Non-economic loss and damage in the context of climate change:

Comparative analysis of

Wakayama (Japan) and Khulna (Bangladesh)

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ABBREVIATIONS

AHP	Analytic Hierarchy Process
BDT	Bangladeshi Taka
CCA	Climate Change Adaptation
COP 16	Sixteenth Session of the Conference of the Parties
CR	Consistency Ratio
DC	Deputy Commissioner
DM	Disaster Management
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
ELDs	Economic Loss and Damages
EOC	Emergency Operation Center
FDMA	Fire and Disaster Management Agency, Japan
FGD	Focus Group Discussion
IPCC	Intergovernmental Panel on Climate Change
JPY	Japanese Yen
L&Ds	Loss and damages
M&V	Measurability and Verifiability
MIC	Ministry of Internal Affairs and Communications, Japan
NELDs	Non-Economic Loss and Damages
PTSD	Post-Traumatic Stress Disorder
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNO	Upazila Nirbahi Officer

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EXECUTIVE SUMMARY

1. Background

Loss and damages (L&Ds) caused by climate-related disasters are urgent challenges in changing a climate that the world is facing. International communities have sought to address the L&Ds, there is an emerging issue of non-economic loss and damages (NELDs). Addressing the NELDs is crucial because the NELDs may exceed economic loss and damages (ELDs) especially in small rural towns in developing countries such as Japan and also in developing countries such as Bangladesh. However, there is not yet adequate assessment frameworks for NELDs, due to the difficulty of understanding, identifying and estimating NELDs. Insufficient treatment of NELDs can make the actual disaster losses underestimated, lead to lacking investments in post-disaster recovery and limited decision-making on disaster risk reduction (DRR) and climate change adaptation (CCA), and result in a decrease in community disaster resilience.

This study aims to identify a post-disaster assessment framework for integrating NELDs into policy decision-making and takes case studies from Nachikatsuura town in Japan and Koyra sub-district (upazila) in Bangladesh, in order to:

- Understand NELDs caused by climate-related disasters;
- Identify and prioritize key NELD-related thematic areas, indicators, risk reduction practices, as well as relevant decision criteria, and
- Make recommendations to local and national governments to enhance existing DRR and/or CCA countermeasures for addressing NELDs.

2. Key findings

First of all, in Chapter 2 and Chapter 3, comprehensive literature review was undertaken to understand NELDs in the context of DRR and CCA, existing methodologies related to NELDs, and current status of NELDs between Japan and Bangladesh on the national levels. This study revealed that NELDs need specific attention and renewed interest from the viewpoints of both DRR and CCA fields. It is also shown that there is a need to develop comprehensive methodologies that DRR and CCA stakeholders can use for

decision-making to address NELDs. Taking the national cases of Japan and Bangladesh, the results demonstrated that both countries have included more data categories related to ELDs than NELDs in their disaster reports and statistics. This can lead to underestimation of actual total L&Ds and ineffective decision-making. Hence, it is important to explore practical and verifiable indicators of NELDs for practitioners and policymakers to use in disaster reports and to consider NELDs in their risk reduction practices.

Second, this study found the Analytic Hierarchy Process (AHP), a multi-criteria decision-making method, is one of the effective approaches to provide deeper insights on NELDs among relevant stakeholders, reach a consensus and select practices to respond to NELDs in communities. The reasons were that there are various interpretations of NELDs and this makes it difficult to agree and choose effective practices for NELDs; and that the practices should be relevant to local contexts because vulnerabilities and exposures can be different in accordance with socio-economic characteristics at the local level.

Third, in Chapter 5 in responding to Chapter 4, a case study of Nachikatsuura town, Wakayama prefecture in Japan was carried out to examine key NELDs caused by 2011 Typhoon No. 12 in 2011 and important practices to address the NELDs. This study applied the AHP to prioritize key NELD-related elements including criteria, indicators and practices. These elements were in order scrutinized through: comprehensive literature review; expert consultation; and focus group discussion (FGD) in the affected community. Questionnaire surveys were conducted to prioritize the key NELD elements targeting the affected communities and the town officials. This study found that both communities and town officials agree on the importance of addressing mental diseases and issues affecting the collaboration of local government with local communities. Besides that, communities identified their limited participation in decision-making as a challenge. In terms of health issues, in addition to mental diseases, town officials also recognized the importance of addressing chronic diseases. It is also indicated that the town's shelter policy and disaster management plan will help addressing these issues, although the relative effectiveness differs depending on the demographic characteristic of respondents.

Fourth, in Chapter 6, a case study of Koyra sub-district, Khulna district in Bangladesh representing developing countries was implemented to observes key NELDs caused by Cyclone Aila in 2009 and vital risk reduction practices by using same methodology as Nachikatsuura town. Key NELD elements were prioritized from the perspectives of the affected local communities and the local government officials. This study found that both

communities and local government officials agree on the importance of addressing issues with inaccessible sanitation and waterborne diseases. Furthermore, communities identified mental diseases as a challenge. Local government officials also recognized the importance of addressing schools discontinued. It is also demonstrated that the national disaster management plan will assist in addressing these issues.

Fifth, in Chapter 7, this study found that both Japan and Bangladesh cases emphasized the importance of addressing mental diseases as a key NELD. It is also shown that Japan's local communities highlighted the need for addressing local governance issues for post-disaster recovery, while those in Bangladesh raised the demand for addressing water and sanitation issues.

3. Conclusions and way forwards

This study contributed to enhanced understanding of NELDs in terms of DRR and CCA and development of an effective framework to identify and prioritize key NELDs and the risk reduction practices in the context of the study location. This study also provided recommendations to local and national governments to enhance existing shelter policies and disaster management plans for addressing the issues with NELDs. A common message for Japan and Bangladesh is that disaster data collection formats need to include key NELD indicators to ensure that L&Ds are fully reported and to mainstream NELDs in decision-making process for post-disaster recovery. Therefore, as a further research, it is essential to develop an assessment framework to quantify key NELD indicators and to figure out the total L&Ds, including both economic and non-economic aspects.

CHAPTER 1 INTRODUCTION

1.1 Background

Loss and damages (L&Ds) caused by climate-related disasters, such as cyclones, droughts and sea level rise, is an urgent challenge in the context of climate change that the world is facing. There are several interpretations of the L&Ds. One of the related literatures interprets the L&Ds as 'negative effects of climate variability and climate change that people have not been able to cope with or adapt to' (Warner and Geest, 2013, p.369). International attention for addressing the L&Ds has been paid through the discussions at the Conference of Parties (COP) under United Nations Framework Convention on Climate Change (UNFCCC). However, there is an emerging issue of non-economic loss and damages (NELDs) which has not been adequately mainstreamed in the current countermeasures to disaster risk reduction (DRR) and climate change adaptation (CCA) (Hoffmaister and Stabinsky, 2012).

Japan is also one of the most prone countries to climatic events in the world. Climatic disasters such as super typhoons have been often reported during recent years (Ministry of the Environment (MOEJ), 2015). In responding to this situation, the Japanese government has strengthened its countermeasures to facilitate post-disaster recovery. However, the focus is responses to physical economic damages, such as damages to houses and properties while the NELDs have not been sufficiently considered in current policy decision-making. More emphasis on NELDs is essential for Japan as NELDs could exceed economic damages, especially in small rural towns vulnerable to climatic disasters, as is the case that NELDs in developing countries could be more significant than economic damages (UNFCCC, 2013).

1.2 Problem Statement

Adequate assessment frameworks for addressing NELDs have not been established, in part because of the difficulty of understanding, identifying and estimating NELDs (Tol and Fankhauser, 1998; UNISDR, 2004; Hoffmaister and Stabinsky, 2012). NELDs have also not been sufficiently reported in most post-disaster reports and databases (Swiss Re, 2013). The actual disaster losses can be significantly underestimated if NELDs are treated

as less emphasis, and this can lead to insufficient investments in post-disaster recovery and limited decision-making on DRR and CCA, and result in a decrease in community resilience to climatic disasters (Morrissey and Oliver-Smith, 2013; IPCC, 2014).

1.3 Research Objective

Keeping the above in view, the objective of this study is to identify a post-disaster assessment framework for integrating NELDs into policy decision-making, through:

- Understand NELDs caused by climate-related disasters;
- Identify and prioritize key NELD-related thematic areas, indicators, risk reduction practices, as well as relevant decision criteria, and
- Make recommendations to local and national governments to enhance existing DRR and/or CCA countermeasures for addressing NELDs.

1.4 Research Hypothesis

The NELDs have not sufficiently considered in current decision-making processes on DRR and CCA. This study attempts to establish that understanding the issues of NELDs from community-based perspectives and integrating NELDs into policy decision-making can contribute significantly to better post-disaster recovery from climatic disasters.

This study seeks to address the following questions:

- What are important NELDs caused by climate-related disasters?
- What are effective frameworks to identify and prioritize key NELDs?
- What commonalities and differences in NELDs are between the perspectives of communities and local governments and also between developed and developing countries?
- What risk reduction practices and how they should be enhanced for addressing NELDs?

1.5 Research Methodology

The methodology used in this study is described in the following steps:

1. Comprehensive literature review: A desktop study was undertaken to understand NELDs in the context of CCA and DRR and to identify key NELD-related thematic areas, indicators, risk reduction practices, as well as relevant decision criteria.

2. Expert consultations: Consultation workshops were conducted with relevant experts to vet NELD-related elements (decision-making criteria, indicators and practices) identified from the literature in each country's context of study locations;

3. Community consultations: Focus group discussions in affected communities were implemented to identify key NELD elements appraised by expert consultations from the community perspectives;

4. Questionnaire surveys: Questionnaire surveys were carried out to prioritize key NELD elements from the perspectives of affected local communities and local governments, and to identify the differences between these two stakeholders on the relative importance they give to various NELD elements.

5. Analytical method: Analytic Hierarchy Process (AHP) was used to prioritize the data about key NELD elements collected from questionnaire surveys; and

6. Make recommendations to local and national governments to enhance existing DRR and/or CCA-related plans/policies for addressing NELDs.

1.6 Study location

This study mainly focused on NELDs caused by recent past climatic disasters in Japan, such as extreme typhoons, and a case study was conducted in Nachikatsuura town, Wakayama prefecture in Japan to explore NELDs caused by Typhoon No. 12 in 2011. Nachikatsuura was chosen as the study site for reasons, including: 1) severity of loss and damages from the Typhoon No. 12; 2) vulnerability to climatic disasters as rural small

municipality; and 3) abundance of social, cultural and environmental assets which can be impacted by NELDs.

Another case study for the purpose of comparative analysis between the Japan case and developing countries was carried out in Koyra sub-district, Khulna district in Bangladesh to discover NELDs caused by Cyclone Aila in 2009 that Bangladesh suffered most severe disaster during recent years. Koyra was selected as the study location due to similar reasons as the Japan case in terms of: 1) serious loss and damages from the Cyclone Aila; 2) geographic location as remote rural community; and 3) richness of social, cultural and environmental assets.

1.7 Study Scope and Limitations

This study is based on literature review, stakeholder consultations and questionnaire surveys in the study countries. The results are specific to these countries but it may be applicable to other country situations. In addition, since thorough explanations and longer questionnaires were needed to some extent in the survey forms to adequately explain respondents about the purpose and contents under the AHP method, it is unavoidable that the burden to answer by respondents might affect the survey result.

