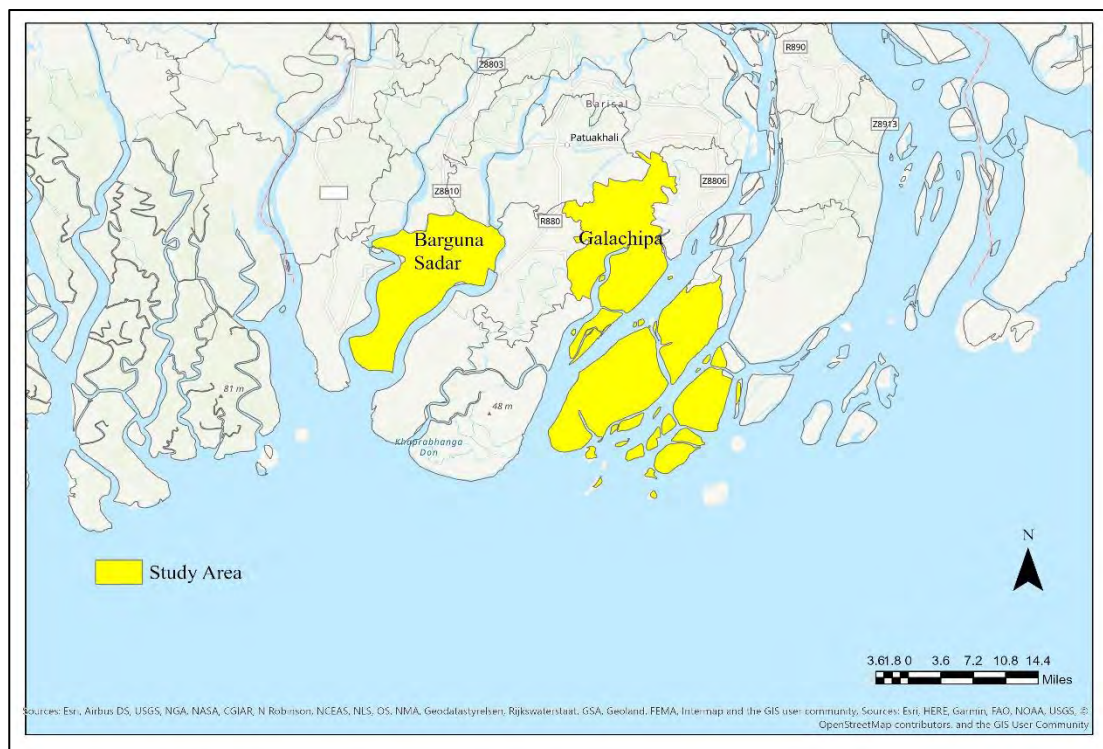
Figure 4.1: Map showing the study area (Galachipa and Barguna Sadar upazila)

Barguna Sadar upazila occupies an area of 454.83 sq. km. of which 8.26 sq. km. is under forest. It is located between 21º58' and 22º15' north latitudes and between 89º59' and 90º14' east longitudes. The upazila is bounded on the north by Mirzaganj upazila and Patuakhali Sadar upazila of Patuakhali district and Betagi upazila, east by Amtali upazila, south by the Bay of Bengal and west by Patharghata upazila and Bamna upazila (BBS, 2011). Location of both upazilas are shown in maps 4.2 and 4.3.

Table 4.1: Administrative features of the study area

Feature	Galachipa Upazila	Barguna Sadar Upazila
Number of Pourashava	01	01
Number of Union	13	10
Number of Mouza	140	53
Number of Villages	227	191

(Source: BBS, 2011)

Patuakhali
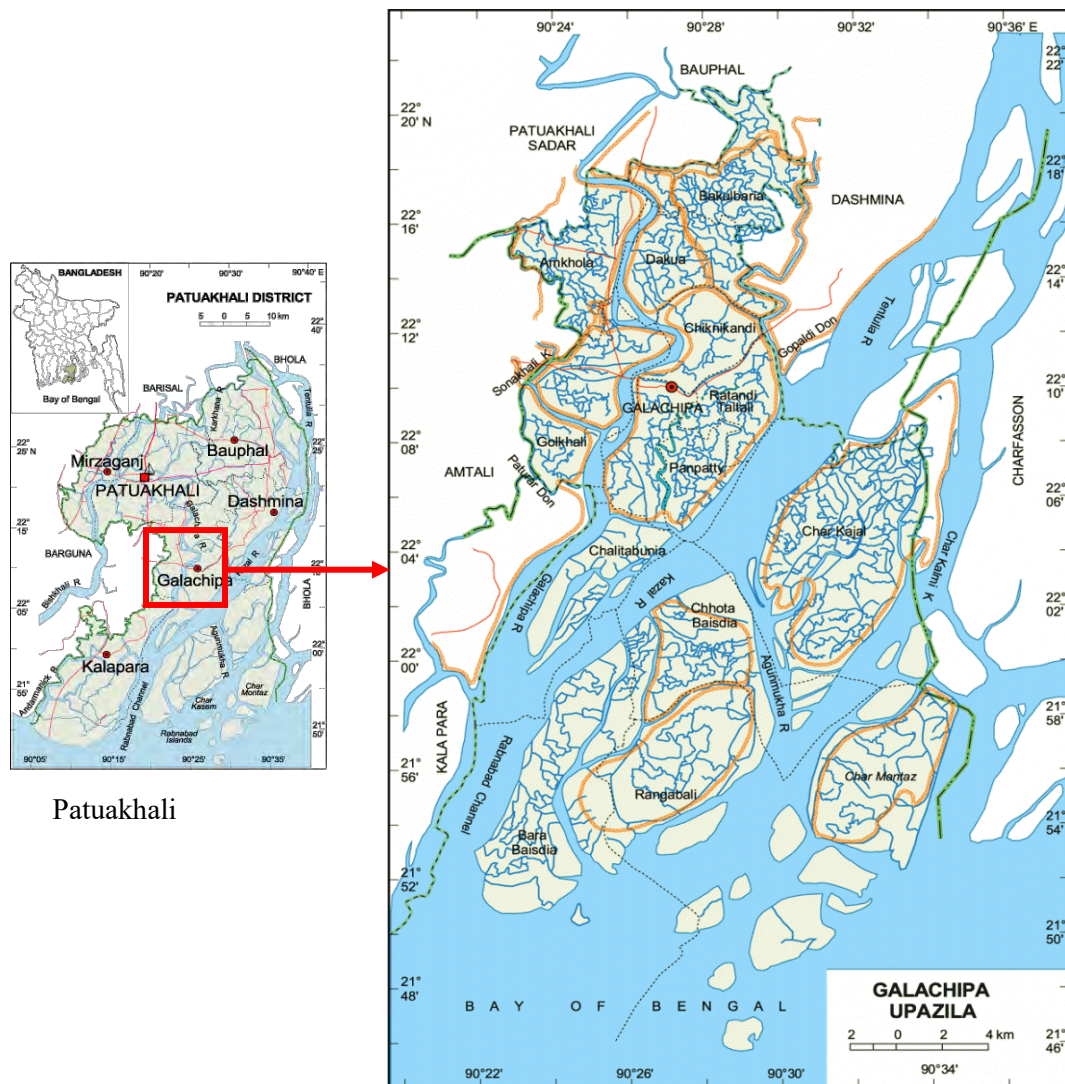
Figure 4.2: Map showing Galachipa upazila and the surrounding regions (Source: http://galachipa.patuakhali.gov.bd, retrieved on February 14, 2020)

Barguna district
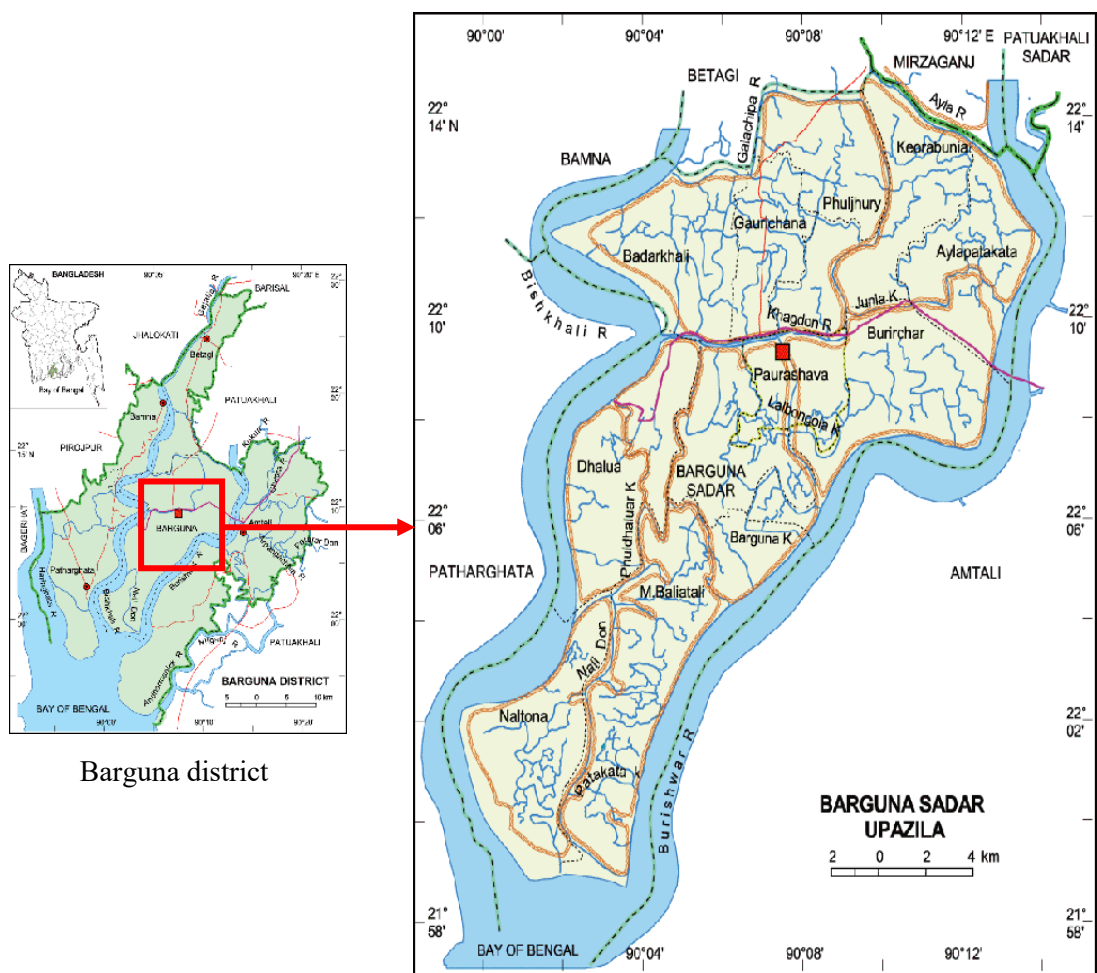
Figure 4.3: Map showing Barguna Sadar upazila and the surrounding region (Source: http://sadar.barguna.gov.bd/, retrieved on February 14, 2020)

4.3   Socio-demographic Information of Study Area

Previous research works have shown that cyclone evacuation behavior can be related to socio-demographic characteristics including age, gender, occupation, household size, education, etc. (Uddin, 2010; Paul and Dutt, 2010; Paul, 2012). Key demographic information of both upazilas are presented in Table 4.2. It reveals that more than half (50.51%) of the population of the study area are female. Most people live in rural areas (90.7%), and only 9.3% of the total population lives in urban areas.

Table 4.2: Demographic features of the study area

Feature	Galachipa Upazila	Barguna Sadar Upazila
Total Population	3,61,518	2,61,343
Density per sq.km.	285	575
Male Population	1,79,652	1,28,580
Female Population	1,81,866	1,32,763
Urban Population	25,917	32,235

Rural Population	3,35,601	2,29,108
Urbanization (%)	7.17%	12.33%
Number of households	80,054	62,086
Literacy rate (%)	44.4%	58.6%
School attendance (%)	50.6%	61.8%
Persons with disability (%)	1.8%	2.1%

(Source: BBS, 2011)

There are similarities between the age group-wise distribution of Galachipa and Barguna Sadar upazila. As seen from Figure 4.4, there is a dominance of age group 0-10 years and 31-50 years in both upazilas. The higher percentage of women, children, and rural population make the study area extremely vulnerable to the impacts of a cyclone.
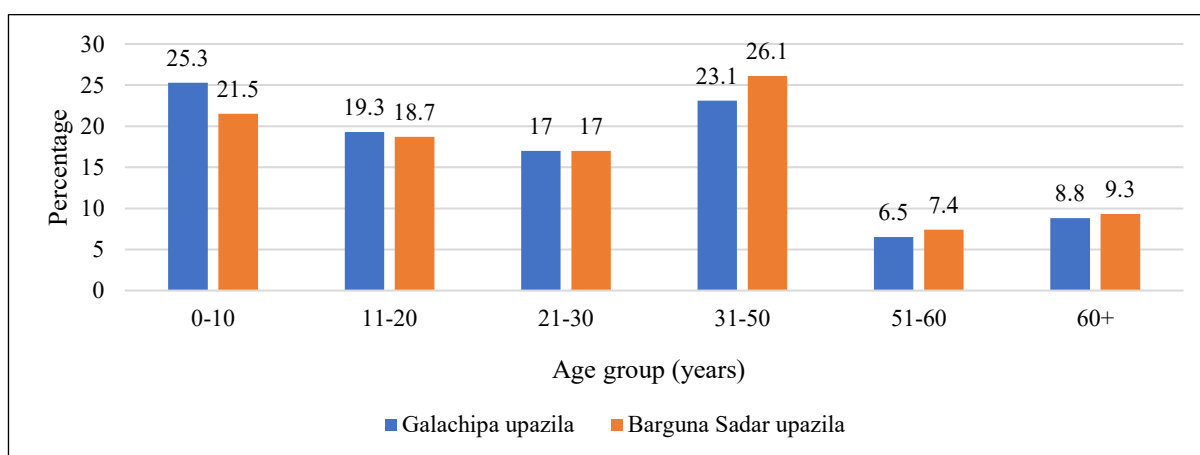
Figure 4.4: Age group wise distribution of population in the study areas (Source: BBS, 2011)

In terms of occupation, main sources of income are from agriculture 68.18%, non-agricultural laborer 4.41%, industry 0.40%, commerce 11.53%, transport and communication 1.19%, service 4.22%, construction 1.23%, religious service 0.25%, rent and remittance 0.18% and others 7.41%. (BBS, 2011; GoB-UNDP, 2017).

4.4 Physical Characteristics of Study Area

4.4.1 Land Use: According to a land use survey undertaken by Sheltech Consultants in 2009, there is a dominance of agricultural land (44%) followed by residential land (37%) and water bodies (10%) in Galachipa upazila (LGED, 2013).

4.4.2 Type of Structures: Cyclone disaster vulnerability can be linked to construction materials of houses. In coastal areas of Bangladesh, houses are constructed primarily of straw, bamboo, and corrugated iron sheets, making them structurally vulnerable to high wind speed and flooding caused by cyclones (Alam and Collins, 2010; Malick *et al.*, 2011).

According to BBS (2011), 83.6% and 89.2% households live in kutcha houses in Galachipa and Barguna Sadar upazila respectively. Around 13.4% of households in the study area lives in "Jhupri" (shanties), which means houses made of very cheap construction materials such as straw, bamboo, chhan (grass), goalpata (leaves) etc. (Figure 4.5).

Galachipa upazila   Barguna Sadar upazila
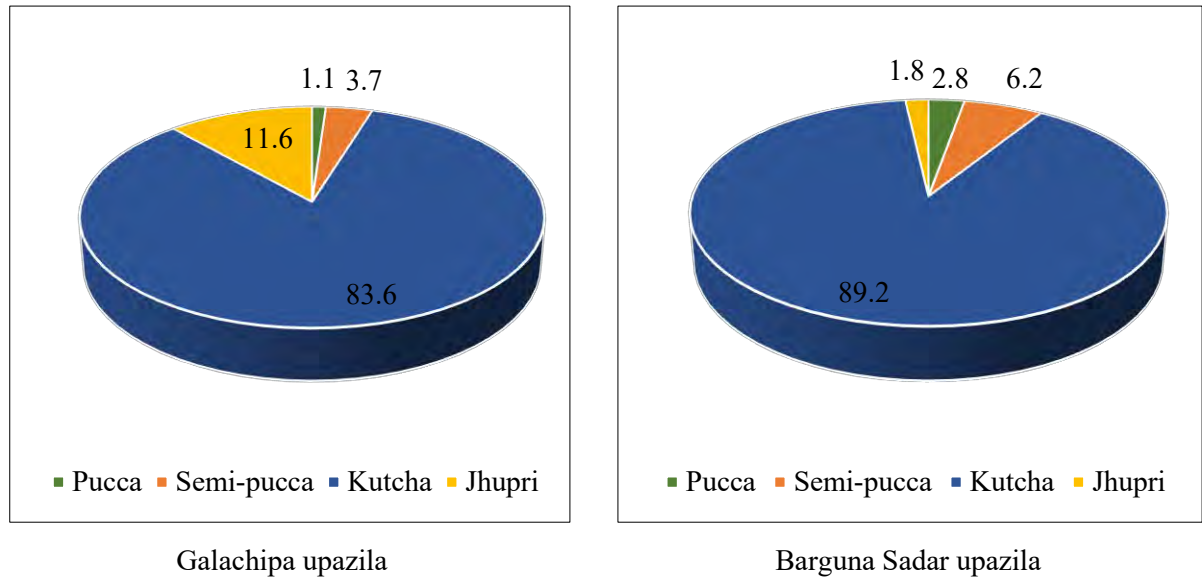
Figure 4.5: Distribution of households according to type of structure (Source: BBS, 2011)

4.4.3 Transportation System: In Galachipa upazila, the transportation management survey conducted by LGED (2013) and field survey (2019) revealed that no public or private bus service is available for intrazonal movement of passengers. The water transport network of Galachipa has significant importance in carrying goods. Both Galachipa and Barguna Sadar upazila have "launch ghat" which maintains a connection with Dhaka and Barisal. Three rivers are adjacent to the study area- Payra, Bishkhali, and Tentulia River. Rabnabad channel, which flows from Dhankhali River is also notable (GoB-UNDP, 2017).

4.5   History of Cyclones in Study Area

Galachipa upazila and Barguna Sadar upazila are situated in the cyclonic storm tracts region and Risk Zone/High Risk Area of Bangladesh (DFID, UNDP, and MoDMR, 2008; Hossain *et al.,* 2019). According to the study of MCSP (1993), Risk Zone (RZ) extends from the coastline (coast or riverbank) to an inland limit up to which surge water can reach, and the High-Risk Zone (HRZ) extends from the coastline up to a limit, where the storm surge can inundate more than one-meter height of land (BUET-BIDS, 1993).

Both of the upazilas are located adjacent to the Bay of Bengal and are vulnerable to flooding from cyclones and linked storm surges (LGED, 2013). Since 1970, the areas are frequently

struck by cyclonic storms. All the major cyclones that struck Bangladesh coast affected these upazilas. Table 4.3 provides a list of major cyclones with consequent damage that hit the study area.