1.8 Structure of the Thesis

The thesis consists of seven chapters (Figure 1.1). Chapter 1 provides an introduction of the study by explaining the background, objective, hypothesis and methodology. Chapter 2 and Chapter 3 reviews literature and gives an overview of NELDs by describing the interpretation and importance of NELDs, existing methodologies related to NELDs, and current status of NELDs between developed and developing countries through cases of Japan and Bangladesh focusing on the national levels.

Chapter 4 focuses on the Japan case and provides firsthand local community and government perspectives on NELDs caused by recent past extreme typhoons, through an initial field survey in Wakayama. Then, Chapter 5 deals with the case of Nachikatsuura town and examines key NELDs caused by 2011 Typhoon No. 12 in 2011 and important risk reduction practices. Chapter 6 takes up Koyra sub-district in Bangladesh as a case of

developing countries and observes key NELDs caused by Cyclone Aila in 2009 and vital risk reduction practices by using same methodology as Nachikatsuura. Finally, Chapter 7 compares key findings from the Japan and Bangladesh case studies, and summarizes the conclusion of the study.

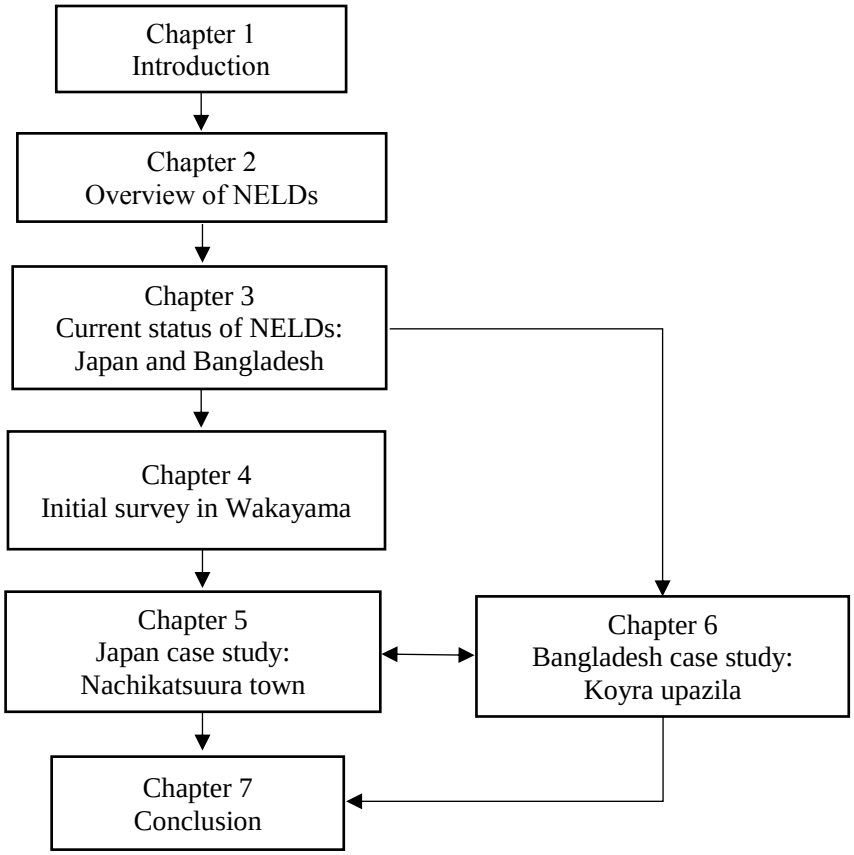

Figure 1.1 Structure of the thesis

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CHAPTER 2 OVERVIEW OF NON-ECONOMIC LOSS AND DAMAGE

2.1 Introduction

Natural disasters have been causing socio-economic, cultural and environmental impacts around the world. According to the Annual Disaster Statistical Review 2014, 324 natural disasters have affected 140.8 million people worldwide in 2014 alone. Asia is most frequently hit by natural disasters, including climate-related disasters, wherein the region is accounted for 44.4% of the disasters and 69.5% of disaster victims in the world in 2014 (Guha-Sapir *et al.*, 2015).

Weather-related events are reported to have been increasing in the last three decades (Warner *et al.,* 2012). The Intergovernmental Panel on Climate Change (IPCC) has concluded that current climate change effects have changed the frequency, intensity and duration of extreme weather and climate events (Seneviratne *et al.*, 2012). This has implications in terms of loss and damages (L&Ds) and non-economic loss and damages (NELDs) in particular (UNFCCC, 2012a). NELDs have the potential to fundamentally weaken a community's resilience (Morrissey and Oliver-Smith, 2013) and hence it is necessary to recognize and manage the risk of NELDs. Taking into view the importance of addressing the growing L&Ds in the context of climate change, the 2010 Cancun Agreements reached in the Conference of Parties on its sixteenth session (COP 16) under United Nations Framework Convention on Climate Change (UNFCCC) recognized that it is necessary to understand and reduce L&Ds from extreme weather events and slow onset events (Decision 1/CP.16, paragraph 25). The COP 19 has established a Warsaw International Mechanism to address L&Ds particularly in vulnerable countries in 2013 (Decision 2/CP.19, plaragraph 1-17). Subsequently, the Paris Agreement adopted by the COP 21 in 2015 further reiterated the importance of addressing L&Ds and approved the continuation of Warsaw International Mechanism until its review in 2016 (Decision /CP.21, paragraph 48-52).

Keeping these issues in view, this chapter reviews the literature to examine the importance of NELDs and looks into currently available methodologies and their limitations for assessing NELDs in both disaster risk reduction (DRR) and climate change adaptation (CCA) fields. This chapter benefits from the limited but rapidly emerging literature on the NELD aspects of DRR and CCA in an international community.

2.2 Understanding L&Ds

DRR intends to reduce the damage caused by natural hazards and is interpreted as 'the policy objective aimed at preventing new and reducing existing disaster risk and

managing residual risk, all of which contributes to strengthening resilience' (UNISDR, 2015a, p.14). On the other hand, CCA is a response to the adverse impacts of climate change, including climate-related disasters, and is defined as 'the process of adjustment to actual or expected climate and its effects', 'in human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities' and 'in some natural systems, human intervention may facilitate adjustment to expected climate and its effects' (IPCC, 2014a, p.118).

The discussion on L&Ds is not new among the DRR communities. Natural disasters have negative impacts on humanitarian, economic, and ecological aspects. The native impacts are often the loss of life, human injury, property damage, social and economic disruption or environmental degradation (UNISDR, 2005).

Traditionally, disaster risk management (DRM) decisions have often been made based on the understanding of previous disaster impacts that reflect the underlying vulnerabilities of communities, regions and institutions. For example, relief agencies have often been advised to plan disaster relief, based on the L&Ds reported in the previous disaster events in a given location (EMA, 2002). However, this traditional understanding of L&Ds will pose difficulties in a changing climate as less emphasis on NELDs compared to economic loss and damages (ELDs), limited attention to slow-onset events, and not often takes long-term view but rather the focus is to plan for that particular year based on the understanding from the recent past.

While the above understanding has been from the DRM literature, L&Ds in the context of climate change is defined as 'negative effects of climate variability and climate change that people have not been able to cope with or adapt to' (Warner and Geest, 2013, p.369). The Climate and Development Knowledge Network (2012) opined that L&Ds are residual negative impacts which would still happen after implementing adaptation efforts. L&Ds have also been interpreted as 'the actual and/or potential manifestation of impacts associated with climate change in developing countries that negatively affect human and natural systems' (UNFCCC, 2012a, p.3). There is an emerging importance of addressing NELDs among the CCA community as discussion on L&Ds has long been focused on economic aspects, such as loss of income and damage to property. NELDs has been discussed in more detail in the subsequent section.

2.3 NELDs and its importance

2.3.1 What are NELDs?

Climate change impacts can result in an increase in non-economic losses such as loss of social, health, cultural and environmental assets at the local and community level (UNISDR, 2015b). There are several interpretations of non-economic losses. A common definition of NELDs in the context of climate change has not been universally

agreed yet. UNFCCC (2013, p.3) referred the economic losses as 'the loss of resources, goods and services that are commonly traded in markets' and that 'market prices can be used to value economic losses'. Non-economic losses, on the other hand, are interpreted as the loss of those that are not commonly traded in markets (UNFCCC, 2013). Morrissey and Oliver-Smith (2013, p.3) opined that 'non-economic losses are those material goods and immaterial services which are lost through both direct and indirect climate change pathways', but which are ignored in the practices of market valuation. On the other hand, in the DRR field, non-economic losses can be intangible losses, which are potentially emerging in months after the disaster event, as loss items cannot be bought and sold for dollars (EMA, 2002). Fischer (2010) interpreted that non-economic damages can be subjective and non-verifiable losses and could include pain and suffering, emotional distress, injury to reputation, loss of consortium and so on.

2.3.2 Why addressing NELDs is important?

In many developing countries, NELDs can be more significant than ELDs. The quantified L&Ds from climate-related disasters may likely increase if NELDs are considered (UNFCCC, 2012). Despite its importance, NELDs have not been considered in the assessment and analyses of both climatic and non-climatic in nature and in designing insurance and compensation mechanisms (UNISDR, 2004; Hoffmaister and Stabinsky, 2012). NELDs have also not been sufficiently reported in the most post-disaster reports and databases (Swiss Re, 2013). Part of the problem has been the difficulty in estimating the non-economic damages (Tol and Fankhauser, 1998). According to the IPCC's 5th Assessment Report, disaster losses have been underestimated since it is difficult to value and monetize NELDs such as loss of human lives, cultural heritage and ecosystem services (IPCC, 2014b). If NELDs are not adequately addressed, it could negatively impact community resilience to climate-related disasters (Morrissey and Oliver-Smith, 2013). Hence the UNFCCC has called for urgent attention to keep NELDs at the center of climate change policies (UNFCCC, 2013).

2.3.3 What are different types of NELDs?

The literature has referred NELDs as losses of human lives, damages to livelihoods of people, territory, cultural heritage, ecosystem services and species extinction (Hoffmaister and Stabinsky, 2012; Morrissey and Oliver-Smith, 2013). UNFCCC (2013) has highlighted losses of life, health, displacement and human mobility, territory, cultural heritage, social capitals, indigenous/local knowledge, biodiversity and ecosystem services. In addition, L&Ds of education and local governance can also be considered as significant. Keeping the above understanding in view, NELDs can be grouped into losses of human functions, social and cultural assets and environmental assets (UNISDR, 2015b) (Table 2.1). An effort has been made here to elaborate on some of NELDs.

2.3.3.1 L&Ds of human functions

Loss of life is more likely to be directly caused by extreme weather events such as floods and landslides by torrential rainfall. Lives may be threaten by indirect L&Ds such as malnutrition through a food shortage resulting from decrease in crop yields due to slow onset events (UNFCCC, 2013). Loss of health can happen through injury, physical and mental illnesses (Hajat *et al.*, 2003). Health is directly or indirectly affected by both extreme weather events and slow onset events. For instance, storms and floods can cause injury and mental illness such as severe metal trauma. Heatwaves can cause cardiovascular and respiratory diseases.

Existing evidence reveals that children are more susceptible to the adverse effects of environmental degradation (UNICEF, 2012). Children in developing countries in particular are likely to suffer loss of education such as discontinuity in education due to climate-related disasters. Research also indicates that about 65 percent of children and women will be affected by climate-related disasters in the next decade (UNICEF, 2012).