Table 4.3: Previous cyclonic disasters and consequent damage experienced by the study area

Name of Cyclone	Damage in study area
Cyclone Sidr (2007)	• Patuakhalki and Barguna were two of the worst affected districts during Sidr (2007). Both Galachipa and Barguna Sadar upazila were severely affected. • The cyclone caused the deaths of 1,345 people in Barguna district. Storm surge height was more than 20 ft leading to the deaths of 29 people in Noltona union of Barguna Sadar upazila. After the cyclone, a mass burial was conducted, which was later developed as 'Sidr memorial' at Gorjonbuniya village of the union. • About 6.8 km and 69.06 km road was damaged with an economic cost of USD 1,14,068 and USD 26,89,902 in Galachipa and Barguna Sadar upazila respectively.
Cyclone Aila (2009)	• The waves damaged river and flood-control embankments and dykes, submerging many villages in Patuakhali. Many unions went under deep water.
Cyclone Mahasen (2013)	• Barguna and Patuakhali were the most affected districts. About 51.62% and 14.18% of total households were affected in Barguna Sadar and Galachipa upazila respectively.
Cyclone Roanu (2016)	• Galachipa upazila was categorized as 'highly damaged', and Barguna Sadar was categorized as 'moderately damaged' in the cyclone. • Damage extent was particularly high for livelihood and critical infrastructure. More than 6,000 families were affected.
Cyclone Mora (2017)	• Around 5,000 people were evacuated in Barguna Sadar and Galachipa upazila.
Cyclone Fani (2019)	• In Gapachipa upazila, around 200 households were affected. Twenty villages in Patuakhali were inundated by storm surges of 4-5 ft. height. More than 2 million people were evacuated. • In Barguna, many low-lying areas, including the Barguna Sadar, Betagi, Bamna, and Patharghata were inundated due to the storm surge.
Cyclone Bulbul (2019)	• Both Baguna Sadar and Galachipa upazila were categorized as 'moderately impacted areas' with wind speed of 80-100 km/h. Although there was no casualty in these upazilas, strong wind uprooted trees and collapsed houses.

(Source: GoB, 2008; IFRCS, 2013; Sarwar et al., 2016; DDM, 2017; NAWG, 2019; Field Survey, 2019)

4.6 Profile of Cyclone Preparedness Programme in Study Area

Due to frequent cyclones and proximity to the Bay of Bengal, CPP was established in Galachipa and Barguna Sadar upazila during its early periods. Since 1972, CPP has been conducting its early warning activities in the study area.

CPP Volunteers of Study Area

Currently 4,215 CPP volunteers are working in the study area (2,025 volunteers in Galachipa and 2,190 volunteers in Barguna Sadar upazila). One-third of the volunteers (33%) are female as per CPP guidelines regarding the inclusion of female volunteers.

Figures 4.6 and 4.7 show the distribution of CPP volunteers according to age group and occupation, respectively. Most of the volunteers belong to 26-35 years (37.49%) and 36-45 years (26.90%), that denotes the willingness of young people to work for their communities. Only 0.78% of the volunteers are of more than 55 years of age who are respected and well-accepted within the community, but are less active in the field compared to younger volunteers.
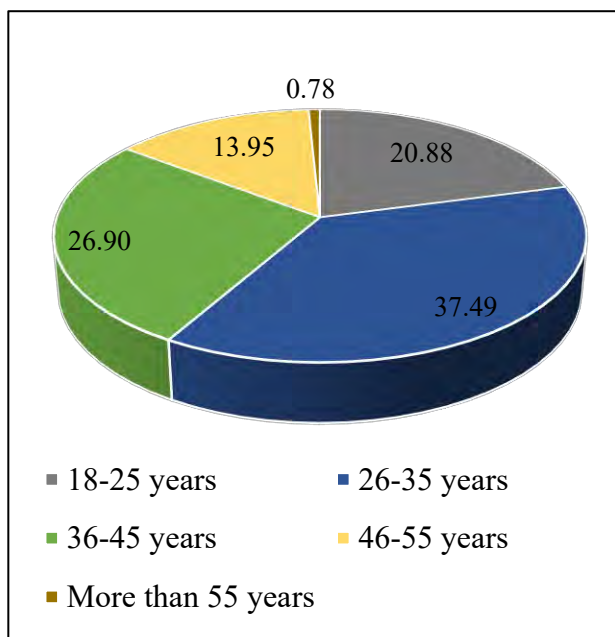
Figure 4.6: Distribution of volunteers in the study area according to age group (Source: CPP Database, Field Survey 2019)
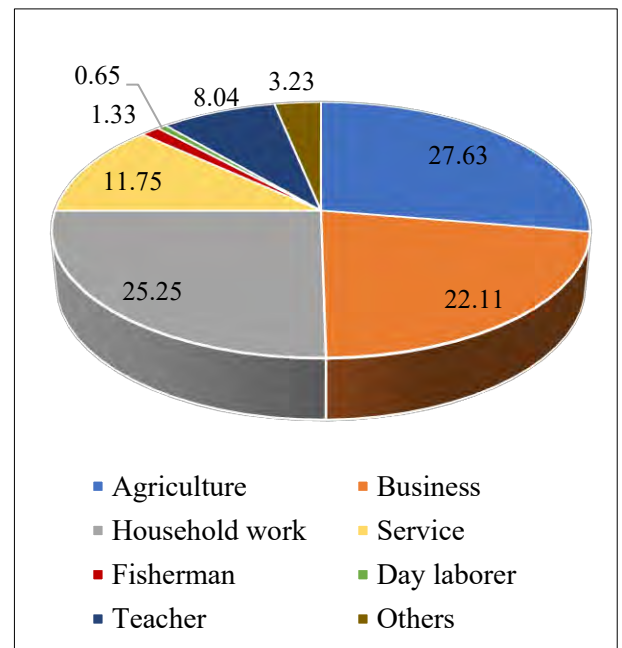
Figure 4.7: Distribution of volunteers in the study area according to occupation (Source: CPP Database, Field Survey 2019)

In terms of occupation, most of the volunteers are farmers (27.63%), small business owners (22.11%), farmers, and service holders (11.75%). Only 1.33% of volunteers are from the

fisherman community, which is identified as one of the most vulnerable communities to cyclone. Most female volunteers (around 80%) are involved with household works. Teachers consist of 8.04% of the CPP volunteers. Educational institutions of the area are often used as cyclone shelters, and teachers of these institutions get enrolled as CPP volunteers due to close interaction with community. The 'others' category (3.23%) includes doctors, local elite personnel, etc. who are respected community members and have a profound influence over the community.

Field Level Activities

Galachipa upazila is under Barisal zonal office and Baguna Sadar upazila is under Barguna zonal office of CPP. There are 135 and 146 units in Galachipa and Barguna Sadar upazila, respectively. Field level activities of the study area include capacity building, dissemination of cyclone warning, search and rescue, relief distribution, etc. However, cyclone drills and public awareness activities are not conducted on a regular basis (CPP, 2019; Field survey, 2019).

Table 4.4 shows the distribution of CPP volunteers in two upazilas according to the unit group. Although unit volunteers of Galachipa upazila are equally distributed among five groups, in Barguna Sadar upazila, the number of volunteers in the signal, first aid, shelter groups are comparatively higher.

Table 4.4: Distribution of CPP volunteers of the study area according to unit group

Area	Number of volunteers				
	Signal	Rescue	First Aid	Shelter	Relief
Galachipa upazila	405	405	405	405	405
Barguna Sadar upazila	435	433	441	435	425

(Source: CPP Volunteer Database, 2019)

During the cyclone, CPP volunteers perform their duties according to the assigned responsibilities. Before the cyclone makes landfall, signal volunteers start disseminating warning messages and advise people to evacuate in accordance with the level of warning. Rescue CPP volunteers are well trained regarding search and rescue actions and conduct rescue operations after the cyclone. First Aid CPP volunteers provide first aid to injured in the form of control of bleeding, dressing of wounds, taking care of fainted, poisoned, burnt, electrical injured, fevered, bone fractured persons, and transportation of injured to the

hospitals. Shelter volunteers are responsible for shelter management before and after the cyclone (Amin, 2012; CPP, 2019; Field Survey, 2019).

4.7   Summary

This chapter depicts the overall scenario of the existing condition of the study area. Before analyzing the data from the field survey, it is imperative to have a general idea of the study area so that the findings of the research can be linked with the present condition. This chapter's primary purpose is to provide the socio-economic, physical characteristics, and profile of CPP of the study area before going through a detailed analysis of the findings from surveys and concluding recommendations.

CHAPTER 5: ANALYSIS OF THE INTER-ORGANIZATIONAL NETWORK STRUCTURE FOR CYCLONE MANAGEMENT IN BANGLADESH

5.1 Introduction

This chapter investigates the characteristics of the network structures during pre-disaster (preparedness and risk reduction), during-disaster (warning and emergency response), and post-disaster (relief, recovery, and rehabilitation) activities in the context of cyclone Bulbul (November, 2019). The research analyzed the composition of the network, critical organizations in the system, and ranking of the organizations based on centrality measures. The analysis presented in this chapter is based on both primary and secondary data collection. Data presented in this section reflect the pattern of interactions that occurred among international, national, regional, and local organizations in the disaster management network of Bangladesh.

5.2 Warning and Response Network of Cyclone Bulbul

5.2.1 Network Composition

The warning and response network of cyclone Bulbul consists of 49 organizations. Table 5.1 shows the composition of the organizations as found in the analysis. In terms of organizations, 38 or 77.5% are classified as government organizations, 7 or 14.3% are nonprofit, 4 or 8.16% are joint organizations. The breakdown by jurisdiction shows that the largest number of government organizations are from the national level (22, 44.9% of total organizations). The local organizations are defined as the organizations working at the upazila or union level of Bangladesh. These organizations make up the second-highest group of organizations in the network (35.7%), and the majority of the local organizations belong to the government sector (14, 28.6% of total organizations). Joint organizations represent CPP head office and CPP zonal, upazila, and union offices as they are under a joint program of the government of Bangladesh and Bangladesh Red Crescent Society.

According to Osman *et al.* (2015), in an effective disaster management network, the government, NGOs, and local organizations work together to pursue a common goal. The national policies of Bangladesh, including SOD (2019), bestows the primary responsibility of disaster response to government or public organizations, which is reflected in the composition.

Table 5.1: Frequency distribution of organizational warning and response system by jurisdiction and organization type

Type / Jurisdiction	Governmental		NGO		Joint (CPP)		Total	
	N	%	N	%	N	%	N	%
International	–	–	5	10.20	–	–	5	10.20
National	22	44.90	–	–	1	2.04	23	45.94
Regional (Division and District level)	2	4.08	–	–	1	2.04	3	5.12
Local (Upazila and Union level)	14	28.57	2	4.08	2	4.08	18	35.73
Total	38	77.55	7	14.28	4	8.16	49	100

(Prepared by Author, Data from Institutional survey and Key Informant Interview in 2019-20; Content analysis and documentation review, 2019)

5.2.2 Organizational Response Activities to Cyclone Bulbul

This section states the responses activities taken by the government, non-government and joint actors in the disaster management system.

Governmental Response

After the cyclone was formed, Bangladesh Meteorological Department (BMD) sent special weather bulletins to the ministries and CPP head office. On November 08, 2019, BMD asked the maritime ports of Mongla and Payra to hoist danger signal no. 7. Bangladesh Inland Water Transport Authority (BIWTA) suspended riverine transport services as the storm reached within 500 kilometers of the coast. On November 09, BMD assigned great danger signal No 10 for the maritime ports of Mongla, Payra, along with nine projected coastal districts, their offshore islands, and chars.

Among the government organizations, the Ministry of Disaster Management and Relief (MoDMR) monitored the situation closely and worked as a focal point of the government's disaster risk management activities. As the signal no. was higher than 4, MoDMR called an emergency coordination meeting of the CPP Implementation Board on November 08, which was attended by different ministries, divisions, and NGOs. An Inter-Ministerial Disaster Management Committee meeting chaired by the State Minister of MoDMR took place on November 09, with the participation of the Principal Secretary of the Prime Minister's Office (PMO), the Information Secretary, Armed Forces Division (AFD), and

other officials. Department of Disaster Management of MoDMR coordinated with local administration for evacuation and other preparatory tasks. Directorate General of Health Services (DGHS) formed medical teams ready to tackle impending health problems.

Emergency meetings were held by local disaster management committees at the district, upazila, and union levels, and respective control rooms were established. Based on the 'great danger signal' that was put in place, the local administrations, i.e., Upazila Nirbahi office (upazila level), Union Parishad office (union level) of the coastal districts evacuated people to cyclone shelters with the help of local volunteers on November 09. The cyclone made landfall in Bangladesh on November 10.

Response of Cyclone Preparedness Programme

Cyclone Preparedness Programme (CPP) head office opened a control room and maintained communication with BMD. The special weather bulletins received from BMD were sent to CPP zonal and upazila offices. Updated information of the cyclone was informed to the Chairman and members of the CPP Implementation Board by the head office. Besides, CPP officials attended the emergency meetings and coordinated with Disaster Management Committees at district, upazila, and union levels. At local level, CPP volunteers were involved in the warning dissemination, hoist of signal flags, evacuation to cyclone shelters, supply of food and water in the shelters, and rescue process. Around 55,500 CPP volunteers worked in 350 unions of the 13 coastal districts to aware people and convince them to go to shelters (NAWG, 2019).

Engagement of Non-governmental Actors

Representatives from international non-governmental organizations such as UNDP, JICA, American Red Cross attended the meetings organized by MoDMR. On November 10, 2019, the Bangladesh Red Crescent Society (BDRCS) called an emergency coordination meeting to share updates on concurrent cyclone conditions and perceived responses through unit offices. Red Crescent Volunteers assisted location administration and CPP volunteers in the warning dissemination process. BRAC activated the Emergency Operation Center (EOC) at the head office level, and emergency teams were prepared to initiate response.

The response activities are organized into four broad categories- alert/warning, cyclone shelters, evacuation, and rescue. The matrix shown in Table 5.2 depicts the participation of organizations in taking different categories of initiatives.

Table 5.2: The matrix of response activities of different types of organizations during cyclone Bulbul (2019)

Organizations \ Response Functions	Monitor cyclone, deliver Special Weather Bulletin and storm modelling	Broadcast cyclone warning	Arrange emergency meetings	Coordination of activities	Attend meeting and make necessary arrangement	Establish control room	Dissemination of warning signals to local people	Hoist of warning flag	Assist local administration	Preparation of cyclone shelters	Food and water supply	Repair of road to shelters	Issue evacuation orders	Dissemination of evacuation orders	Assist local people to evacuate	Deploy medical teams and provide first aid	Undertake rescue operations
	Alert/Warning									Cyclone Shelters			Evacuation			Rescue	
Government Organizations/ Offices																	
Ministry of Disaster Mang. & Relief			●	●	●								●				
Prime Minister's office				●													
Bang. Met. Dept. (BMD)	●																
Dept. of Disaster Mang. (DDM)				●													
Ministry of Defense					●	●											
Ministry of Shipping					●	●											
Ministry of Agriculture					●												
Ministry of Water Resources					●												
Ministry of Health					●												
Ministry of Education										●							
Ministry of Home Affairs			●		●												
Bang. Inland Water Transport Authority					●												
Bang. Inland Water Transport Corporation					●												
Bang. Water Development Board					●												
Upazila Water Development Board						●											
Mass media		●															
Armed Forces Division			●			●											●
Mercantile Marine Office (MMO)						●											
District Administration			●	●	●	●			●								

Organization	1	2	3	4	5	6	7	8	9	10	11	12	13
Ministry of Local Govt & Rural Dev.				●									
UNO office		●	●	●	●			●			●	●	
Union Parishad office					●				●	●	●	●	
Bangladesh Coast Guard													●
Divisional forest officer				●									
Ministry of Information					●								
Public Security Division					●								
Scout												●	●
Police												●	●
Port Authority				●	●								
SPARRSO	●												
Directorate General of Health Services												●	
Institute of Water Modelling	●												
Water Resources Planning Org.				●									
Upazila Project Implementation Officer								●					
Local NGOs									●			●	
Local Govt. Engineering Dept.										●			
Public Health Engineering Dept.									●				
Local Education office									●				
Joint Organizations (Government and NGO)													
CPP Head Office		●	●	●	●			●					
CPP Zonal Office		●	●	●	●			●					
CPP Upazila Office		●	●			●	●				●	●	●
CPP Union Office		●				●	●	●	●	●	●	●	●
Humanitarian Organizations/NGOs													
Bang. Red Crescent Society				●	●								
Local Red Cross Volunteers						●		●			●	●	
UNDP				●									
BRAC				●	●								
American Red Cross				●									

(Source: Institutional survey and Key Informant Interview in 2019-20; Content analysis and documentation review, 2019)

5.2.3 Network Visualization through Warning and Response Network Map

Figure 5.1 presents the network map that visualizes the composition and the structure of the reported cyclone Bulbul warning and response network. The network map consists of 49 nodes and 403 links. Types of organizations are represented by the colors of the node, and jurisdiction areas are shown by node shapes. The network map depicts the presence of a cluster located at the center of the network. It shows that the key actors located at the center of the network predominantly consist of joint organizations, i.e., CPP offices and government organizations. In particular, CPP and government organizations located at the core are mainly from the national and local levels. Actors located outside of the core network primarily include organizations that do not hold the major responsibility for disaster warning and response, such as the Ministry of Agriculture, Ministry of Education, etc. Organizations classified as NGOs have interacted with government organizations at the national and local levels and are connected to the core network structure.

Figure 5.1: Network map of cyclone Bulbul (2019) warning and response system (Source: Data from primary and secondary sources and analysis from ORA)

5.2.4 Key Organizations and Centrality Measures in the Warning and Response Network

The study identified ten key organizations in the warning and response system calculated by ORA, as shown in Figure 5.2. Key entities are those organizations that have the most ability to monitor information flow and reach out to other organizations. The chart shows the organization nodes that are top-ranked overall using the node-level measures, i.e., total degree centrality, closeness centrality, betweenness centrality, etc. Among the ten key organizations, five are governmental organizations, four are joint organizations (CPP), and only one is a non-governmental organization (BDRCS). Interestingly, four out of ten organizations are from upazila/union level. This reflects the vital contribution made by local organizations, i.e., CPP upazila and union offices, UNO office, and Union Parishad office in responding to cyclone Bulbul.

Figure 5.2: Key organizations in the warning and response system (Source: Data from primary and secondary sources and analysis from ORA)

An analysis of network centrality identifies those actors that are the most important in shaping the performance of the network, as they have the most ties with other actors (Wasserman and Faust, 1994). Three types of centrality reveal interesting characteristics of this network: degree centrality, closeness centrality, and betweenness centrality. Table 5.3 shows the top 10 organizations ranked by order of importance based on their degree, betweenness, and closeness centrality.

Table 5.3: Rank of organizations according to the centrality values in response network

Total degree centrality (Total= 0.17 or 17%)			
1. CPP Head office	0.629	5. BMD	0.320
2. MoDMR	0.588	7. CPP Zonal office	0.309
3. CPP Upazila office	0.515	8. District Administration	0.278
4. CPP Union office	0.485	9. Union Parishad office	0.268
5. UNO office	0.412	10. BDRCS	0.258
In-degree centrality (Total=0.169 or 15.9%)			
1. UNO office	0.408	5. BDRCS	0.306
2. Union Parishad office	0.408	7. CPP Union office	0.245
3. MoDMR	0.388	8. Bangladesh Coast Guard	0.245
4. CPP Head office	0.347	9. MMO office	0.224
5. CPP Upazila office	0.306	10. District Administration	0.204
Out-degree Centrality (Total=0.169 or 15.9%)			
1. CPP Head office	0.898	5. CPP Zonal office	0.429
2. MoDMR	0.776	7. UNO office	0.408
3. CPP Upazila office	0.673	8. District Administration	0.327
4. CPP Union office	0.653	9. DDM	0.306
5. BMD	0.449	10. BDRCS	0.204
Betweenness Centrality			
1. MoDMR	0.220	5. BWDB	0.050
2. CPP Head office	0.169	7. BMD	0.045
3. CPP Upazila office	0.088	8. District Administration	0.041
4. UNO office	0.078	9. Mass media	0.023
5. CPP Union office	0.072	10. IWM	0.021
Closeness Centrality			
1. CPP Head office	0.923	5. CPP Zonal office	0.640
2. MoDMR	0.828	7. UNO office	0.608
3. CPP Upazila office	0.762	8. District Administration	0.600
4. CPP Union office	0.738	9. DDM	0.593
5. BMD	0.649	10. LGED	0.558

(Source: Prepared by Author, Data from primary and secondary sources and analysis from ORA)

Total Degree Centrality

As discussed in Chapter 3, an analysis of total degree centrality shows the organizations that most frequently interacted with other organizations in the network (Comfort and Haase, 2006). In this study, it shows the total number of organizations connected to a given organization. The greater the degree centrality value of the response organization is, the closer its location to the center of the map (Tang *et al.,* 2018). Table 5.2 shows the rank of organizations as per the total degree centrality calculated by ORA. The organizations with a high degree of centrality are- CPP Head office, MoDMR, CPP Upazila office, CPP Union office, and UNO office. CPP head office has scored the highest degree centrality in terms of the number of interactions it had during the warning and emergency response phase. There is no NGO in the top five organizations. Only BDRCS has ranked tenth in the list as BDRCS has built-in communication structures that enable the organization to coordinate with government agencies that frequently respond to disasters.

Among the top ten organizations, three are national, two are regional, and five are local. In terms of organization type, five are governmental, four are joint (CPP offices), and one is an NGO. This finding reflects that government and joint organizations, especially those working at the national and local level, are the primary response organizations in the warning and response network of cyclone Bulbul.

A centrality degree analysis can be represented by two types of scores- in-degree and out-degree. The findings showed that the warning and response network had a relatively low in- and out-degree centralization index (15.9%).

In-degree Centrality

In-degree centrality depicts the number of links directed to a node, or the number of connections the node of interest receives from other nodes (Wasserman and Faust, 1994). The top organizations in terms of in-degree centrality include- UNO office, Union Parishad office, MoDMR, CPP Head office, and CPP Upazila office. UNO office and Union Parishad have ranked first and second, respectively, which denotes that the local administration has received a substantial flow of information from other nodes in the form of a cyclone warning, order of evacuation, and preparation cyclone shelters, etc. Therefore, strengthening local administration can leverage this effect and significantly impact overall emergency management.

Out-degree Centrality

Out-degree centrality represents the number of links or connections emanating from a node (Wasserman and Faust, 1994). Organizations with high out-degree centrality scores include CPP head office, MoDMR, and CPP upazila office. CPP head office delivered instructions to CPP offices located at upazila and union level and other CPP Implementation Board members. Additionally, MoDMR called an emergency coordination meeting and communicated with other ministries.

Table 5.4: Degree centrality values by type of organization and jurisdiction level

	Category	Total degree	In-degree	Out-degree
Jurisdiction Level	**National**	14.8%	13.7%	15.7%
	Regional	23%	19.7%	**25.9%**
	Local	**19.6%**	**20%**	19%
	International	14%	18.8%	9%
Organization Type	**Government**	14.4%	15.5%	13%
	Joint (CPP)	**48.5%**	**29.6%**	**65.3%**
	NGOs	13.2%	17%	9.2%

(Calculated by ORA)

Table 5.4 shows the total degree, in-degree, and out-degree centrality values of organizations categorized according to their jurisdiction level and type. In the case of jurisdiction, the in-degree centrality of local organizations is highest, whereas the regional organizations have the highest value of out-degree centrality. This indicates that regional organizations were mostly the 'source' of information, and the local organizations act as the 'receivers' of information. Regional organizations worked as a hub where they received the information from national organizations and transferred it to the local organizations. The international organizations mostly received information from national organizations in the form of weather bulletins or participated in the meetings. They transmitted very little information to others, as indicated by their low out-degree centrality (9%).

While viewed from the perspective of organization type, it is evident that CPP played a significant role in sending and receiving information in the warning and response network.

The highest values of both in-degree and out-degree centrality suggest that CPP worked as both 'source' and 'receivers' of information to government actors and NGOs.

Betweenness Centrality

Betweenness centrality represents the number of shortest paths that pass through a specific node (Chung *et al*., 2017). Greater betweenness centrality of an actor depicts that more actors are dependent on that actor to communicate with other actors (Kapucu *et al.*, 2010). In the case of betweenness centrality, the top organizations are- MoDMR, CPP Head office, CPP Upazila office, UNO office, and CPP Union office (Table 5.2). All the organizations are governmental organizations working at the national, regional, and local levels. The results indicate that MoDMR and CPP head office are the information hubs, which play essential roles in collecting and disseminating information. Being the shortest path between other nodes, these organizations served as bridges between organizations and controlled the flow of the response network.

Closeness Centrality

Nodes with high closeness centrality values are likely to receive information more quickly than others, as there are fewer numbers of intermediaries to reach them (Cheong and Cheong, 2011). This measure is useful in estimating the flow of information through a network, assuming that the exchange of information occurs more quickly if the actors are close to one another (Comfort and Haase, 2006). The top organizations in terms of closeness centrality include CPP Head office, MoDMR, CPP Upazila office, etc. CPP head office coordinated the efforts of CPP local level offices as well as maintained connection with MoDMR. Besides having the highest number of links in the network, the CPP head office had the closest path to every other actor in the network as reflected by its highest value of closeness centrality.

The discussion on key organization and centrality measures reflects the significance of CPP head, upazila, and union offices in the warning and response network. CPP offices at all levels had a relatively high number of connections in the network. In addition, CPP offices have the potential to bridge other actors. Ministry of Disaster Management and Relief is the leading key organization that signifies the traditional hierarchical order of disaster management in Bangladesh. However, it also evident from the discussion that the local level organizations also played an effective role in responding to cyclones.

5.3 Relief and Recovery Network of Cyclone Bulbul

5.3.1 Network Composition

The network of relief and recovery of cyclone Bulbul contains 29 organizations. As seen in Table 5.5, the majority of these organizations are government organizations (22, 75.86% of total organizations). Among the governmental organizations, 13 or 44.82% are at upazila/union level, 1 or 3.45% are at the district/division level, and 8 or 27.58% are at the national level. It is noteworthy that 17 or 58.62% of total organizations in the network are local organizations working at upazila and union level.

Table 5.5: Frequency distribution of organizational relief and recovery system by jurisdiction and organization type

Type / Jurisdiction	Governmental		NGO		Joint (CPP)		Total	
	N	%	N	%	N	%	N	%
International	–	–	2	5.89	–	–	2	5.89
National	8	27.58	–	–	1	3.45	9	31.03
Regional (Division and District level)	1	3.45	–	–	–	–	1	3.45
Local (Upazila and Union level)	13	44.82	2	5.89	2	5.89	17	58.62
Total	22	75.86	4	13.79	3	10.34	29	100

(Prepared by Author, Data from Institutional survey and Key Informant Interview in 2019-20; Content analysis and documentation review, 2019)

5.3.2 Organizational Relief and Recovery Activities to Cyclone Bulbul

This study focuses on four categories of post-cyclone activities- loss and damage assessment, repair of basic infrastructures, collection and distribution of relief materials, and rehabilitation (Table 5.6).

Governmental Initiatives

On November 11, 2019, District Administration, Bangladesh Navy, Bangladesh Coast Guard (BCG) of Mongla West Zone, Fire Service, and Civil Defense started working day and night to rehabilitate the affected people of the coastal area. Damage of cultivable land

was assessed by the Department of Agricultural Extension (DAE). Bangladesh Rural Electrification Board (BREB) handled the situation of power disruption due to cyclone and evaluated the damage in electric poles and transformers. Department of Forest under the Ministry of Environment, Forest and Climate Change assessed the extent of destruction in the Sundarbans. Assessment and repair of damaged embankments were conducted by Upazila Water Development Board. The Local Government Engineering Department (LGED) was responsible for repairing the damaged roads.

Each of these organizations prepared reports of the assessed damage and sent them to respective ministries. The ministries then planned projects for the recovery and communicated with the Ministry of Finance to get allocation for the projects. Ministry of Disaster Management and Relief (MoDMR) also collected the reports and coordinated the overall assessment of loss and damage. At local level, these activities were coordinated by Deputy Commissioner at district level; Upazila Nirbahi Officer (UNO), and Upazila Project Implementation Officer (PIO) at upazila level, and Union Parishad Chairman at the union level.

In the case of distributing relief materials, the district administration assigned the relief as per the level of damage in the upazilas. UNO allocated the relief materials to Union Parishad Chairman, who collected and carried the relief goods to their unions. Later the distribution of relief materials was coordinated and supervised by Union Chairman.

Activities by Cyclone Preparedness Programme

CPP Union office collected local loss and damage data and sent them to the CPP Upazila office. Finally, the CPP head office compiled the data collected from upazila offices and sent the report to MoDMR.

Engagement of Non-governmental Actors

Among the NGOs, the Bangladesh Red Crescent Society conducted its assessment and sent the data to the International Federation of Red Cross and Red Crescent. Relief materials were distributed among the unions under the supervision of Red Cross volunteers according to the damage level.

5.3.3 Network Visualization through Relief and Recovery Network Map

The network map for relief and recovery is depicted in Figure 5.3. It consists of 29 nodes and 179 links. Here, the color of the node shows the type of organization, and the shape of the node represents the actors' jurisdiction area. The network is denser at the center due to the presence of local administration. District Administration, UNO office, and Union Parishad office are placed at the center of the network. They are primarily responsible for the coordination of damage assessment and relief distribution activities. Government local organizations accountable for loss and damage assessment occupy positions close to the core network. One interesting finding from the network is that the network is scattered and less dense across the peripheries. NGOs such as BDRCS conducted loss assessment and relief distribution through a distinct process. As a result, they are located outside the core network.
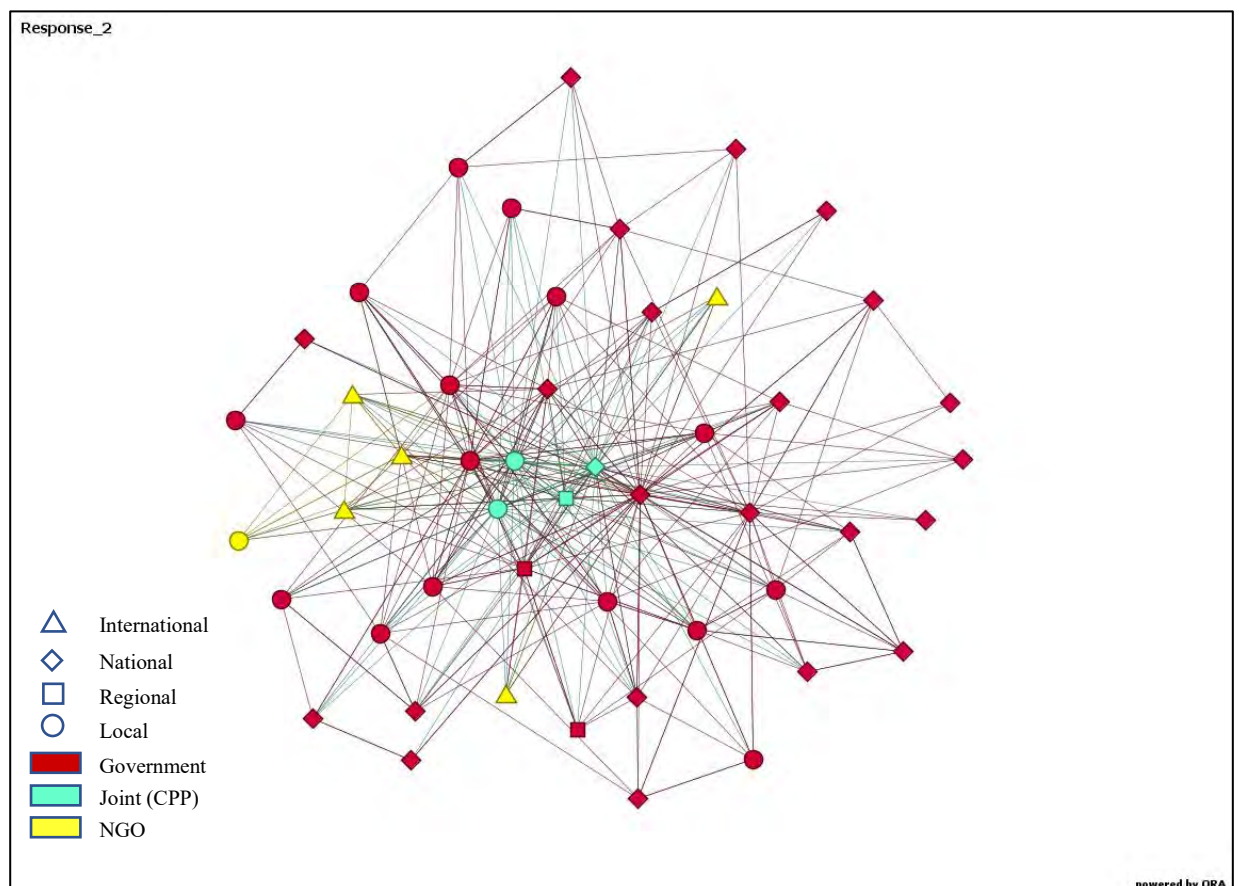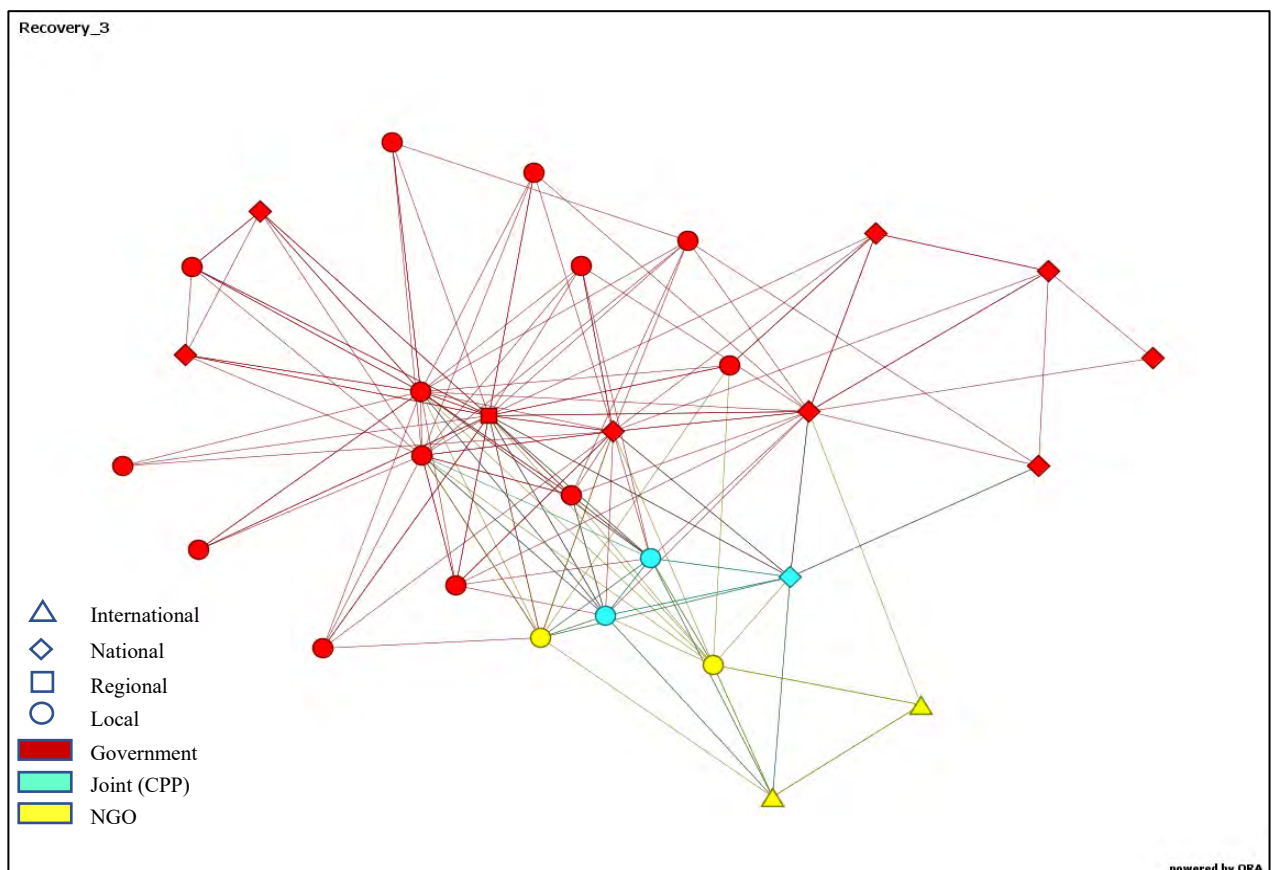

Figure 5.3: Network map of cyclone Bulbul (2019) relief and recovery system (Source: Data from primary and secondary sources and analysis from ORA)

Table 5.6: The matrix of relief and recovery activities of different types of organizations after cyclone Bulbul (2019)

Organizations \ Recovery Functions	Collect detailed loss and damage information	Verify loss and damage information	Prepare loss and damage reports and submit to upper administration/ministry	Allocate funds for recovery	Coordinate preparation of requirements for humanitarian assistance and recovery	Undertake projects to address damaged sectors	Repair of damaged water supply & sanitation	Emergency repair of embankments	Restore electricity supply	Emergency repair of roads/earthen roads	Medical camp	Collection of relief materials from upper administration	Distribution of relief materials	Supervise the distribution of relief	Rehabilitation and construction
	Damage Assessment						Repair					Relief			Construction
Government Organizations/ Offices															
Ministry of Disaster Mang. & Relief				●		●	●								
Dept. of Disaster Mang. (DDM)			●		●	●									
Ministry of Environment, Forest and Climate Change			●	●		●									
Ministry of Agriculture			●	●		●									
Ministry of Finance			●	●		●									
Ministry of Water Resources			●	●		●									
Forest Department	●		●												
Rural Electrification Board (REB)	●		●						●						
Department of Agricultural Extension	●		●												
District Administration		●	●		●		●					●			
UNO office		●	●									●		●	
Union Parishad office		●	●									●	●	●	
Upazila Project Implementation Officer		●	●											●	
Local Govt. Engineering Dept.			●							●					●
Dept. of Public Health Engineering			●				●								
Upazila Water Development Board			●					●							
Bangladesh Navy															●
Bangladesh Coast Guard															●
Police															●
Dept. of Health			●								●				

Dept. of Fisheries	•		•										
Water Resources Planning Org.	•		•				•						
Joint Organizations (Government and NGOs)													
CPP Head Office		•	•										
CPP Zonal Office		•	•										
CPP Upazila Office	•												
CPP Union Office	•											•	
Humanitarian Organizations/NGOs													
International Federation of Red Cross				•									
Bang. Red Crescent Society			•	•							•	•	
Local NGOs					•				•	•		•	
Local Red Cross Volunteers	•											•	

(Source: Institutional survey and Key Informant Interview in 2019-20; Content analysis and documentation review, 2019)