Mobility is an important human function and it is referred as 'a continuum from completely voluntary movements to completely forced migrations' (Cutter *et al.*, 2012, p.300). Human mobility is affected by extreme weather events and slow onset events. For example, cyclones and floods can cause forced displacement. Desertification and ocean acidification can result in displacement. Humans are highly attached to their territory through place identity and place dependence and hence loss of territory could severely impact human functions (White *et al.*, 2008; UNFCCC, 2013). Territory is more likely to be affected by slow onset events. For instance, inundation due to sea level rise, droughts, salinization, land degradation and desertification can make land uninhabitable.

Table 2.1 Key types of NELDs

Sectors where NELDs will occur	Types of NELDs	Categories	Climate-related disasters
Life	Loss of life	Human functions	E
Health	Health deterioration	Human functions	E, S
Education	Loss of educational opportunity	Human functions	E, S
Mobility	Displacement	Human functions	E, S
Territory	Loss of place attachment	Human functions Social assets	S
Social capital	Break of social network	Social assets	E, S
Cultural heritage	Loss of cultural attachment	Social/Cultural assets	E, S
Indigenous knowledge	Loss of indigenous knowledge	Social/Environmental assets	S
Local governance	Break of institutional network	Social/Institutional functions	-
Biodiversity /Ecosystem	Biodiversity / ecosystem deterioration	Environmental assets	S

E: extreme weather events/extreme air temperature, S: slow onset events, -: unknown
Source: Prepared by Author from Raschky (2008); UNFCCC (2012b); UNICEF (2012); Striessnig *et al.*(2013); UNFCCC (2013).

2.3.3.2 L&Ds of social and cultural assets

Social capital is an important social asset and is referred to as 'networks together with shared norms, values and understandings that facilitate co-operation within or among groups' (Keeley, 2007, p.103). Social capital can be affected by climate-related disasters through breaking or stressing social network by displacement or resource shortages (UNFCCC, 2013), and through altering trust and reciprocity of people within communities (Fleming *et al.*, 2014). Cultural heritages include intangible cultural heritages such as oral traditions, performing arts and rituals, and tangible cultural heritages, such as historic buildings, monuments and artifacts, which are considered worthy of preservation for the future (UNESCO, 2015a; UNESCO, 2015b). Cultural heritages may have non-use value and form cultural identity and attachment to their community (Rizzo and Mignosa, 2013). Cultural heritage is affected by both extreme weather events and slow onset events. For example, cyclones and storms can destroy historical buildings. Drought has affected the World Heritage sites such as the Stone Circles of Senegambia (UNFCCC, 2013). Indigenous knowledge is the local knowledge that is unique to a particular cultural group or community and it is often relevant to environment, agriculture and so on (The World Bank, 2015). Indigenous knowledge, which contributes to social cohesion and identity, is more likely to be affected by slow onset events especially in climate-sensitive areas such as Arctic,

deserts and rainforests (UNFCCC, 2013). Increasing temperatures and desertification may make the traditional farming practices of indigenous people useless in Africa.

Local governments play an important role in addressing climate-related disasters at community level. However, local governments are also likely to suffer NELDs that affects local governance through disruption of institutional network, putting pressure on institutional cohesion and coordination leading to institutional conflicts. Local governance is 'the formulation and execution of collective action at the local level' (Shah and Shah, 2006, p.1) to make communities self-governed. There have been very few comprehensive studies on NELDs that local governments are likely to suffer as such impacts may not be easily quantified (Surminski *et al.*, 2012).

2.3.3.3 L&Ds of environmental assets

Biodiversity constitute fundamental building blocks of ecosystems (UNEP, 2007). It has intrinsic value to people who wish it to exist there, regardless of its value to humans (Mace *et al.*, 2012). Ecosystem is 'a dynamic complex of plant, animal, and microorganism communities and the nonliving environment, interacting as a functional unit' (MA, 2003, p.49). The supply of ecosystem services can be sensitive to changes in biodiversity (MA, 2003). Climate change can lead to a significant biodiversity loss (CBD, 2015). Biodiversity and ecosystem services are more likely to be affected by slow onset events as in the case of Central America where increasing temperatures have made species such as endemic frogs to extinct (Dobson, 2007). Ocean acidification has negatively affected coral reefs (ISRS, 2008).

2.4 Assessment of NELDs

2.4.1 Methodologies for assessing NELDs

A comprehensive L&D assessment methodology in the context of climate change has not been well developed (Surminski *et al.*, 2012). However, there are several approaches that are currently used in two schools of thoughts on DRR and CCA which are internationally applied and can be referred as relevant elements for the L&D assessment. The major difference among these approaches is whether the focus is on pre-disaster assessment or post-disaster assessment. Some approaches are useful for addressing NELDs. For instance, the approaches used in DRR for assessing NELDs include vulnerability assessments and disaster loss or damage assessments; the approaches used in CCA include climate change impact, adaptation and vulnerability assessments. Both DRR and CCA approaches include environmental impact assessments, strategic environmental assessments and environmental risk assessments (Table 2.2). Economic valuations such as cost–benefit analysis, wealth and capital accounting, as well as non-market valuation including stated and revealed preference methods, can be applied for assessing NELDs (Champ *et al.*, 2003).

Table 2.2 Examples of approaches for assessing NELDs

Area	Approaches	Assessment focus	Extent of approaches	How are relevant to NELDs
DRR	Vulnerability assessment	Post-disaster	Assess social vulnerability to stressors at multiple scales	Non-economic determinants (e.g., nutrition levels, strength of social networks) are considered.
	Disaster loss/damage assessment	Post-disaster	Assess natural disaster impacts; especially economic costs	Non-economic effects from natural disasters are assessed.
CCA	Climate change impacts, adaptation and vulnerability assessment	Pre-disaster	Assess climate change impacts on societies at multiple scales for CCA decision-making	Non-economic impacts from climate change and the vulnerability are assessed.
DRR/CCA	Environmental impact assessment	Pre-disaster	Assess environmental impacts of development projects, and economic/social impacts for planning	Both economic and non- economic effects are assessed in development projects.
	Strategic environmental assessment	Pre-disaster	Assess environmental impacts of policies and plans, and economic/ social impacts for strategic decision-making	Both economic and non- economic effects are assessed in strategic actions
	Environmental risk assessment	Pre-disaster	Assess human and environmental effects of hazardous production processes and products	Non-economic risks to the natural environment and human health are assessed for planning.
Economic valuation	Cost–benefit analysis	Pre- and post-disaster	Assess monetary costs and benefits of policies and plans for decision-making	There are many non-economic benefits and costs of policies and plans.
	Wealth/capital accounting	-	Assess national wealth and capital based on assets	Both economic capital and non-economic capital (e.g., natural capital) are included in national assets.
	Stated/revealed preference methods	Pre- and post-disaster	Assess non-market value of goods and services	Non-economic values of goods and services are assessed.

-: unknown

Source: Prepared by Author from Surminski *et al.*(2012); UNFCCC (2013).

2.4.2 Limitations of existing assessments

Although various L&D assessments exist, they have several limitations. First of all, most existing L&D assessments heavily depend on physical and economic assessments of disaster impacts and often do not consider L&Ds such as social, environmental or psychological damages (Kelly, 2008). Important social and environmental L&Ds such as cultural heritage, environmental qualities, governance and trust cannot be easily quantified because they are difficult to estimate, which leads to underestimation of such losses (IPCC, 2014b). Lack of well-developed methodologies for measuring and estimating L&Ds is leading to insufficient reporting of NELDs in various national, regional and international disaster databases. In addition, L&Ds from climate-related disasters such as slow onset events including sea-level rise and salinization are not captured in the existing disaster loss databases such as EM-DAT. Moreover, these databases only reflect large loss events in the context of predefined loss thresholds without adequately accounting for smaller events (Surminski *et al.*, 2012). The discussions in subsequent sections are focused on the post-disaster phase.

2.5 Conclusion

The L&Ds from climate-related disasters are expected to increase especially in the vulnerable parts of the Asia-Pacific region. Though the L&Ds are not a new concept in the DRR field, the L&Ds in the context of climate change needs specific attention and renewed interest both for comprehensive DRR and CCA especially from the point of view of addressing NELDs. In order for various stakeholders to address NELDs, there is a need for development of comprehensive methodologies and tools that DRR and CCA stakeholders can use for decision-making at various stages of DRR and CCA. Existing assessment methodologies in DRR and CCA fields can be useful for addressing NELDs to a limited extent, while there are some limitations. This chapter contributed to enhanced understanding and clarification on interpretations, classification and methodologies of NELDs in terms of DRR and CCA.

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CHAPTER 3 CURRENT STATUS OF NON-ECONOMIC LOSS AND DAMAGE: JAPAN AND BANGLADESH

3.1 Introduction

The Asia Pacific region is expected to suffer serious climate-related disasters and countries such as Japan and Bangladesh with long coastline are experiencing more loss and damages (L&Ds) from climate-related disasters (Rabbani *et al.*, 2013; MOEJ, 2015). It is assumed that the type and extent of non-economic loss and damages (NELDs) would depend on the nature of disasters and inherent socio-economic and development factors such as poverty level. This chapter seeks to assess and compare the nature of NELDs between Japan and Bangladesh representing developed and developing countries in Asia. It looks into different types of NELDs caused by major climatic disasters (i.e., typhoons in Japan, and cyclones, droughts and salinity intrusion in Bangladesh). NELDs are broadly categorized into those related to human functions, sociocultural assets and environmental assets (Chapter 2). Then, it explores the extent to which NELDs have been reported in both the countries and presents an analysis of the extent to which national plans and policies have addressed NELDs. This chapter benefits from the literature on the NELD aspects of disaster risk reduction (DRR) and climate change adaptation (CCA), pre-surveys and a series of consultations that the author had with local governments in Japan and Bangladesh including two workshops organized with DRR and CCA practitioners, government officials and researchers in Japan and Bangladesh. In the workshops, the NELDs identified from literature was appraised in each country's context, and key relevant indicators of NELDs for each country were identified.

3.2 Japan

3.2.1 What are climate-related disasters in the country?

Japan is prone to natural disasters due to its topography and climate. It is located in the Pacific Ring of Fire and in the Asian monsoon zone, one of the most pluvial areas in the world. The average annual precipitation is 1,690 mm, which is twice as much as the world average annual precipitation of 810 mm (MLIT, 2014). Due to its geographical and geological characteristics, Japan has suffered countless earthquake, typhoons and other

types of disasters (JICA, 2015). In particular, typhoons and accompanying wind and flood related disasters have occurred year after year. They are expected to increase in their frequency and intensity due to climate change impacts (MOEJ, 2015). During the past few years, there are several major typhoons, and the Typhoon No.12 in 2011 (Asian name: Typhoon Talas) particularly caused significant L&Ds to Japan and has contributed significant lessons for improving the disaster risk management in the country. During the typhoon in the Kii Peninsula, one of the most typhoon and intense rainfall prone areas in Japan, the total amount of the precipitation exceeded 1,000 mm (JMA, 2011). The record-breaking heavy rainfall has caused landslides, inundation and river flooding and resulted in significant economic damages and human casualties. Wakayama prefecture in particular has recorded the highest deaths of 56, out of total 82 deaths in all the prefectures in the country in 2011 (FDMA, 2012a).