5.3.4 Key Organizations and Centrality Measures in the Relief and Recovery Network

Figure 5.4 represents the key organizations in the relief and recovery network of cyclone Bulbul. District administration and UNO office are the first and second-ranked organization on the list. Previously in the warning and response stage, UNO office and Union Parishad office were more active at the field level than the district administration. However, district administration plays a vital role in the relief and recovery stage. Most loss and damage assessment reports of the upazilas are first submitted to the respective DC offices before channelizing them to the ministry. Eight of the ten top-ranked organizations are public or governmental. BDRCS ranked ninth in the list due to its contribution it the damage assessment and relief distribution through the association of its affiliated international donor organization IFRCS.
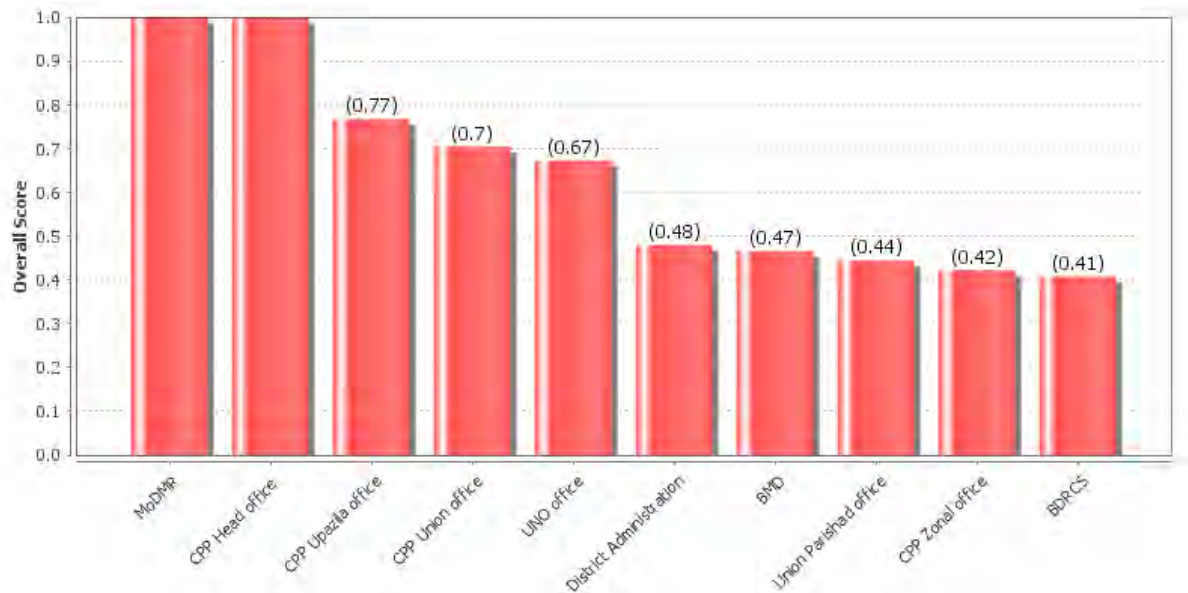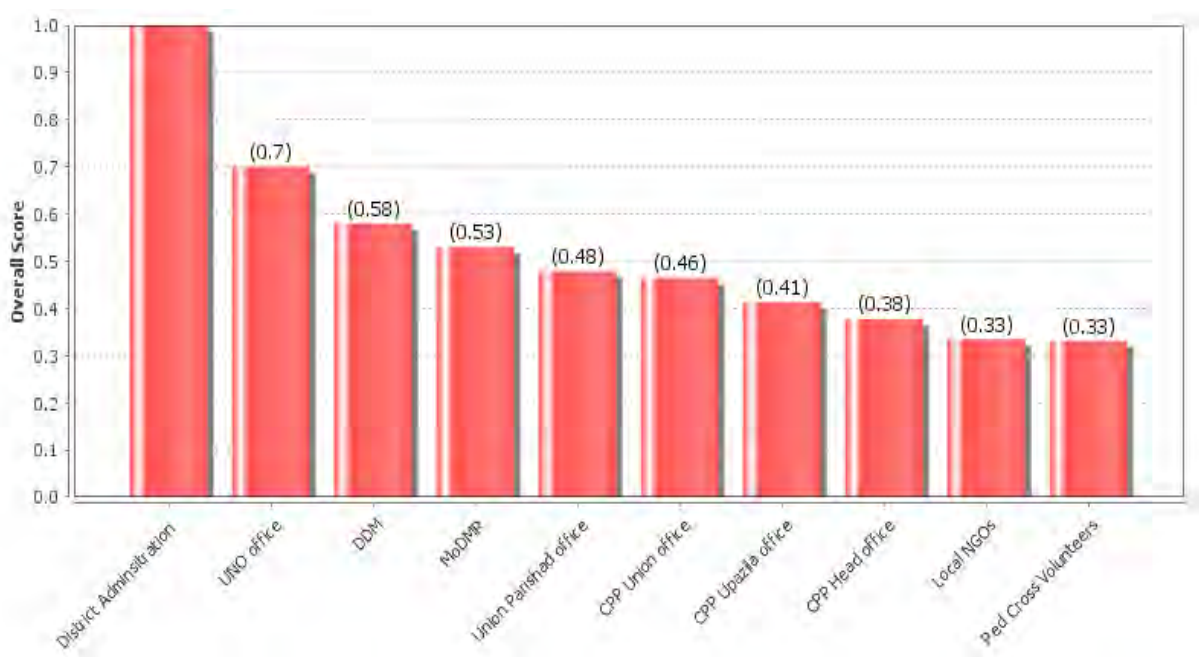

Figure 5.4: Key organizations in the relief and recovery system (Source: Data from primary and secondary sources and analysis from ORA)

The ten organizations with the highest values in three types of centrality measures are listed in Table 5.7. District administration or DC office had the highest number of connections with other organizations in the network as suggested by its highest score in total degree centrality. Besides, the DC office worked as an intermediary or gateway among other organizations of the system and was close to other actors in terms of the shortest possible path. As CPP is a joint venture of government and BDRCS, the CPP union office linked

the initiatives of both local administration, and Red Cross volunteers as indicated by its position in all measures.

Table 5.7: Rank of organizations according to the centrality measures in recovery network

Total degree centrality (Total= 0.218 or 21.8%)			
1. District Administration	0.684	5. MoDMR	0.368
2. UNO office	0.526	7. CPP Upazila office	0.351
3. DDM	0.439	8. CPP Head office	0.298
4. Union Parishad office	0.421	9. Local NGO	0.281
5. CPP Union office	0.368	10. Project Implementation Officer	0.246
Betweenness Centrality			
1. District Administration	0.304	5. CPP Head office	0.067
2. UNO office	0.160	7. CPP Upazila office	0.039
3. MoDMR	0.134	8. Union Parishad office	0.032
4. DDM	0.081	9. BDRCS	0.031
5. CPP Union office	0.075	10. Red Cross Volunteers	0.030
Closeness Centrality			
1. District Administration	0.308	5. CPP Head office	0.272
2. DDM	0.292	7. CPP Upazila office	0.272
3. Red Cross Volunteers	0.282	8. Local NGOs	0.272
4. Ministry of Water Resources	0.280	9. MoDMR	0.272
5. CPP Union office	0.275	10. UNO office	0.272

(Source: Prepared by Author, Data from primary and secondary sources and analysis from ORA)

The average in-degree and out-degree centrality value of the recovery network is 21.5% for both, which is higher than the average in-degree and out-degree centrality value of the response network (15.9%). It means that in the case of the recovery network, a more significant percentage of the ties were controlled by or depended on key actors compared to the response network (Mohammadfam *et al.*, 2015). The findings also indicate that regional and local organizations substantially contributed to the relief and recovery network. Starting from loss and damage assessment to distribution of relief materials, the local administration actively participated in the process. In this case, national organizations were highly dependent on the information provided by regional and local organizations. The analysis also suggested that different organizations had varied ways of conducting

relief and recovery activities. Although both national organizations and NGOs assessed the damage and distributed relief goods, they utilized different sets of local actors. Additionally, the loss and damage report reached the ministries through various channels, with multiple actors working to pursue a common objective. There was no platform to oversee and coordinate the functions of the related organizations, which is an indicator of low functioning of information flow and problem-solving network (Osman *et al.*, 2013).

5.4   Network for Cyclone Preparedness and Risk Reduction

5.4.1   Network Composition

The study has divided cyclone preparedness and risk reduction activities into four categories- capacity building of volunteers, the arrangement of cyclone drill, mass awareness-raising activities, and regular supervision of cyclone shelters. Through key informant interviews, it was found that, although mentioned in the national policies, awareness campaigns for community people for improving their understanding of warning signals and evacuation plans are not implemented regularly. The coastal community is already familiarized with the signals because of their long-term experience in dealing with cyclones. Therefore, the study has considered only the above-mentioned categories of activities that are practiced on a regular basis for cyclone preparedness and risk reduction.

Table 5.8: Frequency distribution of organizational preparedness and risk reduction system by jurisdiction and organization type

Type / Jurisdiction	Government		NGO		Joint (CPP)		Total	
	N	%	N	%	N	%	N	%
International	–	–	6	30	–	–	6	30
National	2	10	–	–	1	5	3	15
Regional (Division and District level)	2	10	–	–	1	5	3	15
Local (Upazila and Union level)	5	25	1	5	2	10	8	40
Total	9	45	7	35	4	20	20	100

(Prepared by Author, Data from Institutional survey and Key Informant Interview in 2019-20;
Content analysis and documentation review, 2019)

The network for preparedness and risk reduction activities consists of 20 organizations. Table 5.8 shows the frequency distribution of these organizations according to organization type and jurisdiction level. The results indicate that 6 or 30% of the organizations participating in the system are international, 3 or 15% are national, 3 or 15% are regional, and 8 or 40% are local. When viewed according to the type of organizations, 9 or 45% of the organizations belong to the government, followed by NGOs (35%) and joint organizations (20%). Compared to the previous two networks, the participation of international actors is higher in the preparedness and risk reduction system.

5.4.2 Cyclone Preparedness and Risk Reduction Activities

Governmental Initiatives

In the case of repairment of cyclone shelters, Upazila Project Implementation Officer (PIO) sends the requirement to the Department of Disaster Management. DDM conducts the repair works in association with MoDMR. MoDMR also allocates funds for training programs, cyclone drills and participates in the programs as guests. The organization of the programs is mainly coordinated by the administrations at the district and upazila level.

Activities by Cyclone Preparedness Programme

CPP Head office receives an allocation from MoDMR and other donor agencies to arrange training programs for volunteers. Government-funded training programs are planned at the beginning of the year, whereas fund from donor agencies comes on a project basis. CPP head office collects the information of participants from CPP upazila offices and sends it back to MoDMR. On the other hand, the allocation for the training is transferred to the CPP upazila office. In the case of cyclone drills, CPP zonal and upazila office assist the district and upazila administration to organize the drills. CPP union volunteers participate in both training, drills and organize rallies on various occasions for public awareness.

Engagement of Non-governmental Actors

NGOs, in association with MoDMR, organized a number of capacity building programs for CPP volunteers. For example- United Nations Development Proramme (UNDP) took the initiative to strengthen CPP by building the capacity of around 5.000 volunteers in coastal districts. NGOs like American Red Cross, BDRCS, Save the Children, Christian Aid, and IFRCS trained CPP volunteers on disaster preparedness, first aid, early warning systems, and other life-saving skills as part of their projects.

Table 5.9: The matrix of cyclone preparedness and risk reduction activities of different types of organizations

Organizations \ Preparedness and Risk Reduction Functions	Provision of funds and financial assistance	Coordination and arrangement of trainings	Provision of technical assistance and knowledge	Participants of training	Venue and logistics	Provision of equipment	Provision of financial assistance	Arrangement of cyclone drill	Participants of the drill	Awareness activities (Occasional rallies)	Regular observation of cyclone shelters	Repair of cyclone shelters
	Training and Capacity Buildings Programs						Cyclone Drill			Mass Awareness	Cyclone Shelters	
Government Organizations/ Offices												
Ministry of Disaster Mang. & Relief	●		●	●		●	●		●			●
Dept. of Disaster Mang. (DDM)								●	●		●	
City Corporation office									●			
District Administration					●			●	●			
UNO office		●			●				●			
Union Parishad office		●			●				●		●	
Upazila Project Implementation Officer		●							●		●	
Member of Parliament			●						●			
Police			●						●			
Joint Organizations (Government and NGOs)												
CPP Head office				●	●			●	●			
CPP Zonal office		●		●	●			●	●			
CPP Upazila office		●		●	●			●	●	●		
CPP Union office				●	●			●	●	●		
Humanitarian Organizations/ NGOs												
UNHCR	●	●	●					●				
UNDP	●	●	●									
Bang. Red Crescent Society	●	●	●			●			●			
American Red Cross	●	●	●					●				
Save the Children	●	●	●									
Christian Aid	●	●	●									
Local NGOs									●	●		

(Source: Institutional survey and Key Informant Interview in 2019-20; Content analysis and documentation review, 2019)

5.4.3 Network Visualization through Preparedness and Risk Reduction Network Map

Compared to the response and recovery networks, the cyclone preparedness network is a smaller network of only 20 organizations. The network map shown in Figure 5.5 includes 20 nodes and 111 links. Government and joint organizations are located at the center of the network. Organizations situated around the periphery are mainly NGOs and government organizations involved in the donation activities or attending the cyclone drills as guests.
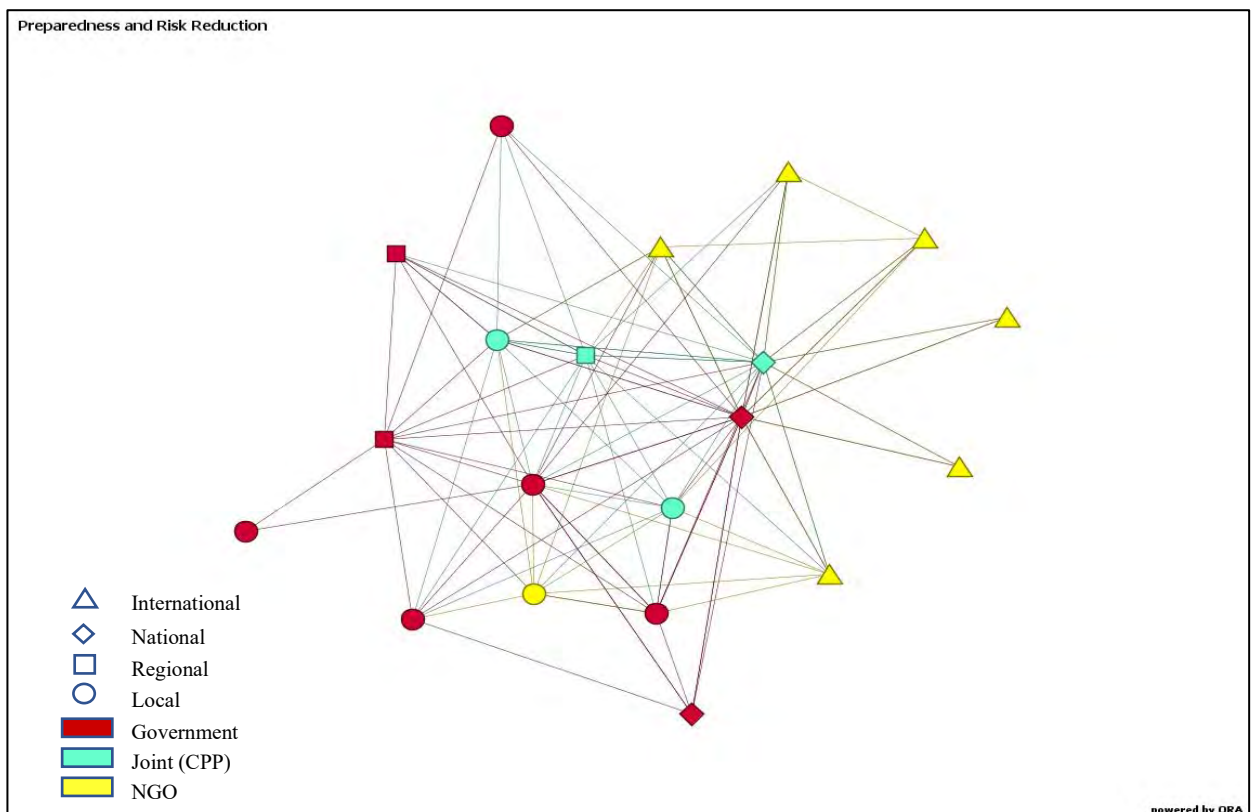
Figure 5.5: Network map of cyclone preparedness and risk reduction system (Source: Data from primary and secondary sources and analysis from ORA)

5.4.4 Key Organizations in the Cyclone Preparedness and Risk Reduction Network

Figure 5.6 shows the key organizations in the network of cyclone preparedness and risk reduction. Out of the ten key organizations, two are national, two are regional, four are local, and two are NGOs. MoDMR and CPP Head office have been ranked as the top two organizations on the list. Both of these organizations have high values of total degree and betweenness centrality (Table 5.10). These findings suggest that both MoDMR and CPP Head office played significant roles in the cyclone preparedness and risk reduction system.
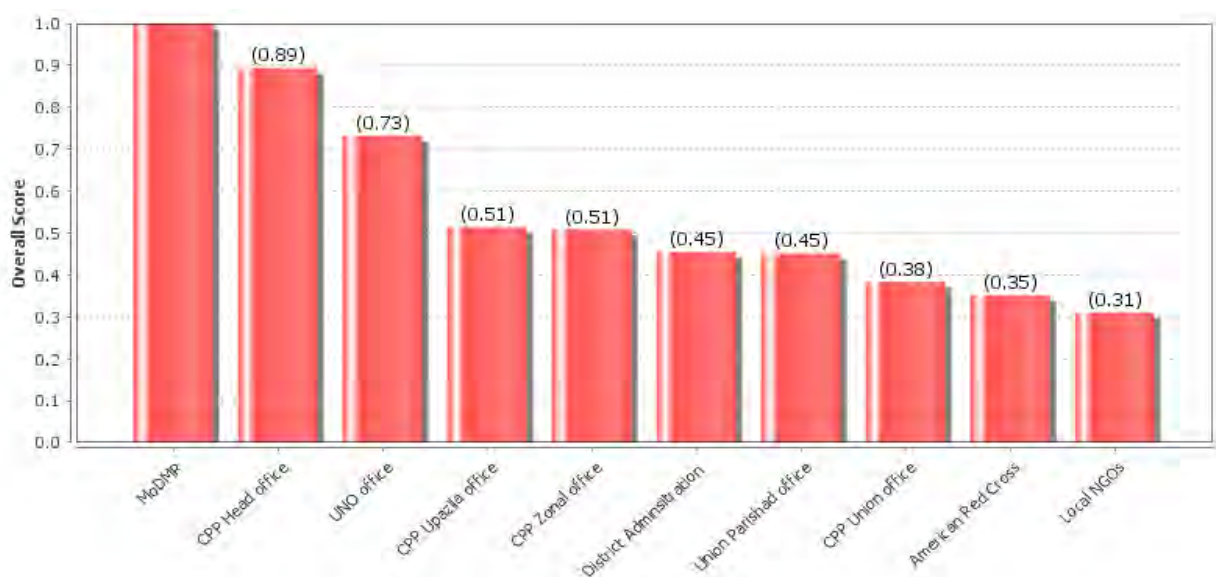
Figure 5.6: Key organizations in preparedness and risk reduction system (Source: Data from primary and secondary sources and analysis from ORA)

Table 5.10: Rank of organizations according to the centrality measures in preparedness network

Total degree centrality (Total= 0.288 or 28.8%)			
1. MoDMR	0.718	5. Union Parishad office	0.359
2. CPP Head office	0.667	7. CPP Union office	0.308
3. UNO office	0.487	8. District Administration	0.308
4. CPP Upazila office	0.410	9. American Red Cross	0.256
5. CPP Zonal office	0.410	10. Local NGOs	0.256
Betweenness Centrality			
1. MoDMR	0.239	5. Union Parishad office	0.031
2. CPP Head office	0.172	7. American Red Cross	0.015
3. UNO office	0.144	8. CPP Union office	0.010
4. CPP Upazila office	0.049	9. Local NGOs	0.007
5. CPP Zonal office	0.033	10. DDM	0.003
Closeness Centrality			
1. District Administration	0.731	5. UNO office	0.380
2. MoDMR	0.475	7. DDM	0.380
3. CPP Head office	0.452	8. Union Parishad office	0.373

4. CPP Zonal office	0.413	9. American Red Cross	0.373
5. CPP Upazila office	0.396	10. CPP Union office	0.339

(Source: Prepared by Author, Data from primary and secondary sources and analysis from ORA)

In the previous two networks of response and recovery, the CPP union office was placed among the top five organizations regarding all centrality measures. However, in the case of preparedness, the managerial and more active role is played by CPP head office and upazila office due to their contribution in fund allocation, program arrangement, maintaining coordination with ministry and donor agencies, etc. Although MoDMR has ranked first in both total degree and betweenness centrality, the district administration has scored the highest for closeness centrality. This result indicates that district administration is included in the shortest path to other organizations of the network.