3.2.2 What are NELDs in the country?

Typhoons have caused NELDs of human functions and sociocultural assets in Japan (Table 3.1). People are injured when a disaster occurs and during post-disaster period including evacuation, relief and rescue operations (Paul *et al.*, 2010). Typhoons have been reported to exacerbate infectious diseases such as exanthema due to being submerged in the water for a long time and poor condition of hygiene because of disrupted water supply and insufficient air conditioning in evacuation centers (Wakayama Medical University, 2012). Typhoons have also caused mental and psychological stresses such as post-traumatic stress disorder (PTSD) in the past (Shaw, 2014). To address metal stresses from the 2011 Typhoon No.12, the Wakayama prefecture has established telephone counseling hotlines for metal care and implemented door to door mental counselling at evacuation centers and homes by psychiatrists and psychiatric social workers (Wakayama Prefecture, 2011).

Typhoons are known to displace people in Japan. The Typhoon No.12 resulted in designation of warning zone based on the Disaster Countermeasures Basic Act where residents have to be displaced, and this affected 295 people (152 households) in the Kinki region (MLIT, 2013). In addition, typhoons have affected place attachment since families with lands and houses were ruined. Typhoons in the past have caused extensive damage to cultural heritage in Japan. The Agency for Cultural Affairs of Japan reported that a total of 36 cultural heritages in 8 prefectures were damaged from Typhoon No.12 in 2011 (The Shikoku Shimbun, 2011). In Wakayama prefecture, historic sites and cultural heritages

such as Nachi Taisha Shrine, registered as a World Heritage Site, were affected by Typhoon No.12 induced landslide and flooding. This led to a damage to reputation with decrease in tourists to these heritage sites (MLIT, 2012). Typhoons have also had social consequences such as increase in conflicts and disputes between affected people in evacuation centers, disagreements in the Bon festival between affected and not affected communities, and increase in school dropouts (based on the interviews with community leaders who live in communities in Wakayama prefecture affected by Typhoon No.12, in October, 2014). Typhoon No.12 damaged 14 ha of forest area in Japan (MAFF, 2013) and may have resulted in an unspecified amount of biodiversity and ecosystem loss as typhoons are more likely to cause ecological disturbance (Nakashizuka, 2009).

3.2.3 How NELDs have been reported?

The Japan's Statistics Bureau under the Ministry of Internal Affairs and Communications (MIC) publishes national disaster statistics on natural disasters, including typhoons. The disaster statistics mainly records economic loss and damages (ELDs) of natural disasters such as damage amount (million yen), number of damaged houses and non-residential buildings, area (ha) of flooded fields and number of damaged schools, bridges and rivers (Statistics Bureau, 2016). Some data related to NELDs such as the number of households and people affected and number of people killed, missing and injured have also been reported. However, the disaster statistics has included more categories of ELDs than NELDs. In addition, the statistics does not report L&Ds of sociocultural and environmental assets as in the case of Bangladesh.

Municipal governments are generally required to collect disaster data and report the data to prefectural governments, which then report to the Fire and Disaster Management Agency (FDMA) under MIC and other concerned government ministries as appropriate (MIC, 2014). Municipal governments create three necessary documents when a disaster occurs: the Disaster Summary within 30 minutes after the disaster is recognized; the Disaster Damage Summary on a continuous basis; and the Disaster Report within 20 days after the emergency response (FDMA, 2001; FDMA, 2012). Same as national disaster statistics, these documents include more indicators of ELDs than NELDs.

3.2.4 How national plans and policies have addressed NELDs?

The Japan's Central Disaster Management Council has developed the Disaster Management Basic Plan under the Disaster Countermeasures Basic Act, a comprehensive and long-term master plan for disaster reduction activities (Central Disaster Management Council, 2015). The plan consists of various counter-measures to natural disasters including earthquakes and typhoons and accident disasters including nuclear and forest fires at each phase of prevention and preparedness, emergency response and recovery and rehabilitation. At the phases of prevention and preparedness, the plan stipulates the counter-measures to address NELDs of human functions such as preparation of rescue supplies and first-aid by municipalities, preparation of emergency medical care supplies and designation of disaster base hospitals and designation of evacuation centers by municipalities. At the phase of emergency response, the plan describes the counter-measures such as implementation of rescue activities and medical care including mental care and setting up and operation of evacuation centers and temporary houses for affected people. At the phase of recovery and rehabilitation, the plan stresses the support for continuity of community for affected people and town planning with environmental conservation and recreation space in community as well as support for mental care and securing of living places for affected people. This is relevant to addressing NELDs of sociocultural and environmental assets.

3.3 Bangladesh

3.3.1 What are climate-related disasters in the country?

Bangladesh is one of the most vulnerable countries to natural hazards. The major disasters include floods, cyclones, droughts, tidal surges, tornadoes, earthquakes, river erosion, fire, high arsenic contents of ground water, water logging, water and soil salinity (DDM, 2014). It experiences climate-related disasters almost every year which cause heavy L&Ds of life and property. Most climate-related disasters in Bangladesh are likely to originate from the south i.e., the Bay of Bengal and the adjoining North Indian Ocean as these water sources are major causes for tropical cyclones, storm surges, floods, coastal erosion, monsoon wind and droughts (Ali, 1999).

Bangladesh is especially vulnerable to cyclones due to its location at the triangular shaped head of the Bay of Bengal, the sea-level geography of its coastal area, its high population density and the lack of coastal protection systems (Haque *et al.*, 2012). Cyclones and associated storm surges frequently hit the coastal areas of Bangladesh during the pre-monsoon and post-monsoon monsoon seasons (DDM, 2014). Approximately 40 percent of the total global storm surges are recorded in Bangladesh (Haque *et al.*, 2012). Bangladesh has suffered serious adverse impacts from more frequent and intense droughts and increasing temperature due to climate variability and non-availability of surface water resources (Selvaraju and Baas, 2007). Bangladesh is affected by major country-wide droughts every five years with the northwestern areas of the country being particularly vulnerable to droughts. Droughts have caused L&Ds to agriculture production, land, livestock population, employment and health. In addition, salinity intrusion is one of the most serious problems in the coastal regions of Bangladesh. The coastal area covers about 20 percent of the country and about 53 percent of the coastal areas are affected by different degrees of salinity (Haque, 2006). Severe storm surges and sea level rise have aggravated the salinity during recent years (Rasel *et al.,* 2013).

Future climate change projection indicates that annual mean temperature will increase by 1.4 ℃ and 2.4 ℃, annual mean precipitation will increase by 6 % and 10% and annual sea level will rise by 32 cm and 88 cm by 2050 and 2100 respectively (MOEF, 2005). The future impacts are expected to further increase the frequency and intensity of disasters such as cyclones, drought and salinity intrusion with associated increase in ELDs and NELDs.

3.3.2 What are NELDs in the country?

3.3.2.1 Cyclones

Cyclones have caused several NELDs in Bangladesh (Table 3.1). Haque *et al.* (2012) have shown several direct and indirect NELDs to human health, livelihoods and sociocultural assets from cyclones in Bangladesh. In terms of human health, cyclones have affected access to drinking water and food and have increased the transmission risk of infectious diseases (e.g. diarrhea, hepatitis, malaria, dengue, pneumonia and eye infections) and skin diseases, as well as waterborne diseases due to the lack of safe drinking water (Cash *et al.*, 2013). Cyclones have aggravated surface water contaminated by saline intrusion and poor sanitation systems, which are common in coastal regions of Bangladesh. They also compounded the malnutrition of children due to the L&Ds of crops

and reduced access to fish (Haque *et al.*, 2012). Regarding the metal health, reports indicate cyclones causing post-traumatic stress and depression in the post-disaster period (Krug *et al.*, 1998; Paul *et al.*, 2010). Cyclones have caused significant population displacement in the past and have often been associated with the increase in suicide and crime rates, and adverse pregnancy outcomes (Buekens *et al.*, 2006; Paul *et al.*, 2010).

3.3.2.2 Droughts

Droughts are known to have caused several NELDs of human functions, sociocultural and environmental assets in Bangladesh (Table 3.1). Selvaraju and Baas (2007) has highlighted several NELDs from droughts in Bangladesh. Decline in crop production due to droughts has resulted in increased human health and nutrition risks (Hossain *et al.*, 2005). Droughts have caused major deterioration in human health with impact on drinking water sources, food security and incidence of insect pests lead to substantial increases in vector-borne diseases (Slenning, 2010). In addition, increased summer heat and humidity have caused problems of dehydration, especially affecting women, the elderly and children (Keim, 2008). Decline in water quality has led to greater risk of waterborne diseases in most areas (Rose *et al.*, 2001). Furthermore, droughts have led to reduced yield and decrease in income for farmers resulting in population migration (Reuveny, 2007). Intense droughts and increasing temperatures are known to have significant negative impacts on land degradation, distribution, growth and reproduction of fish (Matthews and Marsh-Matthews, 2003; Reed *et al.*, 2007).

3.3.2.3 Salinity intrusion

Salinization of soil and aquifers can result in serious NELDs of human functions, sociocultural and environmental assets (Table 3.1). Abedin *et al.* (2013) have identified several direct and indirect NELDs from salinity intrusion in Bangladesh. In terms of human health, drinking saline water and contaminated water are reported to have caused various waterborne diseases such as diarrhea and cholera, skin diseases, kidney stone, rheumatism, pre-eclampsia and gestational hypertension in pregnant women (Krishnan, 2009; Lara *et al.*, 2009; Paul *et al.*, 2010; Khan *et al.*, 2011; Nasreen *et al.*, 2013). Furthermore, salinity has caused increased infestation of insect and diseases in field crops in the coastal regions (Gain *et al.*, 2007). In terms of sociocultural aspects, salinity intrusion can accelerate women hardship as women are less engaged in shrimp farming which they are used to do at nearby coastal rivers and marshes (Akter, 2009). Salinity problems can also cause social consequences such as harassment of women since salinity water hurts young women's skins and the increase in conflicts and disputes between rice

producers who suffer losses and damages from salinity and shrimp producers who benefit from salinity (Abedin *et al.*, 2013). In addition, salinity intrusion has brought significant threat to food security and caused farmers to relocate in search of other work to feed their families (Rasel *et al.*, 2013). Salinity intrusion has affected ecosystems such as the Sundarbans, the largest mangrove forest in the world, which represents heritage and biodiversity and holds abundant fish resources (Islam and Gnauck, 2008). Salinity has affected fish growth since fresh water fish juveniles cannot survive under high salinity levels (Selvaraju and Baas, 2007).

Table 3.1 Comparison of NELDs from climate-related disasters in Japan and Bangladesh

NELDs	Japan	Bangladesh		
	Typhoons	Cyclones	Droughts	Salinity intrusion
Human functions				
Death	✓	✓	✓	
Injury	✓	✓		
Water-borne diseases	✓	✓	✓	✓
Infectious diseases	✓	✓	✓	
Mental diseases	✓	✓		
Reproductive ill health				✓
Malnutrition		✓		
Sociocultural assets				
Displacement/migration/relocation	✓	✓	✓	✓
Social hostilities/disruption, conflicts, disputes	✓	✓	✓	✓
Women hardship				✓
Damages to cultural heritages	✓			
Children discontinued school	✓			
Environmental assets				
Loss of species abundance (ex., fish)			✓	✓
Loss of ecosystem				✓

Source: Prepared by Author from Selvaraju and Baas (2007); Nakashizuka (2009); The Shikoku Shimbun (2011); Haque *et al.* (2012); MLIT (2012); Wakayama Medical University (2012); Abedin *et al.*(2013); MLIT (2013); Rasel *et al.* (2013); Shaw (2014).