5.5   Examining the Performance of Networks

The social network analysis measures, such as network density and diameter, can be applied to depict the network's structural properties.

Network Density

Network density indicates the degree to which a network is cohesive and is a measure of the total connectedness of a network. It is the number of ties in a network as a ratio of all possible links in a network and describes the general level of cohesion. The high value of density implies the strengthening of coordination between groups. The score of density ranges from 0 to 1. A density score of 1 suggests that all actors are connected and reachable to each other, and they are part of the same component. Deviations from a score of 1 indicate that the network is fragmented and that reachability among actors is low (Comfort *et al.*, 2013; Mohammadfam *et al.*, 2015; Tang *et al.,* 2018).

The overall network density is 0.169 for the warning and response network, 0.215 for the relief and recovery network, and 0.285 for the preparedness and risk reduction network. This means that only 15.9%, 21.5%, and 28.5% of all possible connections among members were present for warning and response teams, relief and recovery team, and preparedness and risk reduction team, respectively. This indicates that the networks' density levels were small, and the actual ties among organizations are minimal compared to the possible connections that may occur if there is effective coordination. The results also suggest that the preparedness and risk reduction network is more connected than the other two networks.

It can be attributed to the lower number of actors in the preparedness network. When many organizations are involved in a system, the network density tends to be low, which doesn't necessarily imply the low effectiveness of the network (Wang, 2012).

Network Diameter and Average Path Length

Average path length (APL) is the average shortest distance between all nodes in a network. Network diameter is defined as the maximum path length for all pairs of nodes. The diameter of a network is closely related to its APL as they both contain information about connectivity and transfer efficiency (Du *et al.*, 2017). In a disaster response system, organizations may search for information and resources needed to solve problems or deliver services. A shorter distance between organizations means higher accessibility to resources and lower traveling costs (Wasserman and Faust, 1994; Wang, 2012). The average path length is calculated by finding the shortest path between all nodes, then dividing the sum value by the total number of pairs. This will represent the number of steps on average it takes to get from one member of the network to another. Table 5.11 shows the diameter and APL of all three networks. As seen from the table, the distance between the organizations is lowest in the preparedness and risk network than the other two networks.

Table 5.11: Network diameter and average path length of the networks

Network	Network Diameter	Average Path Length (APL)
Warning and Response	4	2.05
Relief and Recovery	4	2.006
Preparedness and Risk Reduction	3	1.746

(Calculated from Gephi)

5.6 Summary

The findings presented in this chapter indicate that the organizations interacted with each other to perform various tasks at three phases of the cyclone. This chapter viewed cyclone preparedness, response, and recovery network from four different perspectives. First, the organizational composition of the network was identified through frequency distribution. The results showed that governmental actors were the largest in number. Examining the composition by jurisdiction, local organizations working at upazila and union levels had significant participation in the network. Second, the research reviewed the activities

undertaken by different organizations and prepared a matrix for each phase showing the activities and participant actors. In this way, the purpose of the interactions among organizations was identified. Third, network diagrams were prepared to visualize organizational connections. It was found that mostly CPP and government organizations are located at the center of the networks. Lastly, this chapter focused on the characteristics of the nodes through the analysis of node-level measures. Centrality measures, i.e., total degree, betweenness, and closeness centrality, helped to identify the key actors of the networks. The findings reflect the contribution of CPP head office as well as upazila and union level offices in maintaining the flow of information in the networks. The networks diagram and the centrality analysis suggest the way CPP is one of the key organizations of the network, which coordinates with organizations located at both national and local level. The chapter also analyzed the structural characteristics of the networks to evaluate their performances.

CHAPTER 6: COMMUNITY PERCEPTION OF FIELD LEVEL CYCLONE PREPAREDNESS PROGRAMME

6.1   Introduction

Analyzing the perception of community regarding cyclone disaster management activities of CPP is a significant part of the study. Focus group discussion (FGD) of both community and CPP volunteers and Key Informant Interview (KII) of CPP officials are arranged in the study area. The existing practices of warning dissemination and evacuation, problems in the current way of CPP, and strategies for the improved framework are discussed to know local people's views. Various Participatory Rural Appraisal (PRA) techniques such as process map, priority matrix, cause-effect diagram, seasonal diagram, etc., are applied to collect and analyze this information. This chapter summarizes the outcome of FGD and KII through the application of some PRA techniques.

6.2   Current Role of CPP in Community-Based Cyclone Management

Local people of the study area have vast experience in dealing with cyclones. CPP has been working in this region since 1972. As a result, the community and local CPP have established a set of preparedness and response mechanisms to manage cyclonic disasters. During cyclone Bulbul (November, 2019), CPP volunteers worked in warning dissemination, evacuating, and sheltering people just like the past cyclones. The sequence of events is summarized through a PRA technique named 'Process Map.'

The process map is used to provide a pictorial representation of a process. It falls under the broader family of flow diagram method. Process mapping helps in developing an in-depth understanding of the activities, processes, and characteristics of each of the activities (Kumar, 2002). In this research, the step-by-step methods of warning dissemination and evacuation and sheltering are depicted through process maps. Six FGDs with CPP volunteers and community members are conducted in both Galachipa upazila and Barguna Sadar upazila. Participants are asked questions regarding various activities under the processes, their sequence, and linkages. Figure 6.2 and 6.5 shows the process maps of warning dissemination, evacuation, and sheltering procedure of CPP.

6.2.1 Process of Warning Dissemination

During cyclone Bulbul, Storm Warning Center (SWC) of the Bangladesh Meteorological Department issued bulletins soon after observing the formation of a tropical depression in the Bay of Bengal. SWC sent warnings directly to the National Coordination Committee and national representatives of CPP. The control room of the CPP head office transmitted all the bulletins to zonal and upazila level offices. The upazila offices passed the bulletins to unions, and union team leaders passed the messages to unit team leaders immediately. Since the signal number was more than 4, board meetings are held at zonal and upazila level. At that time, UNO office control rooms were also keeping contact with CPP upazila offices.

After the union and unit-level volunteers were informed, meetings were held where volunteers distribute their responsibilities under their assigned group. Unit team leaders hoist CPP storm-warning flag to communicate the level of danger to community- no flag for signal 1-3, one flag for signal 4, two flags for signal 5-7, and three flags for signal 8-10. In the case of cyclone Bulbul, two flags were hoisted (Figure 6.1). After the meeting, CPP unit volunteers were instructed to disseminate warning. Both male and female unit committee volunteers got prepared and took their megaphones, siren, raincoats, boots, and other equipment. According to current practice, volunteers disseminated warning at the field level via megaphones and house-to-house visits. In the urban areas, team leader and volunteers used car or motorcycle where there were pucca roads (Figure 6.1). However, most volunteers circulated the warning by foot in the remote, inaccessible villages. Cyclone warning information was also circulated through social media. Non-governmental organizations (NGOs), Community based Organizations (CBO), local students etc., were also involved in disseminating warnings in consultation with CPP volunteers.

Figure 6.1: Hoisting of storm-warning flags and warning dissemination by CPP volunteers in Galachipa Upazila (Source: Field Survey, 2019)
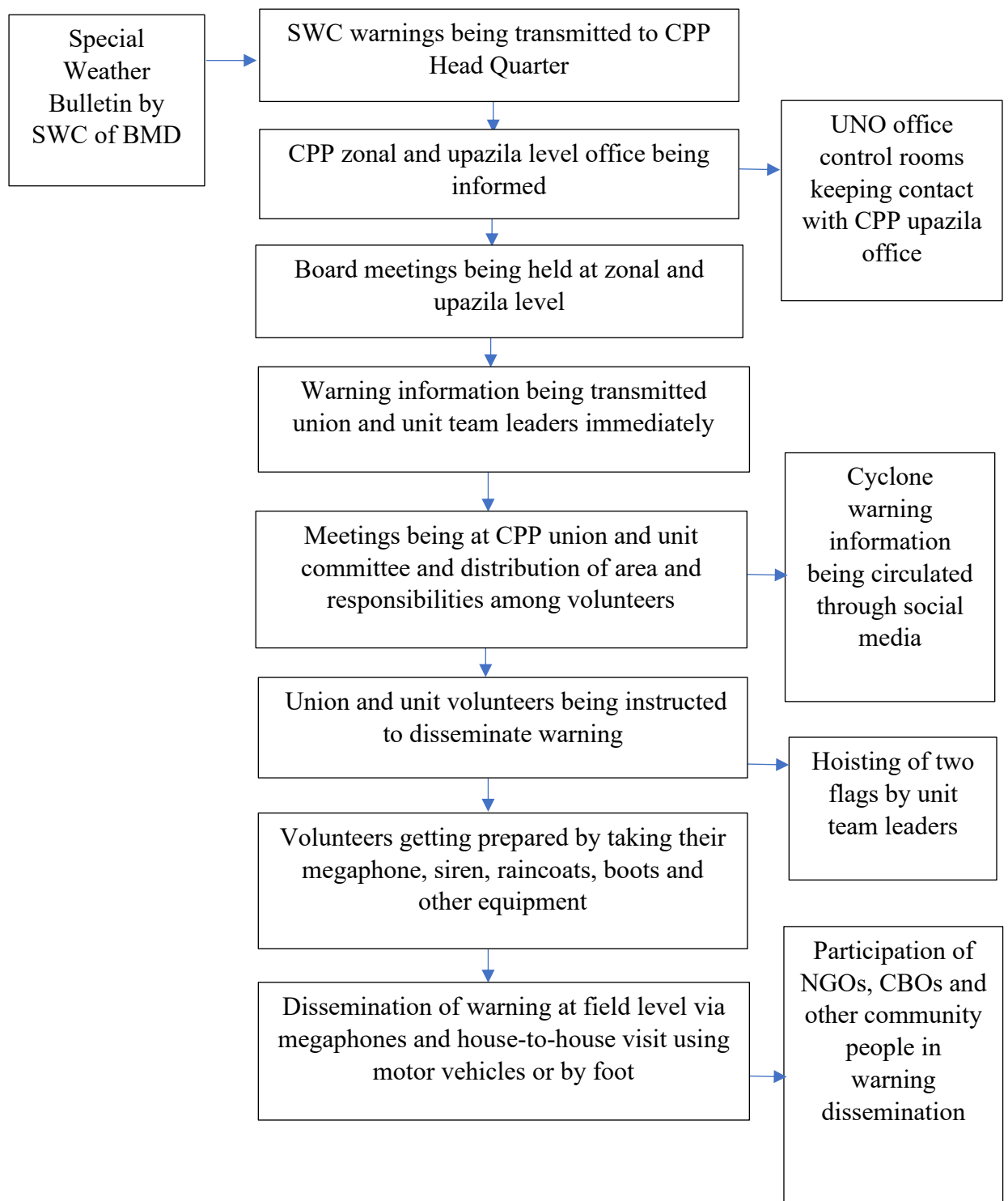
Figure 6.2: Process map of warning dissemination during cyclone Bulbul
(Source: Focus Group Discussion, 2019)

6.2.2   Process of Evacuation and Sheltering

Cyclone shelters of the area are maintained and prepared by CPP volunteers of the 'Shelter' group and UNO office. For signal number 7 or more, an evacuation order is placed, which was the case for cyclone Bulbul. Through a house-to-house visit, CPP volunteers of the 'Shelter' committee explained the warning signal to local people and convinced them to evacuate. Information about the location of pregnant women, mothers with newborn children, and physically challenged people were collected from local community clinics by volunteers during warning dissemination. Female volunteers notably reached out to women, children, elderly persons to evacuate them. Most people walked to the nearest shelter by foot while CPP volunteers took elderly, pregnant women, physically challenged people to shelter by vans. Some people took shelter in neighbor's pucca houses rather than going to cyclone shelters due to the long distance. CPP volunteers also cleared the road to the shelters by removing trees and other obstacles that may have blocked the road. The families themselves carried livestock, poultry, and other belongings. After reaching the shelter, food and water were supplied by CPP volunteers. Women, girls, pregnant women, and the elderly were prioritized during sheltering to ensure privacy. Livestock and poultry were mostly kept in the open spaces or fields adjacent to cyclone shelters. CPP volunteers also entertained people in shelters by singing motivational songs, staging of drama, etc. Food was also supplied by UNO Chairman, who visited the shelters to oversee the condition. After the cyclone was weakened and completely stopped, volunteers were informed through radio broadcasts. As per the CPP volunteers' confirmation, people returned to their homes from cyclone shelters by themselves or with the assistance of CPP volunteers.

Figure 6.3: Female volunteers assisting women and children to evacuate through house-to-house visit during cyclone Bulbul (Source: Field Survey, 2019)

```
┌─────────────────┐        ┌──────────────────────────────────────────────┐
│ Evacuation order │───────▶│ Dissemination of warning signals via          │
│ for signal number│        │ megaphones and sirens                          │
│        7         │        └──────────────────────────────────────────────┘
└─────────────────┘                          │
         │                                    ▼
         ▼                   ┌──────────────────────────────────────────────┐
┌─────────────────┐        │ Explanation of warning signal through          │
│ Preparation of   │        │ house-to-house visit and convincing them to    │
│ cyclone shelters │        │ evacuate                                       │
│ by CPP volunteers│        └──────────────────────────────────────────────┘
│ and UNO          │                          │
└─────────────────┘                          ▼
```

Evacuation order for signal number 7 → Dissemination of warning signals via megaphones and sirens

Preparation of cyclone shelters by CPP volunteers and UNO

Explanation of warning signal through house-to-house visit and convincing them to evacuate

Collection of information from community clinic regarding location of pregnant women and new born babys' mothers

Reaching out to women, children, elderly persons by female volunteers

Going to the nearest shelter/ neighbor's pucca houses by foot while carrying livestock, poultry and valuable belongings

Elderly, pregnant women, physically challenged people being taken to shelter by vans through the assistance of volunteers

Removal of trees and other obstacles and clearing of road to shelter by CPP volunteers

Prioritization of women, girls, pregnant women and elderly are during sheltering

Provision of food, water and entertainment by CPP volunteers

Visit of cyclone shelters by UNO

Volunteers being informed through radio broadcast after the cyclone is weakened

Return of people to homes from shelters

Figure 6.4: Process map of evacuation and sheltering during cyclone Bulbul
(Source: Focus Group Discussion, 2019)

6.2.3 Seasonal Variation of CPP Activities

In Bangladesh, April-June and October-November are considered as the peak season for cyclone formation. Preparedness activities such as training of CPP volunteers don't follow any specific schedule. Depending on government/ NGO funding, union-level training programs are arranged throughout the year. Cyclone drills are held at one union at a time, mostly around April and October.

CPP volunteers are the busiest during the cyclone alert and response phase around the months of April-June and October-November. Post-disaster activities such as the collection of data regarding loss and damage, distribution of relief, reconstruction, etc., occur mostly in May-June and December-January.

Table 6.1: Seasonal diagram of CPP activities

Seasons / Criteria	Winter and Spring		Summer and Pre-monsoon			Monsoon			Post-monsoon		Post-monsoon and Winter	
Months	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
Frequency of cyclone				●●	●●		●●	●●		●●	●●	
Pre-disaster activities (training, drill)	●	●	●	●	●	●	●	●	●	●	●	●
During disaster activities (warning, response)				●●	●●	●●	●●	●●		●●	●●	
Post-disaster activities (relief)	●●				●●	●●	●	●	●	●	●	●●

(Source: Focus Group Discussion, 2019)

6.3   Institutional Linkages

In chapter 6, the network diagrams have been prepared to focus on the organizations that maintain connections with CPP. Along with CPP, there are many institutions active inside and outside of the study area that have a strong influence directly and indirectly on the community.

A commonly used PRA technique named 'Venn Diagram' has been used to understand community's perception about the relationships, interactions, and linkages with these institutions (Kumar, 2002). During FGD at Ratandi Taltali union of Galachipa upazila and Noltona union of Barguna Sadar upazila, participants were asked questions about the institutions working with the community, their influence on local people, and the strength of their interactions.

6.3.1   Internal Institutions

There are various institutions inside the locality that concern about different issues of the study area. Considering the vulnerability of the area to cyclones, many organizations work in the disaster management sector. However, managing disaster is not the only focus for most organizations. In Galachipa upazila, the CPP union office is most strongly connected to the community, both during the normal period and a disaster. There are functional youth associations that work on multidimensional issues, including emergency medical treatment, fire safety, etc. Some NGOs, such as Action Aid, Save the Children, BRAC, and CBOs like 'Sushilan', 'Abdul Gani Memorial Library', are engaged in social welfare activities such as gender violence, child marriage prevention, and poverty reduction.

In the case of Barguna Sadar upazila, there is no active youth association or other CBOs at the union and village level. BDRCS and NGOs like Plan International, Action Aid, 'Jago Nari' work in the area regarding gender issues, relief management, supply of warning equipment, etc. However, during the alert, warning, and response phase, only CPP volunteers are active in the field. Other NGOs mainly work during the post-disaster period.

The localities are deprived of direct and continuous support from the Union Parishad. UP Chairman often provides assistance to CPP volunteers but does not have adequate contact with the community. BDRCS has Regional Red Crescent Unit at both Patuakhali and Barguna, which extend assistance up to village level. They also work closely with the community in providing training, relief materials, etc. CPP unit office and upazila office

are most strongly connected with the community due to frequent interaction and social influence of the volunteers.

6.3.2 External Institutions

Upazila offices have weak linkage with local people, and they only provide assistance through CPP volunteers. After cyclones, often the DC officer and UNO come to monitor and supervise the overall scenario. CPP and BDRCS Head Quarter at Dhaka occasionally have interactions with the community, especially when an official comes to offer training programs. Ministry of Disaster Management and Relief (MoDMR) does not have any interaction with the community.

Venn diagrams in Figure 6.5 and 6.6 demonstrate the linkages between various organizations. The findings of the Venn diagrams show inconsistencies from the network representation of organizational relationships that has been conducted in chapter five. The network diagrams, list of key actors, and centrality analysis have demonstrated that local administration plays a significant role in all phases of cyclone management. Union Parishad office and Upazila Nirbahi office have been identified as critical organizations of the networks. Both of them have high degree centrality values, which means that they had significant interactions with other organizations.