3.3.3 How NELDs have been reported?

The Department of Disaster Management under the Ministry of Disaster Management and Relief, Government of the People's Republic of Bangladesh has published national report on disasters which provides an overview of both natural and human induced disasters in Bangladesh (DDM, 2014). This report records ELDs of disasters such as the number of damaged houses, bridges, roads, schools and embankments, the area flooded and the area of crop affected. This report also includes some data on NELDs such as the number of households and people affected, the number of people killed, injured and taken to temporary shelters. However, the report does not take into consideration on NELDs of sociocultural and environmental assets that are widely reported to occur and presented in Table 3.1. As a result, decision-making based on the limited set of data being collected may not lead to holistic risk reduction.

The disaster data is first collected from Union Parishads and various departmental officers led by the Union Parishad Chairman and Upazila Disaster Management Committee at the local level. Form-D (Form for Assessment of Damage and Loss) is filled and the Upazila Nirbahi Officer (UNO) reports the data to the Emergency Operation Center (EOC) at the Ministry of Food and Disaster Management through the Deputy Commissioner (DC) within 24 hours after a disaster happens. The Form-D records both ELDs and NELDs. However, similar to national disaster report, this form does not take into account the L&Ds of cultural and environmental assets.

3.3.4 How national plans and policies have addressed NELDs?

The Bangladesh's Disaster Management Bureau, Ministry of Food and Disaster Management has developed the National Plan for Disaster Management for 2010-2015. It is a long-term and comprehensive plan on disaster management for addressing natural and human induced hazards including CCA issues based on the global and regional commitment of the Government of Bangladesh. The plan refers to disaster management plans of districts, sub-districts, unions and paurashavas/city corporations. These plans describe counter-measures in the event of a disaster to address NELDs of human functions such as prompt response and relief, provision of emergency medical services, trauma counseling and operation of disaster shelters. These plans also mention resumption of educational institutions and restoration of livelihood for affected people, especially the disabled, elderly, women and children. This is pertinent to addressing NELDs of

sociocultural and environmental assets. Upon reviewing these national and local level plans, it was concluded that these plans provide low to moderate emphasis on elements of NELDs mostly through addressing social elements of disaster risk management.

3.4 Discussion

As presented above, NELDs in both the countries show some commonalities and differences (Table 3.1). Comparing NELDs from cyclones in typhoons in Japan and Bangladesh, both cases recognized NELDs of human functions such as death, injury, infectious diseases, mental diseases and sociocultural assets such as displacement and social disruption. On the other hand, there can be socio-economic vulnerabilities inherent in developing countries related to economic status, social infrastructure and poverty level, malnutrition and crime that could exacerbate NELDs as indicated by the Bangladesh case. Looking at cyclones, droughts and salinity intrusion in Bangladesh, there are common consequences for NELDs such as health deterioration from water-borne diseases and social disruptions. Environmental assets have been affected by droughts and salinity intrusion.

From the national disaster reports and statistics of Japan and Bangladesh, it is evident that both countries have reported more ELD indicators than NELDs and both failed to take into consideration the L&Ds of sociocultural and environmental assets. Considering how NELDs are addressed in national disaster plans and policies, both Japan and Bangladesh's disaster plans have made insignificant emphasis on addressing NELDs of sociocultural and environmental assets. However, Japan's national disaster management plan enlists several countermeasures that could have significant impact in addressing NELDs than what Bangladesh's plan could do. The less emphasis given to NELD elements in national disaster databases can result in underestimation of the actual total L&Ds leading to insufficient relief and recovery, limited progress in DRR and a lack of information for decision-making by practitioners and policymakers on DRR and CCA in both the countries. Challenges to collect information related to NELDs are that the importance of addressing NELDs in social recovery is not properly understood at national and sub-national levels, data collection and measurement frameworks for NELDs are not well established, and there is a limited capacity for stakeholders to understand NELDs information in decision-making. Therefore, there is a need for public awareness and capacity building on concepts and approaches involved in NELDs including assessment

tools to assist various stakeholders to effectively integrate NELD aspects into their interventions.

Key messages from these observations are that although existing literature have recognized several types of NELDs, it is important to identify key NELD indicators that need greater attention in both developed and developing country contexts. It is necessary for researches to explore the actual total L&Ds by further understanding, identifying and measuring NELDs as well as developing adequate assessment frameworks and methods for addressing NELDs. Furthermore, the nature of NELDs can be different, depending on local, regional and socio-economic characteristics. Hence, it is essential for local governments to implement interim assessments of NELDs considering the local characteristics. Moreover, the central governments are required to present the unified guidelines for local governments to assist in the process. Finally, practitioners and policymakers on DRR and CCA are needed to consider NELDs in their decision-making and identify appropriate counter-measures based on the evidence presented from the statistics and research.

Finally, there are some implications to NELDs from existing international frameworks on DRR and CCA. The Sendai Framework for Disaster Risk Reduction 2015-2030 aims to significantly reduce NELDs, such as losses of sociocultural and environmental assets and ELDs. The priority actions to achieve the goal includes systematic evaluation of disaster L&Ds, and understanding of disaster exposures, vulnerabilities and impacts to health, education, cultural heritages, sociocultural and environmental assets (UNISDR, 2015). The results from the case studies above showed that there is a significant need to further consider NELDs, in particular sociocultural and environmental assets. Thus, the Sendai Framework will need to play significant role in increasing awareness for addressing these issues.

3.5 Conclusion and way forward

The Japan and Bangladesh case studies have revealed more commonalities than differences in the types of NELDs due to natural disasters and in the way they are measured and addressed. Both countries have relatively well developed data collection mechanisms at the local level to collect and use the data for decision-making often for the purpose of relief and rehabilitation. In addition, both countries have included more data

categories related to ELDs than NELDs in their disaster reports and statistics. This can lead to underestimation of actual total L&Ds and ineffective decision-making. Therefore, it is essential to explore practical and verifiable indicators of NELDs, which can be reflected in disaster databases, statistics and reports. This makes it possible for practitioners and policymakers to take into account NELDs of their decision-making at community, local, national and international levels. Both countries have also given more emphasis on NELDs of human functions than sociocultural and environmental assets in their disaster reports and statistics and national disaster plans. There is a need for the Sendai Framework and other emerging global framework for climate change adaptation under UNFCCC to play an important role in increasing awareness for addressing these issues and contribute to close linkage between DRR and CCA. This chapter eventually contributed to identification of NELDs in the country context of Japan and Bangladesh and their current status of reporting in national disaster report, plans and policies. As a next step, it is important to advance our understanding on NELDs and to develop an integrated assessment framework for addressing NELDs by referring to existing approaches from DRR and CCA fields.

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CHAPTER 4 INITIAL FIELD SURVEY IN WAKAYAMA

4.1 Introduction

Among climate change adaptation communities, there is an emerging need of addressing the non-economic loss and damages (NELDs) caused by increasing natural disasters in a changing climate, such as extreme weather events (e.g., storms, cyclones, extreme precipitation, floods and heat waves) and slow onset events(e.g., sea level rise, increasing temperatures, ocean acidification and salinization) (UNFCCC, 2013). The reasons are that NELDs have not adequately emphasized but it began with awareness that NELDs may be more significant than economic aspects of loss and damages and that if the total loss and damages may increase if NELDs are considered. NELDs have the potential to weaken disaster resilience in communities and impede post-disaster recovery and rehabilitation (Morrissey and Oliver-Smith, 2013). Despite the importance of NELDs, there is not yet adequate assessment framework for addressing NELDs due to difficulty of the understanding, identification and estimation of NELDs (Chapter 2).

Japan is one of the most pluvial areas in the world as it is located in the Pacific Ring of Fire and in the Asian monsoon zone. Climatic events such as super typhoons with accompanying record-breaking heavy rainfall have increasingly been reported during recent years (MOEJ, 2015). In particular, Typhoon No. 12 in 2011 caused significant loss and damages (L&Ds) to Japan and has contributed significant lessons for improving the disaster risk management in this country. The typhoon brought significant economic damages and human casualties especially in Wakayama prefecture.

4.2 Field survey in Wakayama

An initial field survey was conducted in October 2014 in Wakayama prefecture. The purposes of this survey were to have firsthand experiences of L&Ds caused by most major typhoons during recent past years (i.e., Typhoon No.12 in 2011) and to understand both local community and government perspectives on NELDs. The affected community leaders (Nachikatsuura and Shingu) and local governmental officials (Disaster Prevention Division of Nachikatsuura town office) were interviewed about their thoughts on the NELDs which significantly emerged or increased after the typhoon.

The definition of NELDs has not been globally agreed yet while there are various interpretations on NELDs (Chapter 2). In the context of climate change adaptation, UNFCCC (2013) has interpreted non-economic losses as the loss of those that are not commonly traded in markets and sorted out into: losses of life; health; displacement and human mobility; territory; cultural heritage; social capitals; indigenous/local knowledge; biodiversity and ecosystem services. This framework on NELDs was used for the field survey.

Nachikatsuura town and Shingu city in Wakayama were selected for this survey since these municipalities have been often affected by typhoons while they have abundant social, cultural and environmental assets (Figure 4.1). They are located at rural, coastal and mountainous areas in the southeast part of the Wakayama prefecture in the Kii Peninsula, one of the most typhoon and intense rainfall prone areas in Japan. Nachikatsuura has major industries on fishery in particular with tunas and hot springs with the number of 177 sources (Nachikatsuura Town, 2016a). On the other hand, Shingu has historical background that it has developed with paper and lumber industries since the Meiji era (Shingu City, 2014). They have also world famous tourist destinations with UNESCO-designated World Heritage Sites, including Kumano Nachi Taisha Grand Shrine, Nachi Falls and Kumano Hayatama Taisha Grand Shirne. They lie in a warm-temperate zone and receive average 3.2 typhoons every year (JMA, 2017). The total populations as of 1 April 2015 are 15, 759 of Nachikatsuura (ranked as 14th) and 29,652 of Shingu (ranked as 7th) out of 30 municipalities in Wakayama with its population of 965,597 (Wakayama Prefecture, 2015). The areas are 183 km^2 of Nachikatsuura and 255 km^2 of Shingu out of 4,726 km^2 in Wakayama (GSI, 2013). Depopulation, aging population and declining birth rate have been reported as important social issues that typical rural small or medium size municipalities are facing (Nachikatsuura Town, 2016; Shingu City, 2016).

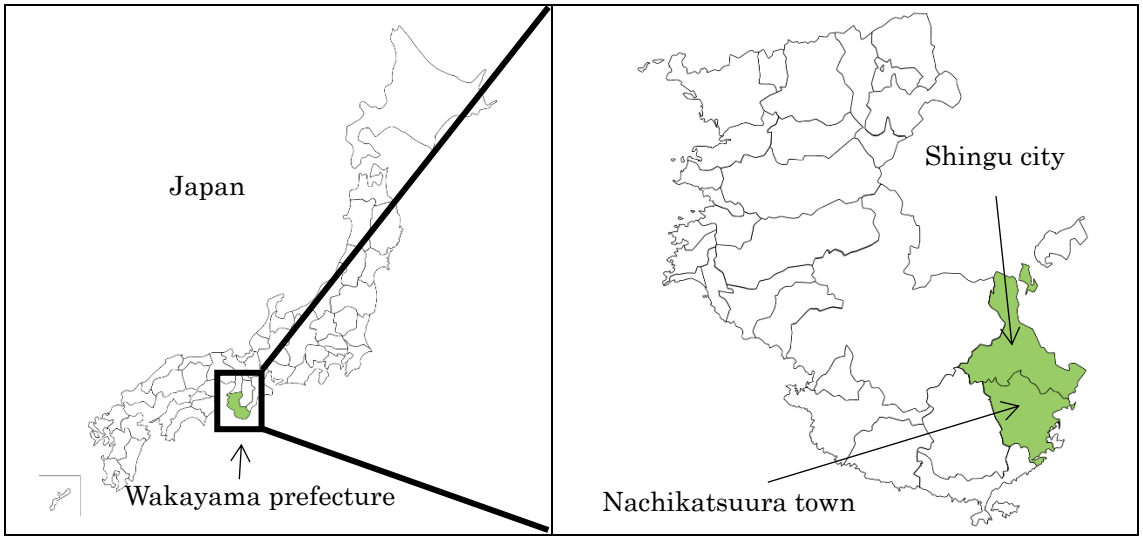


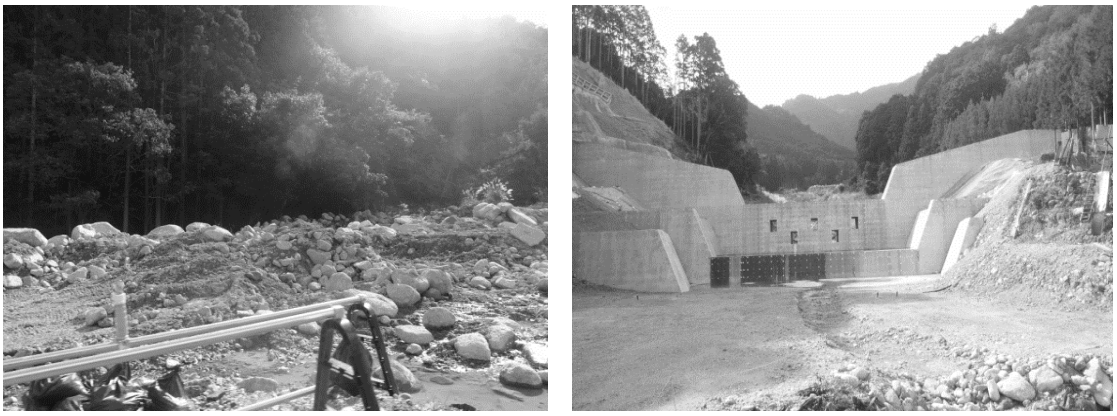
Figure 4.1 Nachikatsuura town and Shingu city, Wakayama prefecture (Source: Prepared from Sankakukei (2016))

Nachikatsuura and Shingu suffered serious L&Ds from the Typhoon No.12 particularily in Wakayama. Typhoon No. 12 in 2011 and its associated record-breaking heavy rainfall caused significant landslides, inundation and river flooding, and resulted in serious physical damages and human casualties. Wakayama recorded the highest number of deaths from the typhoon of 56 (of which, 28 from Nachikatsuura and 13 from Shingu) out of 82 in Japan (Table 4.1). Nachikatsuura largely suffered sediment disasters from the typhoon while Shingu primarily suffered flooding and inundation.(Nachikatsuura Town, 2013; Shingu City, 2015) (Figure 4.2).

Table 4.1 L&Ds from Typhoon No. 12 at glance

	Wakayama	Nachikatsuura	Shingu
Death toll	56	28	13
Evacuees (As of 14 September 2011)	652	122	305
Houses fully destroyed	240	103	81
Houses half destroyed	1,753	905	245
Houses inundated above floor level	2,698	440	1,472
Houses inundated below floor level	3,146	962	1,168
Affected households		2,410	3,154

Source: Prepared from Wakayama Prefecture (2011); FDMA (2012); Nachikatsuura Town (2013); Shingu City (2015)



(a) Debris flows (b) Sediment control dam

Figure 4.2 Iseki-Ichinono district, Nachikatsuura town (Source: Chiba *et al.* (2017))

4.3 Results and conclusions

Table 4.2 presents the local community and government perspectives on NELDs identified in the field survey. The results could be categorized into the issues with health, social capital, education and environment. Regarding health aspects on NELDs, mental diseases such as fears, mental stresses and post-traumatic stress disorder (PTSD), were particularly stated. It was reported that many of these issues raised from evacuees at evacuation centers. In addition, damages to social capitals were found to be important. Social capitals can be interpreted as networks together with shared norms, values and understandings within communities (Keeley, 2007). Relevant problems, such as decrease in social capitals through displacement and relocation, and increase in troubles among affected people, were described. Furthermore, the loss of educational opportunity for children, such as children not attending school and schools discontinued, was considered important. The concerns about environment (i.e., biodiversity and ecosystem) were also recognized to some extent but put less emphasis than health, social capitals and education. This chapter contributed to enhanced understanding of local perspectives on NELDs caused by Typhoon No.12 in Wakayama.

Table 4.2 List of local perspectives on NELDs reported in the field survey

Category	Local perspectives on NELDs:	
	Communities (Nachikatsuura and Shingu)	**Town office** (Nachikatsuura)
Health	Physical illness (e.g., pneumonia), mental stresses, trauma	Mental stresses, post-traumatic stress disorder (PTSD), fears
Social/cultural capitals	Displacement/relocation, decrease in households, troubles between men and women or among affected people, deterioration of interpersonal relations within communities, disagreements in the Bon festival between affected and not affected communities	Displacement/relocation, decrease in households, decrease in number of people who participate in evacuation drills, decrease in tourists to cultural heritages
Education	children not attending school	Schools discontinued
Environment	Never-seen-before grasses, increase in mold	-

-: Not reported

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CHAPTER 5 CASE STUDY: NACHIKATSUURA TOWN

5.1 Introduction

Loss and damages (L&Ds) caused by climate-related disasters have been identified as one of the most crucial challenges in the context of climate change (Warner and Geest, 2013). In particular, non-economic loss and damages (NELDs), such as loss of health, social and cultural assets, and environmental assets have not been sufficiently mainstreamed in the current approaches to climate change adaptation (CCA) (Hoffmaister and Stabinsky, 2012). In 2010, the sixteenth session of the Conference of the Parties (COP 16) under United Nations Framework Convention on Climate Change (UNFCCC) recognized the importance of addressing L&Ds in a comprehensive manner through Decision 1/CP.16. Subsequently, in 2013 COP 19 established the Warsaw International Mechanism to tackle L&Ds (Decision 2/CP.19) and in 2015 the Paris Agreement reached at COP 21 further reiterated the importance of addressing L&Ds (Decision /CP.21). Despite this sustained international attention to L&Ds, measures to deal with NELDs are limited. The reasons for this include insufficient understanding on NELDs and a lack of means of identifying and estimating the NELDs due to the complex ways in which NELDs can manifest involving individuals, society and the environment (UNFCCC, 2013). Lack of a globally agreed definition of NELDs has further contributed to the problem. Prioritizing NELDs is also problematic as there is no scale to compare them. Without a clear definition and prioritization, it is difficult for decision makers to incorporate NELDs into disaster risk reduction (DRR) and CCA initiatives.

Traditionally, disaster risk management decisions in the DRR community have often been based on the understanding of previous disaster impacts that reflect the underlying vulnerabilities of communities, regions and institutions (EMA, 2002). This traditional understanding of L&Ds will cause challenges in climate change because there would be more emphasis on economic loss and damages (ELDs) than NELDs and to make annual plans based on the understanding from the recent past rather than a long term view. In contrast, the CCA community has reported that L&Ds are “negative effects of climate variability and climate change that people have not been able to cope with or adapt to” (Warner and Geest, 2013, p. 369). L&Ds have also been interpreted as residual negative impacts which would still happen after implementing adaptation efforts (CDKN, 2012). There is an emerging need of addressing NELDs among the CCA community, going

beyond the economic aspects which have long been the focus of the discussions on the L&Ds.

Addressing NELDs is important in the context of CCA since inadequate addressing of NELDs will be a major impediment to adaptation as most of the underlying communities' vulnerabilities lie in the non-economic aspects, including dependency on social capital and natural capital. This is especially the case with the rural communities of Japan (Yoshitake and Deguchi, 2008; Tsutsumi, 2017). By not considering the impacts of NELDs, the effectiveness of any adaptation interventions would be significantly reduced.

In Japan, climatic events such as super typhoons with accompanying record-breaking heavy rainfall have increasingly been reported during recent years (MOEJ, 2015). In particular, Typhoon No. 12 in 2011 caused severe L&Ds. The associated record-breaking heavy rainfall caused landslides, inundation and significant physical damages and human casualties. Wakayama prefecture recorded the highest number of deaths from this event; 56 out of 82 in the country, as well as 240 fully-damaged houses and 1,753 partially-damaged houses (FDMA, 2012). There were 652 evacuees as of 14 September 2011 (Wakayama Prefecture, 2011b).

Taking lessons from past events, the Japanese government has strengthened its measures to facilitate recovery after extreme typhoons. However, the countermeasures are focused on addressing physical damages, such as damages to houses, properties and crops. NELDs, such as decline in health (including mental health) and social capital (e.g., community disruption), have not been sufficiently identified and addressed in the existing recovery measures, even though NELDs continue to occur for months and even years after the disaster event (EMA, 2002). Giving greater attention to NELDs is important for Japan as they could exceed ELDs, especially in small rural towns vulnerable to climatic disasters.

Robust frameworks for addressing NELDs have not been established, in part due to the difficulty of understanding, identifying and estimating NELDs (Tol and Fankhauser, 1998; UNISDR, 2004; Hoffmaister and Stabinsky, 2012). NELDs have also not been sufficiently reported in most post-disaster reports and databases (Swiss Re, 2013). The low attention paid to NELDs can result in significant underestimation of actual disaster losses, leading to insufficient and suboptimal investments in recovery, suboptimal

decision-making on DRR and CCA, and a decrease in community resilience to climatic disasters (IPCC, 2014; Morrissey and Oliver-Smith, 2013).

Keeping in view the importance of addressing NELDs to effective DRR and CCA, a survey-based study was conducted to identify and prioritize key NELDs caused by Typhoon No.12 in 2011 in Wakayama prefecture and to figure out important practices that could address these impacts. This chapter presents the results of important NELDs identified through the structured questionnaire survey with affected community members in Wakayama prefecture. It also shows key differences in perspectives between affected local communities and the local government in NELDs, which have important implications for local level DRR and CCA. Finally, it provides recommendations for enhancing DRR and CCA-related policies and plans.

5.2 Methodology

The study applied the analytic hierarchy process (AHP) to prioritize key NELDs caused by Typhoon No.12 in Nachikatsuura town. Elements of AHP analysis for NELDs consisted of decision criteria, indicators and practices. These were identified, evaluated and narrowed down through three sequential steps: 1) comprehensive literature review; 2) expert consultation; and 3) focus group discussion in the affected community. Subsequently, a household questionnaire survey was conducted to obtain the inputs from households in this town. The purpose of the questionnaire survey was to prioritize key NELD-related elements from the perspectives of the affected local communities and the town officials. The questionnaire survey also aimed to identify differences between these two stakeholders on the relative importance they give to various NELD elements.