Focus group discussions with community members and local CPP volunteers have revealed that the connection between local authorities and the community is weak and inconsistent. Several imperative roles and responsibilities are assigned to upazila and union offices, i.e., maintaining coordination with CPP offices, preparing cyclone shelters, distributing relief, loss and damage assessment, etc. While doing these tasks, upazila and union offices do not maintain regular interaction with the community, especially during the normal phase. Their connection with upazila and union-level CPP volunteers is also not stable, showing overlapping of responsibilities, conflict, and confusion during shared tasks. Therefore, although the local authorities are doing an 'excellent' job from the organizations and policy perspectives, community perspective of the interactions portray different results.
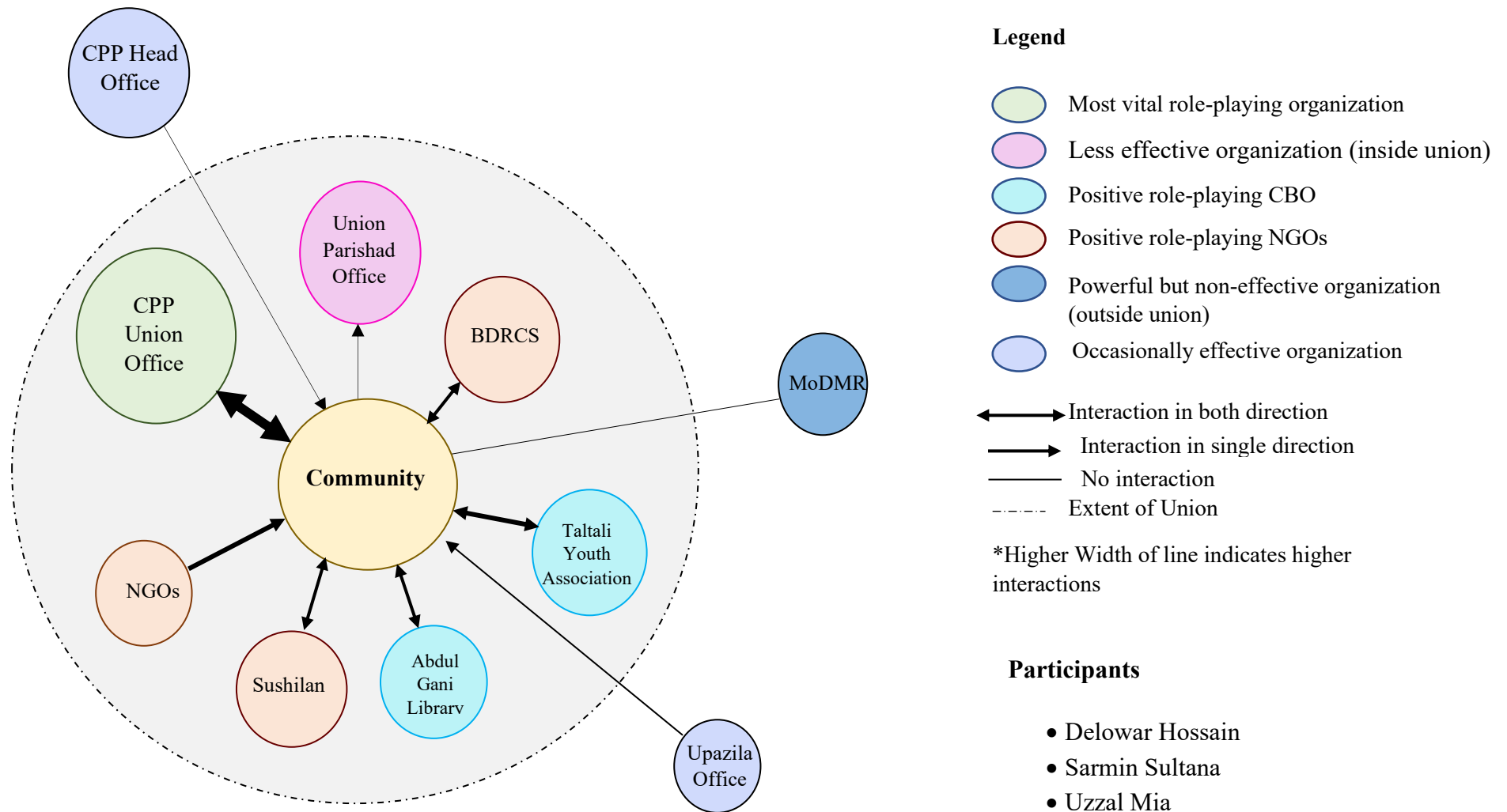
Figure 6.5: Venn Diagram showing linkages among organizations in Ratandi Taltali union, Galachipa upazila (Source: Focus Group Discussion, 2019)

Legend

- Most vital role-playing organization
- Less effective organization (inside union)
- Positive role-playing CBO
- Positive role-playing NGOs
- Powerful but non-effective organization (outside union)
- Occasionally effective organization

→ Interaction in both direction
→ Interaction in single direction
— No interaction
–·–·– Extent of Union

*Higher Width of line indicates higher interactions

Participants

- Delowar Hossain
- Sarmin Sultana
- Uzzal Mia
- Bashir Rari
- Salma Begum

Figure 6.6: Venn Diagram showing linkages among organizations in Noltona union, Barguna Sadar upazila (Source: Focus Group Discussion, 2019)

6.4 Capacity and Drawbacks of the Study Area

From focus group discussions with the local people, the strengths, weaknesses, opportunities, and threats of the study area are identified. Although the study area is extremely vulnerable to cyclones, the dedication and support of CPP volunteers act as a major strength. CPP volunteers are the most well-known faces of the villages. Sense of belongingness and willingness to work for the community is highly noticeable in the study area. Many female members work as CPP volunteers and members of CBOs. Poverty and limited financial resources are the major weakness of the area, which increases the social vulnerability of people. An increasing number of NGOs are working in the area that can act as an opportunity to promote resilience and reduce vulnerability to cyclones.

Strength
- Community bonding
- Dedicated CPP volunteers
- Local wisdom and adaptive strategies for dealing with disasters
- Women participation

Weakness
- Poor economic condition
- Poor accessibility in remote villages

SWOT

Opportunity
- International and national NGOs working in the area
- Motivation of young people towards volunteerism

Threat
- Proximity to the Bay of Bengal
- Inadequate community-based education and outreach activities from government
- Corruption and political malpractice

Figure 6.7: SWOT analysis of the study area (Source: Focus Group Discussion, 2019)

6.5 Identification of Challenges in the Current Practice of CPP

According to Standing Orders of Disaster (SOD), CPP has a set of roles and responsibilities to conduct at regular times, during cyclone and post-cyclone period. Based on SOD (2010), the researcher developed a checklist, which contains the responsibilities of CPP at the local level. During FGD, people belonging to different classes of the community were asked to identify which of these activities had been conducted by CPP volunteers with reference to cyclone Bulbul. In addition, CPP volunteers were asked about the occurrence and regularity of some organizational activities mentioned in SOD, i.e., recruitment, training, supply of

warning kits, etc. Through the checklist, the discrepancies between activities mentioned in SOD and field level implementation of these activities can be recognized (Table 6.2).

Table 6.2: CPP field level activities and compliance with SOD (2010)

Stage of disaster management	Compliance with SOD	Non-compliance with SOD
Normal/ preparedness phase	• Issuance of warning kits to the leaders and volunteers • Assign and maintenance of shelter places	• Arrangement of preparedness programmes and drills on continuing basis in the months of April and September • Recruitment and training of volunteers before the month of April every year • Awareness programmes for local people • Physical verification and repair/replacement of warning equipment • Publicization of evacuation plan
Alert phase	• Maintaining close liaison with BMD • Alerting the Chairman of DMC and community people • Listening to radio broadcast	
Warning phase	• Requesting DMC Chairman for emergency meeting • Shifting of livestock, poultry and other domestic animals to killas • Advising people to go to shelter in the event of evacuation order • Giving warning to people using megaphones, light signals etc.	
Disaster phase	Conducting rescue work	Maintaining coordination with union and upazila authority
Post-disaster phase	• Collecting data on loss and damage • Assisting local authority in relief distribution	

(Adopted from Focus Group Discussion, 2019)

From Table 6.1, it evident that most of the non-compliant activities are in the normal/ preparedness phase. CPP volunteers conduct their responsibilities sincerely during alert,

warning, disaster, and post-disaster phases. But there are some discrepancies during normal period when there is no disaster approaching towards the community.

Based on the FGD and the differences found out from the checklist, problems in CPP's current practice are identified. The challenges are ranked using a PRA method named pairwise ranking. The pairwise ranking is a PRA method that helps the community set priorities, problems, needs, actions, etc. (Cavestro, 2003). According to the view of local people, insufficient equipment such as megaphones, raincoats, boots, first aid box, etc. of volunteers is the main obstacle, followed by inadequate financial assistance to CPP volunteers and lack of training and awareness program for community people (Table 6.3).

6.5.1 *Insufficient warning kits and lack of maintenance*

A common problem of the study area is the volunteers do not have sufficient warning equipment, including megaphones, sirens, raincoats, boots, first aid box, etc. Most of the equipment was provided to them around 5-10 years ago by the government or through some NGOs. In Galachipa upazila, approximately 70% of the sirens and hand mikes are not usable. The sound from the sirens and megaphones do not reach far from 50 ft due to poor battery quality compared to the actual catchment area of 1 km. During cyclone Bulbul, volunteers in the remote villages did not feel secure while performing emergency duties because they were not provided with life jackets and other lifesaving equipment. There is also no arrangement for regular monitoring and repair of the equipment. Many of the items need periodic replacement because of their limited shelf life. As a result, volunteers use old and inefficient equipment, often resulting in delayed dissemination of warning signals. Sometimes volunteers use their own money to purchase batteries, raincoats, boots, etc., which create an economic burden on the poverty-driven coastal community. Volunteers also bear the fuel cost of transportation used during warning dissemination.

The primary reason behind this problem is the lack of government funding for the operational and infrastructural development of CPP. Although the budget allocated for CPP has shown an increasing trend, most of the fund is spent for the remuneration of officers, the arrangement of trainings, etc. The yearly plan of CPP (2019-20) includes the purchase of different equipment with government funding. According to volunteers, although a formal ceremony was arranged regarding the distribution of equipment, volunteers haven't received any equipment yet.

Table 6.3: Pairwise ranking of existing problems

Problem	1	2	3	4	5	6	7	8	9	10	Score	Ranking
1. Lack of training and awareness programme for community people	x	1	3	1	5	1	1	8	1	1	6	3
2. Lack of regular cyclone drills	x	x	3	2	5	2	7	8	9	2	3	7
3. Insufficient equipment/ warning kits (megaphone, raincoat, boots, first aid box etc.) of CPP volunteers	x	x	x	3	5	3	3	3	3	3	8	1
4. Lack of maintenance of equipment/ warning kits	x	x	x	x	5	6	4	4	9	4	3	8
5. No/ insufficient financial assistance to CPP volunteers	x	x	x	x	x	6	5	5	5	5	8	2
6. Lack of cooperation from UNO and upazila office	x	x	x	x	x	x	7	6	6	7	4	5
7. Lack of regular and specialized training programmes for CPP volunteers	x	x	x	x	x	x	x	8	7	10	3	6
8. Lack of communication and transport during disasters	x	x	x	x	x	x	x	x	8	8	5	4
9. Lack of sufficient manpower compared to needs	x	x	x	x	x	x	x	x	x	10	2	10
10. Corruption and political malpractice	x	x	x	x	x	x	x	x	x	x	2	9

(Source: Focus Group Discussion, 2019)

The Director (Admin) of CPP is changed every five years. By the time the Director gets accustomed to CPP through involvement in different trainings, programs, etc., another leader comes who knows little to nothing about CPP. This change of leadership hampers the organization's productivity and long-term vision.

Figure 6.8 shows the cause-effect diagram to visually represent the cause, effects, and their interlinkages according to the view of local people.
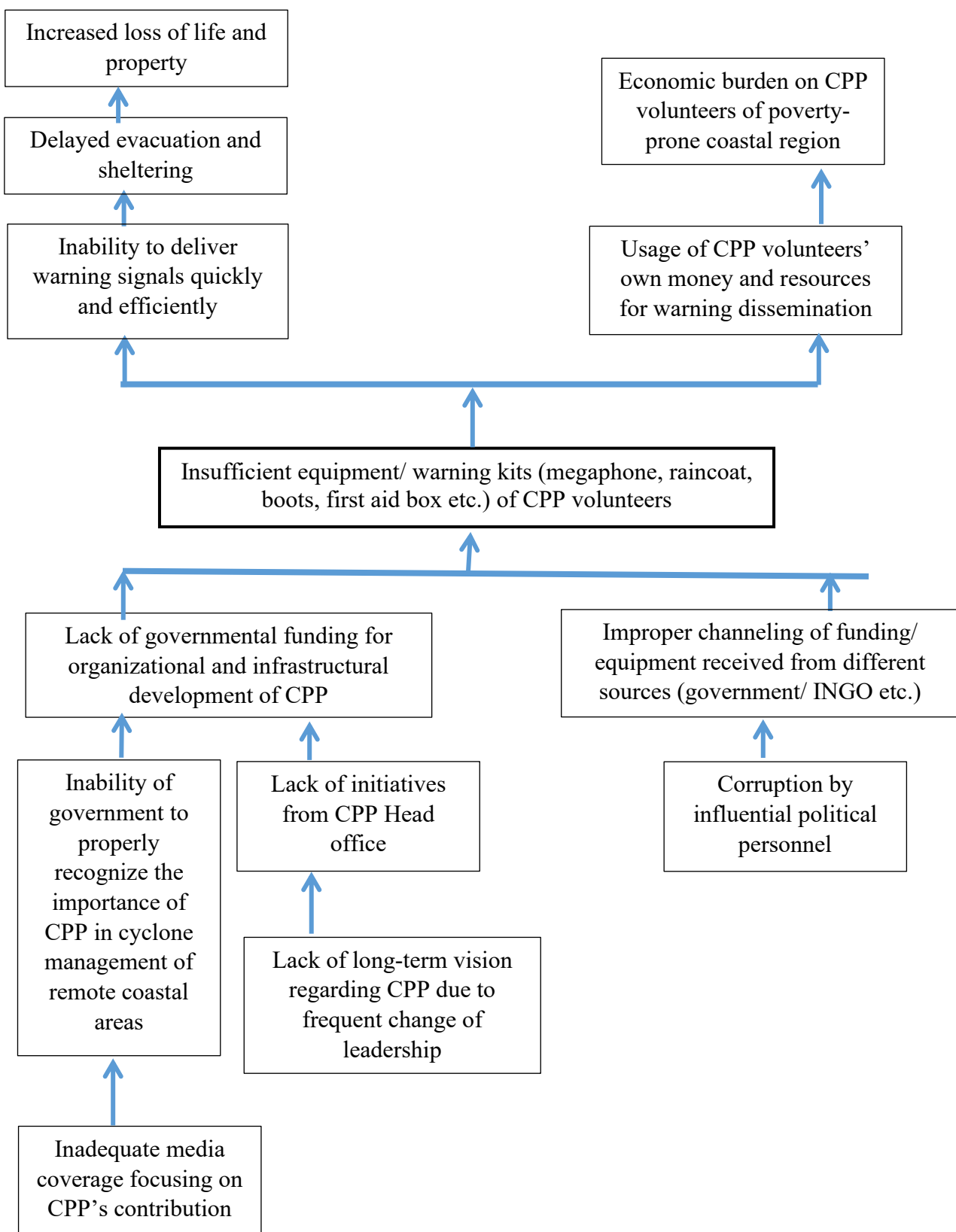
Figure 6.8: Cause-effect diagram of insufficient warning equipment (Source: Focus Group Discussion, 2019)

6.5.2 Lack of cyclone drills and awareness program for the community

According to SOD, field-level CPP is supposed to organize cyclone drills in vulnerable areas in April and September every year to monitor the status of preparedness. However, this is not practiced properly in the study area. Cyclone drill is an integral part of CPP, which is absent in risk areas of the coastal belt. Yearly, two cyclone drills are held at upazilas, mainly in the urban areas, with assistance from Bangladesh Fire Service and Civil Defence. While arranging cyclone drills, remote villages are ignored where most of the poor and ultra-poor households reside. People who do not get the opportunity to participate in the drills lack knowledge regarding cyclone preparedness.

There are no ongoing community-level educational and awareness programs for the local people to improve their understanding of different warning signals. CPP volunteers verbally explain the warning signals to the community at times of cyclone. With the experience of dealing with cyclones, the community understands the meaning of warning signals, evacuation orders, and the location of cyclone shelters by themselves. Still, local people have expressed their need for regular cyclone drills and education programs at the village level with the participation of people from different strata of the society, including women, children, students, etc.

6.5.3 No/insufficient financial assistance to volunteers

CPP volunteers do not receive any regular economic remuneration in exchange for their service. During training programs, volunteers often need to go to Dhaka or other areas. Volunteers have reported receiving only BDT 200-500 per person for their accommodation and transportation cost. After cyclone Bulbul, BDRCS reimbursed the mobile bill for communicating information regarding warning signals among upazila and union team leaders (BDT 300 and 200, respectively). However, the amount reimbursed was negligible, and there was no reimbursement for fuel costs. CPP volunteers at the village level felt they ought to get at least some economic remuneration.

6.5.4 Lack of cooperation from upazila and UNO office

Another common problem is the lack of cooperation from the respective upazila and union offices. Although CPP volunteers are respected and well-recognized by the local authority, volunteers have to conduct all the emergency response activities independently without maintaining any coordination with union offices. Sometimes meetings of CPP are arranged

at UNO offices. Apart from this, volunteers receive little to no support from the local authority during field-level warning dissemination, evacuation, and sheltering. CPP volunteers have reported having some conflict with the local authority regarding warning signal dissemination, equipment distribution, and relief management. Union offices often disseminate wrong signals and hoist flags without coordinating with CPP volunteers. Government funding or other NGO funding provided to CPP volunteers is usually channelized through union offices. Due to corruption, CPP volunteers often do not receive the purchased equipment. Warning equipment is often held by such persons who do not have the knowledge of the appropriate use of the items. Local authority/ UP chairman is also responsible for the distribution of relief materials during post-cyclone interventions. While distributing relief materials, ultra-poor and actually affected households of the area are often deprived due to political malpractice of influential local personnel.

6.5.5   Inadequate manpower

According to local people, the current number of volunteers is insufficient compared to the need. Although SOD insisted on the recruitment and training of volunteers every year, currently, it is not being practiced. To some extent, the physical command area of the CPP unit is larger in comparison to the existing number of volunteers. There are 15 volunteers per unit, and one unit volunteer has to cover at least two villages while disseminating signals and assisting people in evacuating. With the high wind speed and heavy rain, it becomes challenging for the volunteer to reach every household using the inaccessible kutcha roads of remote villages.

6.6 Proposed Strategies for Efficient Performance of Field Level CPP

By analyzing the present situation, strategies have been formulated according to the view of local people which have been ranked by the Pairwise Ranking method (Table 6.4). In their view, the provision of modern equipment and modes of transportations will improve efficiency at the highest level. They have proposed to organize regular cyclone awareness and education programs for community people every three months. The programs should cover both male and female participants coming from different income groups, occupations, etc. Currently, there is a communication gap among CPP, government organizations, and NGOs working for cyclone management in coastal areas of Bangladesh. Regular meetings and interactions should be established during both emergency and normal

periods. Arrangement of specialized training for CPP volunteers at both national and local levels regularly is another strategy to promote effective cooperation.

Table 6.4: Pairwise ranking of strategies

Measures	1	2	3	4	5	Score	Ranking
1. Regular training for CPP volunteers (monthly/ bi-annually) at national and local level	x	2	3	1	5	1	4
2. Regular meetings and interaction with Ministry, government and non-government organizations	x	x	3	2	5	2	3
3. Provision of modern equipment, warning kits and transport to volunteers	x	x	x	3	3	4	1
4. Recruitment of new volunteers at unit level	x	x	x	x	5	0	5
5. Regular cyclone awareness, education programmes and cyclone drill for community people	x	x	x	x	x	3	2

(Source: Focus Group Discussion, 2019)

6.7 Findings from Key Informant Interview and Implementation Level of Proposed Strategies

The challenges and proposed strategies have been discussed with Director (Operation), Deputy Director (Operation) at CPP Head Quarter located at Mogbazar, Dhaka and Deputy Director, Barisal Zonal Office. The summary of the discussion has been stated below-

6.7.1 *Provision of modern equipment and regular maintenance*

According to CPP Head Quarter, they have provided sufficient equipment to the upazilas, and most types of equipment are working fine. Each upazila gets equipment every 6-7 years. CPP head office maintains a list regarding the name of upazila where equipment has been distributed and the corresponding date. While distributing equipment, upazilas that haven't received the equipment in the last 7 years and are facing major problems with damaged equipment are prioritized. Due to budget limitations, CPP cannot distribute new

equipment frequently to each upazila. Besides, Union Disaster Management Committee (UnDMC) should examine the warning equipment every three months as per SOD. But UnDMC works independently and do not coordinate with CPP volunteers resulting in damaged equipment

6.7.2 Cyclone awareness, education programs, and cyclone drill for community people

CPP head office allocates the budget for arranging cyclone drills to CPP upazila offices. Cyclone drill is held in different unions under a upazila by rotation. CPP upazila office selects the unions where the yearly cyclone drills will be held depending on population size and year of the last drill held. Normally cyclone drill is held in a union every 3-4 years. The drill is attended by Member of Parliament, UNO, members of CPP head office, and other important personnel. Occasional rallies are held with the participation of community people on various special days, which are the only awareness programs being held at present.