5.2.1 Study location

Nachikatsuura town, Wakayama prefecture, was selected for the study (Figure 5.1). Nachikatsuura is a rural town with abundant social, cultural and environmental assets. It suffered serious impacts from Typhoon No. 12 from August to September 2011. Nachikatsuura is located in the southeast part of the Wakayama prefecture in the Kii Peninsula, the largest peninsula in Japan, bordering the Pacific Ocean. Nachikatsuura is located in a mountainous region, and this partly explains why forests cover 88% of the total area (MAFF, 2015). It is also a tourist destination with UNESCO-designated World

Heritage Sites, including Kumano Nachi Taisha Grand Shrine and Nachi Falls. The town lies in a warm-temperate zone, has an average annual precipitation of more than 2,000 mm, with the highest recorded in 2011 of 4,000 mm (Nachikatsuura Town, 2013; JMA, 2017). On an average, the town receives 3.2 typhoons every year (JMA, 2017). The town has a total population of 15,946 (male: 7,405; female: 8,541) with a household count of 8,046 as of 1st February 2017 (Nachikatsuura Town, 2017). With 39% of the population above 65 years, a large proportion of whom are single, the town is ranked 9th in Wakayama in terms of proportion of aged population (Wakayama Prefecture, 2016). The town government has identified the aging population, declining birth rate and depopulation as serious social issues that the town is facing.

Typhoon No. 12 in 2011 resulted in the most severe disaster that Nachikatsuura has suffered during recent years. The town recorded the highest casualties in Wakayama prefecture. The main causes of the damages were reported to be debris flow and river flooding, which resulted from the record heavy rainfall that accompanied the typhoon. Consequently, 2,410 households were affected, 29 people died (including one missing), 14,458 people were evacuated (91% of the town population), 103 houses were totally destroyed and 17 public facilities were affected. The economic damages totaled 2,283 million Japanese Yen (JPY) (Nachikatsuura Town, 2013).

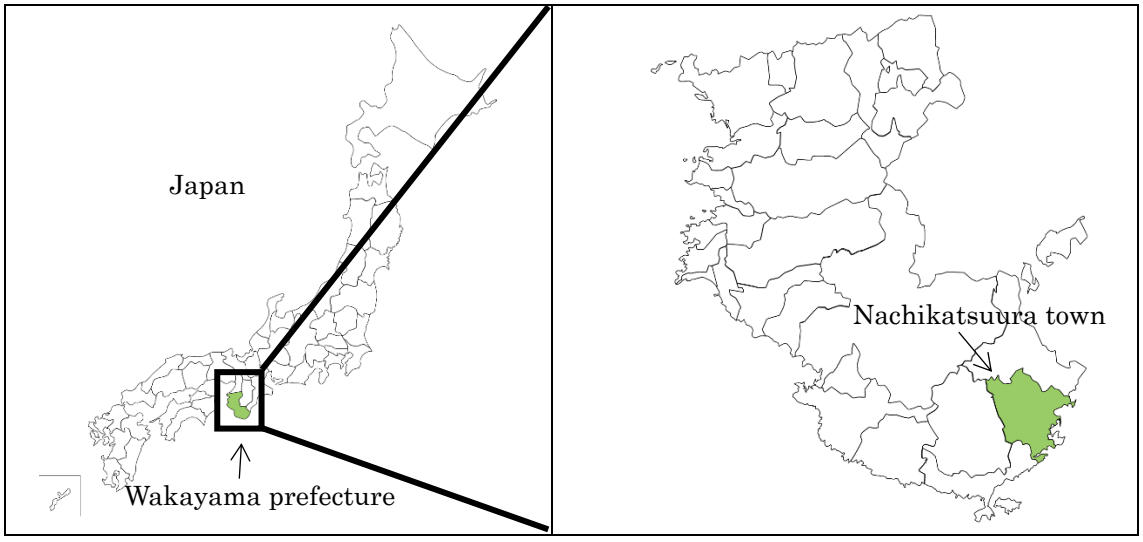


Figure 5.1 Nachikatsuura town, Wakayama prefecture (Source: Prepared by Author from Sankakukei (2016))

5.2.2 Analytic hierarchy process

This study used the analytic hierarchy process (AHP) to prioritize key NELDs caused by Typhoon No.12 in Nachikatsuura. The AHP is a multi-criteria decision-making tool that can be used to solve complex decision problems (Saaty, 1990). It has been widely applied to group decision-making and questionnaire surveys under many disciplines, and it is based on a multi-level hierarchical structure consisting of the goal, criteria, sub-criteria (i.e., indicators), and practices (Triantaphyllou and Mann, 1995). It uses a set of pairwise comparisons to derive the weights of importance for each element in a level, using a scale of absolute judgements that represents how much more one element dominates another (Saaty, 2008). Table 5.1 shows Saaty's fundamental judgement scales for pairwise comparison used in this study.

The AHP was found to be suitable for this study as it helps solving problems that are hierarchical in nature and helps in reconciling opinions of multiple stakeholders in deriving a common agreement (Table 5.2). This is in contrast to traditional regression techniques, which only estimate the relationships among variables in a single layer. Microsoft Excel was used for the AHP analysis (Figure 5.2). The aggregation of individual priorities was done by geometric mean of individual priorities (Forman and Peniwati, 1998). This is appropriate to indicate the central tendency of separate individual preferences without the effect of an outlier.

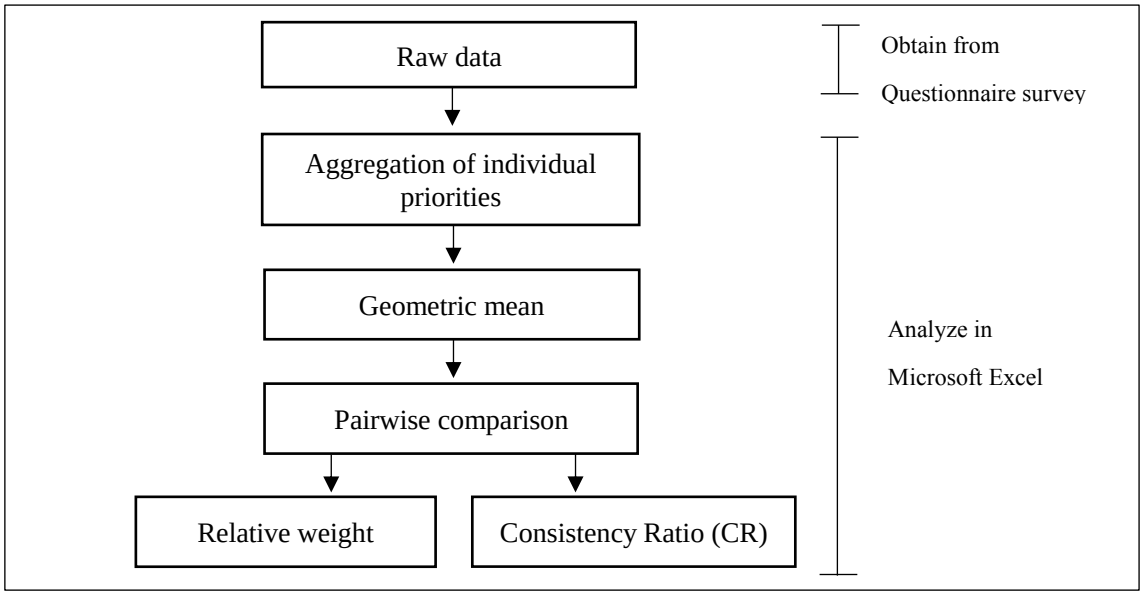
Table 5.1 Fundamental judgement scales for pairwise comparisons

Scale	Description
1	Equal importance of both options
3	Moderate importance of one over another
5	Strong importance for one over another
7	Very strong importance for one over another
9	Extreme importance for one over another

Source: Prepared by Author from Saaty (1990)

Table 5.2 Similarities between the study needs and AHP provisions

Study contextual needs	Provisions in AHP
DRR and CCA decisions often involve multiple stakeholders who differ in their priorities	Allows decision-making in a multi-stakeholder environment through discussion on priorities assigned
Comparing NELD indicators on non-economic basis	Helps compare various elements of the AHP process by using fundamental judgement scale
Stakeholders differ in the criteria they employ in prioritizing indicators	AHP considers criteria at the high level of comparing indicators through which indicators can be compared
Indicators provide basis for comparison of practices for addressing NELDs in DRR and CCA	AHP facilitates comparing various practices in a pairwise fashion by keeping each indicator constant and hence all combinations of pairwise comparisons will identify the best practice



Note: Calculation for relative weight and consistency ratio is based on Takahagi and Nakajima (2005).

Figure 5.2 Calculation flow of AHP analysis

The elements of AHP analysis for NELDs included relevant decision-making criteria, indicators and practices (i.e., risk reduction practices). The NELD-related elements were

identified, evaluated and narrowed down through three sequential steps: 1) comprehensive literature review (Chapter 2 and Chapter 3); 2) expert consultation; and 3) focus group discussion (FGD) in the affected community (Figure 5.3). The published literature was limited but helped to understand the NELD aspects of DRR and CCA. The findings from the literature review were corroborated by 15 experts in a consultation workshop that was conducted in June 2015. The consultation aimed to understand key NELDs caused by the past recent typhoons and assess the suitability of the NELD-related elements identified from the literature in the context of Japan. The workshop was attended by various academian and researchers from NELD-releated sectors, including DRR, CCA, health, education, water, environment, biodiversity and ecosystems, forestry, meteorology, and law. An initial list of NELD-related elements was presented, and then the experts were asked for their suggestions regarding their suitability and priority in terms of typhoons in Japan (Table 5.3). Through the discussion, some of the areas, criteria, indicators and practices were excluded and included in the context of Japan under mutual agreement. Subsequently, a FGD was held with 9 members of the affected community in the Iseki district, one of the most severely affected districts in Nachikatsuura, to evaluate the key NELD elements vetted by the experts from the community perspective in June 2016 (For the discussion sheet for community consultation, see Appendix I.1).