6.7.3 Interaction with Ministry, government, and non-government organizations

CPP head office maintains a close liaison with MoDMR and PM office during both normal and disaster period. However, at the field level the coordination is not maintained. During normal times, Disaster Management Committees at upazila and union level remain mostly inactive. The committees become, to some extent, active during the warning and response period. In the study area, the Disaster Management Committees are almost non-existent as all of the committee members themselves are not aware of such committees. They do not perform regular meetings/activities as per SOD during the normal period.

6.7.4 Need for additional manpower

Director (ops.) claimed that the number of volunteers is sufficient at field level. According to the key informants, there is a shortage of administrative manpower since some posts are vacant for office staff, including Junior Assistant Director (JAD), peon, etc. Recruitment regulations of CPP officials are from IFRCS, which was being followed until 2000. After 2000, there is no new intake on the administrative posts due to bureaucratic complexities. Around 15-20 officers are controlling around 7 zonal offices on 41 upazilas. Recruitment of manpower for the administrative posts is in process.

6.7.5   Institutionalization of CPP

The organogram of CPP is yet to be approved and formalized by the ministry. There are also no formal recruitment rules and regulations for volunteers. Although CPP is a joint programme of BDRCS and MoDMR, BDRCS hardly allocates funding for CPP on its annual budget. Most of the donor agencies work on a project basis. There is a CPP section at the DDM office located at Mohakhali, Dhaka. According to the key informants, the section is not active. There is a lack of cooperation from the ministry regarding the approval of formal organograms and rules for the long-term success of CPP.

6.8 Summary

Long experience with cyclones has made the coastal community resilient to cyclonic disasters. Case studies undertaken as part of the research have shown the procedure of warning dissemination, evacuation, and sheltering of coastal community with the help of CPP volunteers. CPP is already considered an established community-based program that utilizes local volunteers. This chapter also provides some insights on the current level of knowledge, capacity, and functionality of CPP at the field level. CPP activities such as warning, evacuation, sheltering are being conducted as per the SOD. According to local people and CPP volunteers, there is a functionality gap during preparedness and post-disaster activities due to external and internal issues. This gap can be addressed through regular capacity building programs for both CPP and community members and improved coordination with local authorities. To implement these strategies, the acknowledgment of the current issues is necessary. Some inconsistencies were noticed between findings from the field level and from the key informant interviews. The key informants identified a few more challenges regarding funding, institutionalization, administrative manpower, and cooperation from the ministry. Therefore, a more holistic approach is required to solve these issues, both at the upper and lower end activities CPP.

CHAPTER 7: MAJOR FINDINGS, RECOMMENDATIONS, AND CONCLUSION

7.1 Major Findings

The study's primary objectives are to analyze the linkages among CPP and other organizations involved at three stages of cyclone management and assess community perception on the field level activities of CPP. This chapter concludes the research by proposing some recommendations based on the significant findings. Major findings of the study are described as follow:

Involvement of CPP and other Organizations in Cyclone Management Network

The composition of the network structures shows that majority of the actors involved in managing cyclones are government organizations. In the response, recovery, and preparedness network, the percentages of governmental organizations are 77.5%, 75.8%, and 45%, respectively. In terms of jurisdiction, local organizations have significant participation as shown by the percentages of upazila and union organizations in response, recovery, and preparedness networks (36.7%, 57.6%, and 40%, respectively).

Network diagrams prepared under this research helped visualize the network structure for all three phases of cyclone management. In response, the center of the network has mostly consisted of CPP and public organizations. The network map of relief and recovery shows district administration, UNO office, and Union Parishad office at the center. The preparedness network is small compared to the previous two stages. The local administration and CPP offices are located at the center of the preparedness network, while the less-active organizations are located around the periphery.

The research was able to identify critical organizations through centrality analysis. The key organizations of the warning and response network included MoDMR and CPP offices at Dhaka, upazila and union level. The study found that CPP worked as a significant 'source' and 'receiver' of information. It directly received information from BMD and MoDMR, and transmitted them to other upazila and union level organizations. Local organizations working at union and upazila level received substantial information flow as depicted by their higher in-degree centrality value. The higher betweenness and closeness centrality values of CPP indicated that they worked as gatekeepers in information flow and were closer to other actors. For relief and recovery, CPP interaction is much lower compared to

its contribution to the response and preparedness phase. District administration and UNO office are identified as the key organizations for the recovery stage. For preparedness and risk reduction, the CPP Head office played a vital role by coordinating with ministries and NGOs to arrange capacity building programs. The network density values are slightly different for all three networks. Overall, the network density is low, as only around 17-27.5% of all possible connections are present in three phases, depicting the lack of effective coordination among the actors.

Community Perception of the Field Level Activities of CPP

After examining the role and linkages of CPP and other actors through network analysis, the study conducted field visits to understand the CPP's role at the community level and its interaction with local people. Focus group discussions were conducted at the coastal areas of Barguna Sadar upazila under Barguna district and Galachipa upazila under Patuakhali district. Varied perspectives of linkages have been observed between the results of network analysis and community-level discussion. From the organization's perspective, as found from the network analysis, local authority played a critical role during and after cyclone Bulbul. However, at the community level it was found that the CPP union office was most strongly connected to the community due to the social influence of volunteers and their frequent interactions with community members. Except for the warning and disaster phase, UNO office and Union Parishad office did not directly communicate with community during the normal period. CPP often worked as intermediaries between local administration and community. Several challenges were identified which limit the functionality of field-level CPP, resulting in non-compliance with SOD. Two significant challenges include the absence of regular maintenance of equipment and lack of coordination with local administration. With its limited capacity, CPP unit volunteers responded to cyclone Bulbul and any other cyclone of the past because of social responsibility and sense of belongingness to the community. Discussion with CPP officials revealed the necessity of institutionalization and formalization of CPP, which are responsible for its limited scope at the field level.

7.2 Areas of Improvement and Recommendations for Effective Communication and Coordination

Based on the focus group discussion with community members and CPP volunteers, key informant interview, and literature review, the study has identified the major areas of

improvement and accordingly proposed the following recommendations to enhance the coordination and communication in the cyclone management network of Bangladesh.

Bottom-Up Approach of Disaster Management

Bangladesh has a well-structured policy framework for managing cyclones and a country-wide network of organizations. However, empirical findings help to determine the extent to which current practices conform to the stated policies. Findings from both of these objectives indicate that the cyclone management network mostly works following a hierarchy. A traditional top-bottom approach is followed where the national authorities determine the actions to be taken. The disaster governance of Bangladesh is currently undergoing a transitional phase, where the organizations are trying to follow a network structure (Osman *et al*., 2013). Although a top-bottom approach can facilitate rapid decision-making during disaster response, the necessity of the bottom-up approach in disaster preparedness is also well-recognized, especially during the preparedness stage (Parsons *et al.,* 2016). This study found that local organizations were great 'receivers' of information, where they mostly received and implemented the orders sent from a higher authority. Many field-level challenges of CPP are unknown to higher-level officials of CPP and MoDMR. During preparedness, a shifting to a bottom-up approach will enable the government to address local obstacles and take measures accordingly.

To facilitate the bottom-up approach, both government agencies and other organizations should develop the capacity to learn, adapt, and transform organizational practices. Representatives from upazila and union disaster management committees, CPP upazila and union offices, and members of the community-based organizations can be invited to attend regular stakeholder meetings to share their views with government departments and ministries. Community people's experience with cyclones and feedback for better management can be collected through interactive discussions. Every year these sessions can be arranged during the recovery and preparedness stages of cyclones. Increased communication and participation of local actors in the decision-making process will result in increased density and improved network performance.

Trust based Relationship

Mutual understanding and well-established organizational relationships among the collaborating organizations are necessary for the good performance of networks (Kapucu *et al.*, 2010). With regard to immediate response during cyclones, local administration can

be credited for playing its due role, but its coordinative role is still insignificant. Although CPP and local authorities work together during cyclone response and warning, their efforts are not undertaken in a coordinated way. CPP volunteers have to perform major share of responsibilities with limited manpower and financial constraint. The first objective of the study identified the significance of local authority and CPP in all stages of handling the cyclones. The cyclone management network will lack connectedness and cohesion without coordination between CPP and local authority. There is also a lack of trust-based relationship between these two actors. For example- there is a conflict between CPP and local administration regarding warning dissemination, relief distribution, and receival of response equipment.

In order to eradicate this problem, the local organizations should concentrate on promoting a trust-based relationship. The agencies should consider themselves as partners pursuing a common goal. The existing disaster management committees at upazila and union levels are not active during the normal period. These committees should be developed as the platforms for multidisciplinary interaction. The meetings of upazila and union disaster management committees should be held in regular time intervals with the participation of all members, including CPP, UNO/Union Parishad Chairman, and NGOs. Besides, frequent view exchange meetings can be arranged to improve communications among different actors, which might foster a trust-based relationship among them.

Coordination

Coordination and collaboration among the public and private sector at the community, city, national, and even international levels have become increasingly crucial. In the study, the network density of the warning and response network is comparatively higher than the relief and recovery and preparedness and risk reduction networks. As organizations voluntarily and actively interact during the disaster-period, the number of connections is higher for the warning and response network. The same level of urgency, sense of responsibility, and exchange of information should be practiced during the other two stages to increase network density.

At national level, the communication between the ministry and CPP head office needs to be strengthened in order to eradicate the bureaucratic obstacles that hinder the growth of CPP as an essential organization in the disaster management system of Bangladesh. At local level, upazila and union offices should adopt a coordinated and participatory approach

while conducting their services. The goal is to develop a decision-support system based on the exchange of timely, accurate information so that different organizations can adopt reciprocally to handle and overcome complex situations effectively.

Coordination requires an intensive exchange of information among all the participating organizations and the increased capacity of the decision-makers to process the expanding amount of information (Comfort *et al*., 2004). An information infrastructure, such as a socio-technical system (STS), can be designed that will link organizations, individuals, policymakers, etc., using current information and technology. In order to develop an information infrastructure, the identification of existing linkages among different organizations, legal responsibility at different levels, existing resource base, etc., must be known. The network diagrams and links found from the study will facilitate the creation of such a knowledge base.

Shared Responsibility

Several organizations often perform the same task, especially during the recovery phase of cyclones. For example- CPP union volunteers, Red Cross volunteers, and Union Parishad office all collect loss and damage data. In this process, CPP maintains coordination with others, whereas Red Cross conducts the assessment without maintaining any association with the local authority. This creates confusion among national and regional actors and results in the delayed distribution of relief materials. Furthermore, the network for distributing relief materials is not balanced as it lacks the participation of local actors to ensure fairness. Union Parishad Chairman is mostly responsible for collecting the relief from the UNO office and distributing it. It sometimes overloads the chairman with transport and carrying costs. Participation of CPP volunteers, NGOs, and CBOs in the coordination body will not only ensure impartiality in relief distribution it will also ease the burden from the local authority. Through the establishment of such a coordination body, organizations should seek ways of sharing resources and responsibilities in order to achieve a common approach to meet public needs.

Delegation of Authority

Decisions regarding disaster response and recovery are highly centralized in Bangladesh. Local authorities are not autonomous in terms of financial resources and decision-making. In most cases, upazila and union offices have to depend on district administration to allocate resources for relief and recovery. DC office has to go through a long, hectic process before

sending the final requisition to MoDMR. Final decisions come from the ministry that doesn't have specific knowledge on the existing situation and challenges of the local areas. This study recognized the role of local-level organizations in all three phases of the cyclone. Delegation of authorities from the central level to the local level will make the networks more effective and faster. Local organizations will utilize the local level knowledge in making plans for cyclone preparedness, recovery, and response. Through better communication among actors, the quality of field level activities will also be improved.

7.3   Conclusion

The cyclone management system of Bangladesh heavily relies on the inter-organizational network with partners from the government, CPP, and NGOs. Network analysis is a useful tool to analyze the organizational linkages that occur before, during, and after a disaster. Using Social Network Analysis (SNA), this study explored the intergovernmental interactions during warning and response, relief and recovery, and preparedness and risk reduction stages of cyclone Bulbul. Data collected from both primary and secondary sources were utilized to generate adjacency matrices and consequent network diagrams. Through the analysis of node and network-level measures, the research was able to identify the key organizations in all three networks. Later field visits were conducted to explore the community perception of the field level cyclone management activities. Analyzing the findings, one can get a complete picture of the inter-organizational network and the field level implications of CPP's actions. It is evident from the study that the participation of all actors is essential for the prompt delivery of services. Network measures can be used to optimize the distance between organizations for effective and fast information flow during complex scenarios. Findings from the study can be used to make informed decisions in the future, which will ensure better coordination, communication, and participation of all relevant actors in the disaster governance of Bangladesh. The study focused on three stages of cyclone management to depict an intergovernmental response to catastrophic disasters. Further research can be conducted by focusing on task-related or organization-specific networks, i.e., donation network, relief distribution network, the network of NGOs, etc., through the involvement of more actors.

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Appendix A.1: List of key informants and respective organizations

Name of Organization	Key Informant's Position	Type of Organization	Jurisdiction Level
Ministry of Disaster Management and Relief, Government of Bangladesh	Deputy Secretary	Government	National
Bangladesh Meteorological Department	Assistant Meteorologist	Government	National
Cyclone Preparedness Programme Head Office	• Director (Admin) • Director (Operation) • Deputy Director (Operation)	Joint (Government and BDRCS)	National
Cyclone Preparedness Programme Upazila Office	• Deputy Director (Barishal Zonal Office) Additional Charge- Galachipa Upazila Office • Deputy Director- Barguna Upazila Office • Upazila Team Leader, Barguna Sadar Upazila		Upazila
Cyclone Preparedness Programme Union Office	• Union Team Leader, Galachipa Sadar Union • Union Team Leader, Barguna Sadar Union • Unit Volunteer, Ratandi Taltali Union • Unit Volunteer, Noltona Union		Union
Upazila Disaster Management Committee	• Upazila Nirbahi Officer, Galachipa Upazila • Upazila Nirbahi Officer, Barguna Sadar Upazila	Government	Upazila
Union Disaster Management Committee	• Union Parishad Chairman	Government	Union
Armed Forces Division	• Commanding Officer, Bangladesh Navy • Officer, Bangladesh Army	Government	National
Bangladesh Red Crescent Society	• CEA officer and JAD	Non-profit	International
Bangladesh Water Development Board Upazila Office	• Upazila Engineer, Barguna	Government	Upazila
Local Government Engineering Department	• Upazila Engineer, Galachipa	Government	Upazila

Appendix A.2: Checklist for Key Informant Interview

Name of the Organization:

Primary Responsibility of the Organization in Cyclone Management:

Stage	Pre-and During Disaster (Alert, Warning, Response, Search and Rescue)	Post-Disaster (Relief, Recovery, Rehabilitation)	Normal Period (Preparedness and Cyclone Risk Reduction)
Activity			

Interaction and Linkages with Other Organizations:

List of organizations compiled from documentation review (SOD 2010, 2019) and content analysis of newspapers	Phase of Interaction			Purpose of interaction
	Pre-and During Disaster (Alert, Warning, Response, Search and Rescue)	Post-Disaster (Relief, Recovery, Rehabilitation)	Normal Period (Preparedness and Cyclone Risk Reduction)	
1. Ministry of Disaster Management and Relief (MoDMR)				
2. Prime Minister's Office				
3. National Disaster Management Council (NDMC)				
4. Bangladesh Meteorological Department (BMD)				
5. Cyclone Preparedness Programme (CPP) Head office, Dhaka				
6. CPP Zonal office				

List of organizations compiled from documentation review (SOD 2010, 2019) and content analysis of newspapers	Phase of Interaction			Purpose of interaction
	Pre-and During Disaster (Alert, Warning, Response, Search and Rescue)	Post-Disaster (Relief, Recovery, Rehabilitation)	Normal Period (Preparedness and Cyclone Risk Reduction)	
7. CPP Upazila office				
8. CPP Union office				
9. Department of Disaster Management				
10. Ministry of Defense				
11. Ministry of Water Resources				
12. Ministry of Shipping				
13. Ministry of Agriculture				
14. Ministry of Health				
15. Ministry of Education				
16. Ministry of Home Affairs				
17. Bangladesh. Inland Water Transport Authority (BIWTA)				
18. Bangladesh Inland Water Transport Corporation				
19. Bangladesh Water Development Board (BWDB)				
20. Upazila Water Development Board				
21. Mass media				
22. Armed Forces Division (AFD)				
23. Mercantile Marine Office (MMO)				
24. District Administration				
25. Ministry of Local Govt & Rural Development Cooperatives				
26. UNO office				
27. Union Parishad office				
28. Bangladesh Coast Guard				
29. Divisional forest officer				

List of organizations compiled from documentation review (SOD 2010, 2019) and content analysis of newspapers	Phase of Interaction			Purpose of interaction
	Pre-and During Disaster (Alert, Warning, Response, Search and Rescue)	Post-Disaster (Relief, Recovery, Rehabilitation)	Normal Period (Preparedness and Cyclone Risk Reduction)	
30. Ministry of Information				
31. Public Security Division				
32. Scout				
33. Police				
34. Port Authority				
35. SPARRSO				
36. Directorate General of Health Services				
37. Institute of Water Modelling				
38. Water Resources Planning Org.				
39. Upazila Project Implementation Officer				
40. Local NGOs				
41. Local Govt. Engineering Dept.				
42. Public Health Engineering Dept.				
43. Local Education office				
44. Bangladesh Red Crescent Society				
45. Local Red Cross Volunteers				
46. Others (Please specify)				

Appendix B.1: Adjacency Matrix for Warning and Response Network

	MoDMR	PM Office	NDMC	BMD	CPP Head office	CPP Zonal office	CPP Upazila office	CPP Union office	DDM	Ministry of Defense	Ministry of Shipping	Ministry of Agriculture	Ministry of Water Resources	Ministry of Health	Ministry of Education	Ministry of Home Affairs	BIWTA	BIWTC	BWDB	Upazila Water Development Board	Mass media	AFD	Mercantile Marine Office (MMO), Ministry of Shipping	District Administration	BDRCS	Ministry of Local Government,	UNO office	Union Parishad office	Bangladesh Coast Guard	Divisional forest officer	Ministry of Information	Public Security Division	INGO_UNDP	INGO_IFRCS	INGO_JICA	INGO_American Red Cross	Scout	Police	Port Authority (Mongla,	SPARRSO	Directorate General of Health	IWM	WARPO	Upazila PIO	LGED	Local NGOs	Red Cross Volunteers	Public Health Engineering Dept.	Local Education officer
MoDMR	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	0
PM Office	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NDMC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BMD	1	1	1	0	1	1	1	0	0	1	1	1	1	0	0	0	1	1	1	0	1	1	1	1	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
CPP Head office	1	0	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
CPP Zonal office	0	0	0	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
CPP Upazila office	0	0	0	1	1	1	0	1	1	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
CPP Union office	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	1	1	1	1
DDM	1	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0
Ministry of Defense	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Ministry of Shipping	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Ministry of Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ministry of Water Resources	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ministry of Health	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Ministry of Education	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Ministry of Home Affairs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BIWTA	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
BIWTC	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
BWDB	1	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upazila Water Development Board	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mass media	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AFD	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Mercantile Marine Office (MMO), Ministry of Shipping	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
District Administration	1	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	1	1	1	1	1	0	0	1	0	0	0	0	1	0	0	1	1

Organization	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
BDRCS	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0
Ministry of Local Government, Rural Development and Co-operatives	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
UNO office	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	0	0	1	1	0	0	1	0	0	0	0	1	1	0	1	1	0	1	1	0	1	0	1	1
Union Parishad office	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Bangladesh Coast Guard	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Divisional forest officer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ministry of Information	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Security Division	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
INGO UNDP	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	INGO	0	0	0	0
INGO IFRCS	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	IFRCS	0	1	0	0
INGO JICA	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	JICA	0	0	0	0
INGO American Red Cross	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Scout	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	Scout	0	0	0	0
Police	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Port Authority (Mongla, Chittagong)	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SPARRSO	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	SPARRSO	0	0	0	0
Directorate General of Health Services (DGHS)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
IWM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	IWM	0	0	0
WARPO	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	WARPO	0	0	0
Upazila PIO	1	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Upazila PIO	0	0	0	0
LGED	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	LGED	0	0	1
Local NGOs	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Local NGOs	0	0	0
Red Cross Volunteers	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Red Cross	0	0	0	0
Public Health Engineering Dept.	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Education officer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0

Appendix B.2: List of Organization in the Warning and Response Network according to Jurisdiction and Type

Name of Organization	Jurisdiction	Type of organization
1. MoDMR	National	Government
2. PM Office	National	Government
3. NDMC	National	Government
4. BMD	National	Government
5. CPP Head office	National	Joint
6. CPP Zonal office	Regional	Joint
7. CPP Upazila office	Local	Joint
8. CPP Union office	Local	Joint
9. DDM	National	Government
10. Ministry of Defense	National	Government
11. Ministry of Shipping	National	Government
12. Ministry of Agriculture	National	Government
13. Ministry of Water Resources	National	Government
14. Ministry of Health	National	Government
15. Ministry of Education	National	Government
16. Ministry of Home Affairs	National	Government
17. BIWTA	National	Government
18. BIWTC	National	Government
19. BWDB	National	Government
20. Upazila Water Development Board	Local	Government
21. Mass media	National	Government
22. AFD	National	Government
23. Mercantile Marine Office (MMO), Ministry of Shipping	Local	Government
24. District Administration	Regional	Government
25. BDRCS	International	Nonprofit
26. Ministry of Local Government, Rural Development and Co-operatives	National	Government
27. UNO office	Local	Government
28. Union Parishad office	Local	Government
29. Bangladesh Coast Guard	Local	Government
30. Divisional forest officer	Regional	Government
31. Ministry of Information	National	Government
32. Public Security Division	National	Government
33. INGO_UNDP	International	Nonprofit
34. INGO_IFRCS	International	Nonprofit
35. INGO_JICA	International	Nonprofit
36. INGO_ American Red Cross	International	Nonprofit
37. Scout	Local	Government

38. Police	Local	Government
39. Port Authority (Mongla, Chittagong)	Local	Government
40. SPARRSO	Local	Government
41. Directorate General of Health Services (DGHS)	National	Government
42. IWM	National	Government
43. WARPO	Local	Government
44. Upazila PIO	Local	Government
45. LGED	Local	Government
46. Local NGOs	Local	Government
47. Red Cross Volunteers	Local	Nonprofit
48. Public Health Engineering Dept.	Local	Government
49. Local Education officer	Local	Government

Appendix B.3: Adjacency Matrix for Relief and Recovery Network

	MoDMR	DDM	Ministry of Environment, Forest and Climate Change.	Forest Department	Rural Electrification Board (REB)	CPP Head office	CPP Upazila office	CPP Union office	IFRCS	BDRCS	District Administration	Ministry of Agriculture	Ministry of Finacne	Ministry of Water Resource	Department of Agricultural Extension (DAE)	Upazila Water Development Board	UNO office	PIO	Union Parishad office	Local NGOs	Red Cross Volunteers	Water Resources Planning Organization	Dept. of Public Health Engineering	Local Government Engineering Department	Dept. of Fisheries	Dept. of Health	Bangladesh Navy	Fire Service and Civil Defense	Bangladesh Coast Guard
MoDMR	0	1	0	0	0	1	1	1	0	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
DDM	1	0	0	0	0	1	1	1	0	0	1	1	1	0	0	0	1	0	1	1	0	1	1	1	1	1	0	0	0
Ministry of Environment, Forest and Climate Change.	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Forest Department	1	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0
Rural Electrification Board (REB)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
CPP Head office	1	1	1	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
CPP Upazila office	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0
CPP Union office	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0
IFRCS	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
BDRCS	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
District Administration	1	1	0	0	0	1	1	1	0	0	0	1	0	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
Ministry of Agriculture	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ministry of Finacne	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ministry of Water Resources	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Department of Agricultural Extension (DAE)	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Upazila Water Development Board	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
UNO office	0	0	0	0	1	0	1	1	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	1	1
PIO	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Union Parishad office	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	1	0	0	0	0	0
Local NGOs	0	1	0	0	0	1	1	1	0	0	1	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Red Cross Volunteers	0	1	0	0	0	1	1	1	1	1	1	0	0	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0
Water Resources Planning Organization	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Dept. of Public Health Engineering	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Local Government Engineering Department	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Dept. of Fisheries	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Dept. of Health	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0
Bangladesh Navy	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	1
Fire Service and Civil Defense	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1
Bangladesh Coast Guard	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0

Appendix B.4: List of Organization in the Relief and Recovery Network according to Jurisdiction and Type

Name of Organization	Jurisdiction	Type of organization
1. MoDMR	National	Government
2. DDM	National	Government
3. Ministry of Environment, Forest and Climate Change.	National	Government
4. Forest Department	Local	Government
5. Rural Electrification Board (REB)	Local	Government
6. CPP Head office	National	Joint
7. CPP Upazila office	Local	Joint
8. CPP Union office	Local	Joint
9. IFRCS	International	Nonprofit
10. BDRCS	International	Nonprofit
11. District Adminsitration	Regional	Government
12. Ministry of Agriculture	National	Government
13. Ministry of Finacne	National	Government
14. Ministry of Water Resources	National	Government
15. Department of Agricultural Extension (DAE)	Local	Government
16. Upazila Water Development Board	Local	Government
17. UNO office	Local	Government
18. PIO	Local	Government
19. Union Parishad office	Local	Government
20. Local NGOs	Local	Nonprofit
21. Red Cross Volunteers	Local	Nonprofit
22. Water Resources Planning Organization	Local	Government
23. Dept. of Public Health Engineering	Local	Government
24. Local Government Engineering Department	Local	Government
25. Dept. of Fisheries	Local	Government
26. Dept. of Health	Local	Government
27. Bangladesh Navy	National	Government
28. Fire Service and Civil Defense	National	Government
29. Bangladesh Coast Guard	Local	Government

Appendix B.5: Adjacency Matrix for Preparedness and Risk Reduction Network

	MoDMR	DDM	CPP Head office	CPP Zonal office	CPP Upazila office	CPP Union office	Mayor_City Corporation	District Administration	Parliament Member	UNO office	PIO	Union Parishad office	USAID	UNDP	American Red Cross	Christian Aid	World Vision	Save the Children	Local NGOs	Police
MoDMR	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
DDM	1	0	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
CPP Head office	1	0	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	0
CPP Zonal office	0	0	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
CPP Upazila office	1	0	1	1	0	0	1	1	1	1	1	0	0	0	1	0	0	0	0	0
CPP Union office	0	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
Mayor_City Corporation	0	0	0	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
District Adminsitration	1	0	1	1	1	1	1	0	1	1	1	1	0	0	0	0	0	0	1	1
Parliament Member	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNO office	1	1	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	1
PIO	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
Union Parishad office	1	0	1	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	1	0
USAID	1	0	1	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	1	0
UNDP	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
American Red Cross	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Christian Aid	1	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0
World Vision	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Save the Children	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local NGOs	0	0	0	0	1	1	0	0	0	1	1	1	0	0	1	0	0	0	0	0
Police	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix B.6: List of Organization in the Preparedness and Risk Reduction Network according to Jurisdiction and Type

Name of Organization	Jurisdiction	Type of organization
1. MoDMR	National	Government
2. DDM	National	Government
3. CPP Head office	National	Joint
4. CPP Zonal office	Regional	Joint
5. CPP Upazila office	Local	Joint
6. CPP Union office	Local	Joint
7. Mayor_City Corporation	Regional	Government
8. District Adminsitration	Regional	Government
9. Parliament Member	Local	Government
10. UNO office	Local	Government
11. PIO	Local	Government
12. Union Parishad office	Local	Government
13. USAID	International	Nonprofit
14. UNDP	International	Nonprofit
15. American Red Cross	International	Nonprofit
16. Christian Aid	International	Nonprofit
17. World Vision	International	Nonprofit
18. Save the Children	International	Nonprofit
19. Local NGOs	Local	Nonprofit
20. Police	Local	Government

Appendix C: Focus Group Discussion with CPP Volunteers and Community Members

Checklist for CPP Volunteers to identify Non-Compliance with Standing Order on Disasters

Phase of Disaster Management	Questions	Response		
		Yes	No	N/A
Normal/Preparedness phase	1. Does CPP organize preparedness programmes on continuing basis and hold drills in the months of April and September every year?			
	2. Does it ensure recruitment and training of volunteers before the month of April every year?			
	3. Does it ensure issue of warning signal kits to the leaders of volunteers and use by them?			
	4. Do they educate and create awareness amongst the local people about the cyclone preparedness programme and the understanding of different warning signals?			
	5. Does it make physical verification of equipment allotted to the leader of volunteers and their condition and undertake their repairs/replacement, if needed?			
	6. Do they earmark shelter places, killas and safe raised land and keep them fit for use?			
	7. Do they publicize the evacuation plan?			
Alert phase (Response based on recent cyclones such as Fani and Bulbul)	1. Did CPP maintain close liaison with BMD and collect information about the cyclone?			
	2. Did they alert the chairman of District/Upazila/Union DMCs, members, religious leaders, local elites, teachers and persons connected with different organizations?			
	3. Were the volunteers advised to listen to radio broadcasts in order to ensure that work of the volunteers specified in the booklet published by CPP is started?			
Warning Phase (Response based on most recent cyclones	1. Did CPP request DC/UNO/Upazila and UP Chairman to call emergency meeting of the respective DMC(s)?			

such as Fani and Bulbul)	2. Did the CPP volunteers shift the livestock, poultry and other domestic animals to raised land, killas under proper safety measures?			
	3. Were local people provided with proper warning of the cyclone?			
	4. Did volunteers advise the people to go to shelter place in the event of evacuation order and assist them in the process?			
	5. Did CPP give the final warning to the people by using megaphone, light signals and flash lights?			
Disaster Phase (Response based on most recent cyclones such as Fani and Bulbul)	1. Did CPP conduct rescue work in coordination with Union and Upazila authority and provide first aid according to need?			
	2. Did they assist local authority in relief distribution?			

For Community Members to identify Non-Compliance with Standing Order on Disasters

Phase of Disaster Management	Questions	Response		
		Yes	No	N/A
Warning Phase	Did the CPP volunteers shift the livestock, poultry and other domestic animals to raised land, killas under proper safety measures?			
	Were local people provided with proper warning of the cyclone?			
	Did volunteers advise the people to go to shelter place in the event of evacuation order and assist them in the process?			
	Did CPP give the final warning to the people by using megaphone, light signals and flash lights?			

	Did CPP conduct rescue work in coordination with Union and Upazila authority and provide first aid according to need?			
Disaster Phase	Did they assist local authority in relief distribution?			

Appendix D.1: Photos of Field Survey (Focus Group Discussion and Key Informant Interviews)

Figure: Focus group discussion with community people at Galachipa upazila

Figure: Focus group discussion with community people at Barguna Sadar upazila

Figure: Meeting with CPP unit volunteers

Figure: Meeting at CPP union offices in Galachipa (left) and Barguna Sadar (right)

Appendix D.2: Photos of Cyclone Preparedness Programme (CPP)

Warning dissemination

Rescue

Unit level training

Cyclone drill

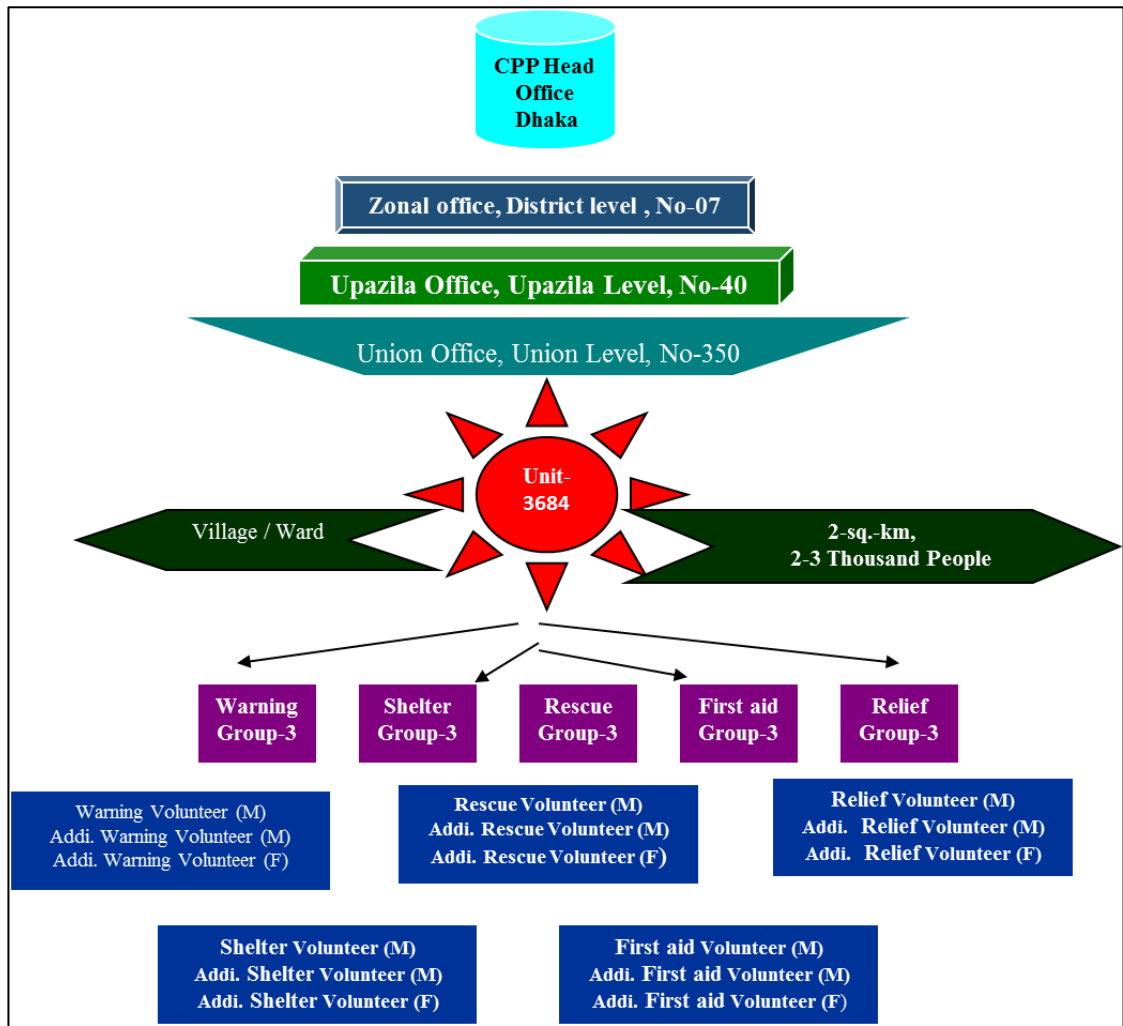Figure: Field level activities of CPP (Source: CPP, 2019)

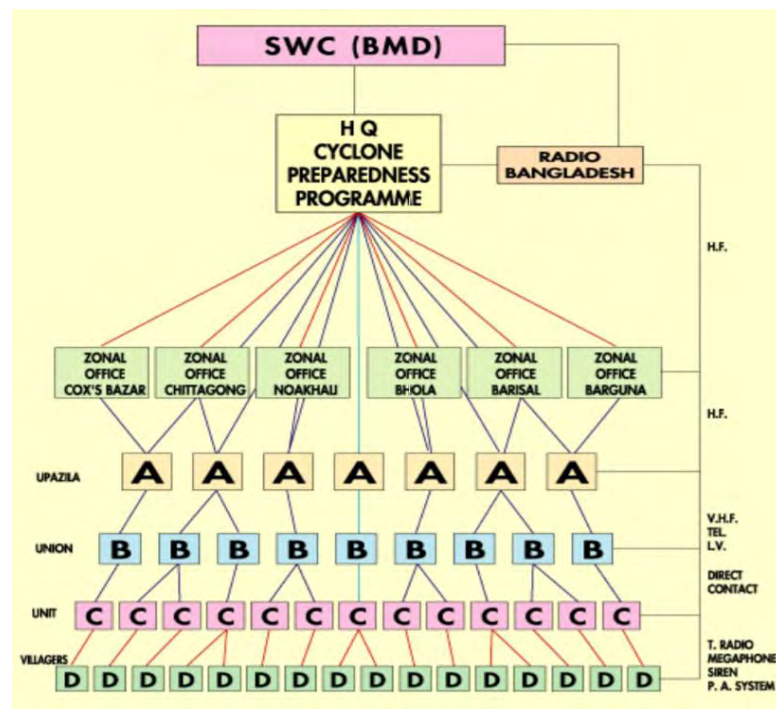Figure: CPP organizational structure (Source: CPP, 2019)

Figure: Dissemination of cyclone warning (Source: CPP, 2019)

Appendix D.3: List of CPP Volunteers

Zone	District	Upazila	Union	Unit	Volunteer		Total
					Male	Female	
Cox's Bazar	Cox's Bazar	Teknaf	6	66	660	330	990
	Cox's Bazar	Ukhiya	6	25	250	125	375
	Cox's Bazar	Cox's Bazar	8	69	690	345	1035
	Cox's Bazar	Moheskhali	9	96	960	445	1440
	Cox's Bazar	Chakaria	11	70	700	350	1050
	Cox's Bazar	Pekua	7	49	490	245	735
	Cox's Bazar	Kutubdia	6	55	550	275	825
Chittagong	Chittagong	Chittagong City	0	3	30	15	45
	Chittagong	Sitakunda	10	63	630	315	945
	Chittagong	Mirsharai	10	80	800	400	1200
	Chittagong	Sandwip	15	146	1460	730	2190
	Chittagong	Banshkhali	11	71	710	355	1065
	Chittagong	Anwara	7	50	500	250	750
	Chittagong	Patiya	5	31	310	155	465
Noakhali	Noakhali	Noakhali Sadar	0	3	30	15	45
	Feni	Sonagaji	9	100	1000	500	1500
	Noakhali	Companiganj	8	119	1190	595	1785
	Noakhali	Subaranchar	9	120	1200	600	1800
	Noakhali	Hatia	11	177	1770	885	2655
	Lakshmipur	Ramgati	9	101	1010	505	1515
	Lakshmipur	Kamalnagar	9	63	630	315	945
Bhola	Bhola	Monpura	4	55	550	275	825
	Bhola	Daulatkhan	9	91	910	455	1365
	Bhola	Borhanuddin	6	64	640	320	960
	Bhola	Tajumuddin	5	81	810	405	1215
	Bhola	Lalmohan	9	137	1370	685	2055
	Bhola	Char Fasson	19	165	1650	825	2475

	Bhola	Bhola Sadar	9	87	870	435	1305
Barisal	Barisal	Barisal Sadar	0	3	30	15	45
	Patuakhali	Dashmina	7	78	780	390	1170
	Patuakhali	Galachipa	13	135	1350	675	2025
	Patuakhali	Rangabali	5	64	640	320	960
	Pirojpur	Mathbaria	8	85	850	425	1275
	Bagerhat	Sarankhola	4	45	450	225	675
Barguna	Patuakhali	Kalapara	12	158	1580	790	2370
	Barguna	Amtali	8	115	1150	575	1725
	Barguna	Taltali	7	58	580	290	870
	Barguna	Barguna Sadar	10	146	1460	730	2190
	Barguna	Pathaghata	7	103	1030	515	1545
Khulna	Khulna	Dakop	10	91	910	455	1365
	Khulna	Koyra	7	73	730	365	1095
	Satkhira	Assasuni	11	101	1010	505	1515
	Satkhira	Shyamnagar	12	143	1430	715	2145
	Bagerhat	Mongla	7	66	660	330	990
Total=7	13	41	355	3,701	37,010	15,505	55,515