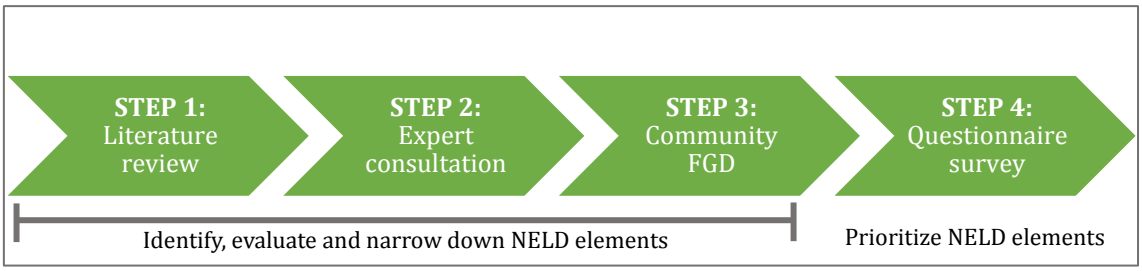


Figure 5.3 Workflow for implementing the study

Table 5.3 Initial list of NELD criteria, indicators and practices for expert consultation

Decision-making criteria	
▪ Value given by society	
▪ Significant impact on the larger well-being of family/society in the long-run	
▪ Cost of measuring the indicator	
▪ Policy relevance	
▪ Relevance to DRR-CCA planning	
▪ Measurability	
▪ Verifiability	
▪ Familiarity	
▪ Exclusivity	
Impact areas	**Indicators**
Human life	▪ People killed
Human health	▪ People injured
	▪ People suffered infectious diseases
	▪ People suffered chronic diseases
	▪ People suffered mental diseases
	▪ People suffered malnutrition
Education	▪ School bullying
	▪ Schools discontinued
	▪ Children dropped out school
	▪ Children temporary discontinued school
Human mobility	▪ People displaced
Territory	▪ Decrease in place identity to the area felt by people
	▪ Decrease in lace dependence on the area felt by people
Social capital	▪ Less participation to local/social activities
	▪ Less acceptance of community leaders
	▪ Social hostilities
	▪ Less ability to build consensus
	▪ Decrease in cooperatives/membership in societies
	▪ Households migrating (seasonally)
	▪ Women with migrated husband
Cultural heritage	▪ Decrease in cultural identity to cultural heritage sites felt by people

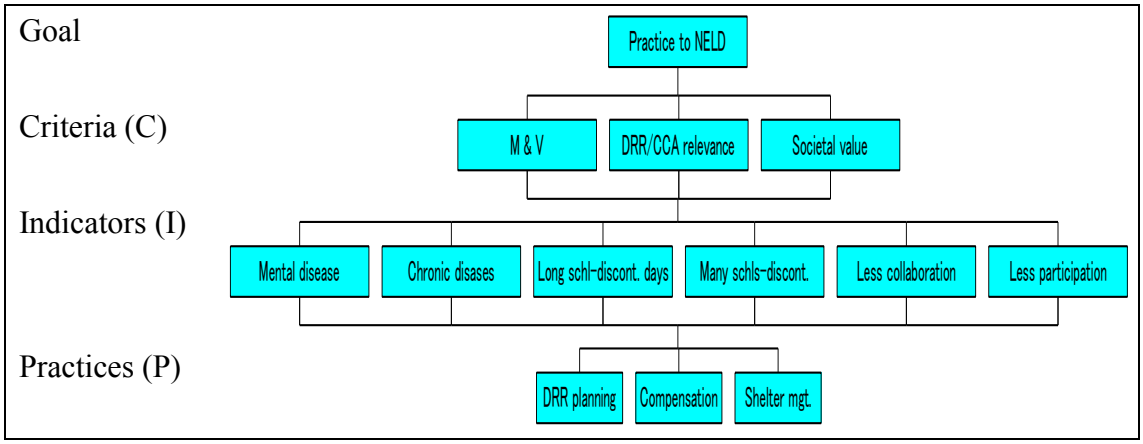
	▪ Decrease in cultural dependence on cultural heritage sites felt by people
	▪ Cultural heritage ruined
Indigenous knowledge	▪ Less availability of indigenous knowledge
	▪ Decrease in people with indigenous knowledge
Local governance	▪ Less collaboration
	▪ Organizational conflicts
	▪ Less ability to facilitate external coordination
Biodiversity/Ecosystem	▪ Decrease in species abundance
	▪ Decrease in species diversity
	▪ Decrease in area of forest
	▪ Decrease in water availablilty in rivers and lakes

Risk reduction practices
▪ Disaster insurance
▪ Disaster compensation
▪ Disaster preparedness planning
▪ Shelter management
▪ Land-use policy

Source: Comprehensive literature review and expert judgement

5.2.3 Structure of the decision hierarchy

Figure 5.4 shows the hierarchy diagram of the AHP, which reflected the key NELD-related elements identified through the steps described above. The goal of the problem was defined as ‘selection of best risk reduction practices for addressing NELDs caused by the Typhoon No.12’, with the assumption that NELDs should be addressed for better recovery. The indicators and practices that were identified from the literature review and were further vetted through consultations were included in the AHP analysis.



Note: M&V = measurability and verifiability

Figure 5.4 Hierarchy diagram of AHP analysis

The expert and community consultations have identified three crucial NELD impacts of the typhoon: 1) health deterioration; 2) loss of educational opportunity for children; and 3) disruption in local governance. For each of these impact areas, the two most important indicators were listed and prioritized for inclusion in the AHP analysis.

5.2.4 Questionnaire survey

The purpose of the questionnaire survey was to prioritize key NELD-related elements (i.e., criteria, indicators and practices) from the perspectives of the affected local communities and the local government (For the questionnaire survey sheets, see Appendix I.2 and I.3). The questionnaire survey also aimed to identify differences between these two stakeholders on the relative importance they give to various NELD elements. Stakeholders represented in the questionnaire survey were the affected households and town officials of Nachikatsuura who are engaged in DRR and social welfare. The questionnaire survey was conducted at the household level for communities and at the individual level for town officials.

A total of 175 questionnaires were returned by the community members which is 322 (54%) of the sample. The sample size was derived from the formula ($n = [t^2 \times p(1-p)]/m^2$] where n is sample size; t is confidence level (1.96); p is estimated prevalence (2,410 affected households/8,084 total households); and m is confidence interval (0.05)). Stratified random sampling was conducted to ensure representative participation according to the socio-economic profile of the town; the stratification was done according to household's status in terms of gender, age, and annual income (Table 5.4). The

stratification was done by obtaining demographic statistics from the study location, randomly identifying the sample groups and sending the questionnaire to the randomly selected households. Household's status on gender was viewed whether household's head is male or female. The age status was observed into three groups: youth (its head is 20-39 age); middle-aged (its head is 40-64 age); and elderly (its head is more than 65 age). Both low-income and above-low income households were included, with low-income being defined as an annual income of 2 million JPY or less. Twenty-two questionnaires were returned by the town officials from the Disaster Prevention, Social Welfare, Inhabitant, Education, Tourism and Industry and Construction departments.

Table 5.4 Sample characteristics for the households

Gender		**Age**		**Annual income**	
Male:	137 (78%)	Youth:	9 (5%)	Low:	41 (23%)
Female:	31 (18%)	Middle-aged:	67 (38%)	Above low:	120 (69%)
Unreported:	7 (4%)	Elderly:	92 (53%)	Unreported:	14 (8%)
		Unreported:	7 (4%)		
Total: 175					

The questionnaire surveys were conducted in October and November 2016, in cooperation with the Disaster Prevention Division of the town office. The questionnaire forms were developed in consultation with the division and relevant experts. A thorough explanation was included and clear and easy to understand terms were used. The anonymous questionnaire forms were firstly distributed to the affected households via a circular and then collected by community leaders. The questionnaire forms to the town officials were distributed and collected by the Disaster Prevention Division. The AHP analysis was conducted using Microsoft Excel and the results were presented by comparing between the perspectives of the affected local communities and the town officials. The Consistency Ratio (CR) was used to test the uniformity of results across the responses. The CR represents the consistency of pairwise comparisons, and if the CR is less than 10% (0.1), it is considered acceptable (Saaty, 1990). Depending on the unstructured nature of the parameters, inconsistency of up to 0.15 can be allowed, though even a CR ratio of 0.2 or more could be acceptable for very abstract parameters (Bhushan and Rai, 2004). Hence, considering the abstract nature of the parameters used in this study, especially for lay people, a high inconsistency ratio may not be an exception in this study. The results are presented as the geometric mean of all scores given by individual's pairwise comparisons.

5.3 Results and Discussion

5.3.1 NELD criteria, indicators and practices

5.3.1.1 NELD criteria

Criteria represent the underlying logic that humans apply while prioritizing competing alternatives and are related to the worldview that determines their decision-making. Stakeholders differ in the criteria they employ for prioritizing options that are put before them. Understanding the differences in criteria helps in understanding the choices that they make in DRR and CCA.

In the study context, identifying the criteria employed by stakeholders is a crucial first step in prioritizing NELD indicators and in turn the practices for addressing NELDs. Three criteria that governed the decision-making process for prioritizing indicators and practices for addressing the NELDs were: 1) measurability and verifiability (M&V); 2) relevance to DRR/CCA policy and planning; and 3) compliance with societal value. M&V refers to whether or not the NELDs were objectively severe, measurable and verifiable to enable the NELDs to be adequately addressed and replicated in other communities in the town (GIZ, 2014). Relevance to DRR/CCA policy means whether or not the identified NELD indicators and practices are applicable within the DRR/CCA policy and planning domains. Any indicators and practices that are not applicable and identifiable by the relevant communities could fail to attract attention due to attitudinal and capacity constraints and hence fail to be adopted. Similarly, compliance with societal value refers to the extent to which the identified indicators and practices are socially relevant, which is necessary for them to be accepted by society.

5.3.1.2 NELD indicators

Two most important NELD indicators were detected from three crucial NELD impacts of the typhoon (health, education and local governance) in the context of the study location in Japan, through expert and community consultations (Table 5.5). In this section, literature pertinent to the identified indicators is presented to provide a deeper understanding on these indicators.

Table 5.5 List of criteria, indicators and practices prioritized in this study through expert and community consultations

Criteria	Indicators	Practices
Measurability and verifiability	Mental diseases	DRR policy and planning
Relevance to DRR/CCA policy	Chronic diseases	Disaster compensation
Compliance with societal value	Period of school discontinuation	Shelter policy
	Number of school discontinued	
	Collaboration between local government and community	
	Community participation in decision-making	

Health: Health deterioration is one of the critical NELDs caused by typhoons and can manifest in the form of physical injury, infectious diseases and mental illnesses (Hajat *et al.*, 2003). The two most relevant indicators identified were mental diseases and exacerbation of chronic diseases. While mental diseases were reported in the literature, exacerbation of chronic diseases was pointed out by the expert consultation (Shaw, 2014). In Nachikatuura, school counselors were dispatched to provide mental-care due after Typhoon No. 12 (Wakayama Prefecture, 2011b). Reports indicate that chronic diseases such as hypertension and stroke worsened because medicines were damaged during the typhoon (Wakayama Medical University, 2012).

Education: Loss of educational opportunity for children is an important NELD associated with discontinuation of education. Climate-related disasters were reported to be one of the major causes of loss of child education worldwide (UNICEF, 2012). The two most pertinent NELD indicators identified were the period of school discontinuation and the number of school discontinued. These indicators were regarded as significant by the consulted experts. The community consultation indicated that 3 kindergartens, 7 elementary schools and 4 junior-high schools in Nachikatsuura were closed during different periods of time after the typhoon (Nachikatsuura Town, 2013). Some of the schools were closed for a year and a half. The main reasons include damage to schools

by debris flow, damage to piped-water connection in the town and loss of access to public transportation.

Local governance: Similar to loss of health and education, loss of local governance was found to be an important NELD that received little attention in CCA and DRR interventions. Local governance plays an important role in the formulation and execution of collective action at the local level (Shah and Shah, 2006, p.1) and local governments play an important role in supporting self-governance at the community level. Oftentimes, local governments themselves suffer loss and damages that can affect their ability to govern. Disruption of institutional networks, and pressures on institutional cohesion and coordination leading to institutional conflicts are some of the ways in which local governance is affected by disasters.

The two most applicable indicators that capture loss and damage in terms of local governance are reduced local government-local community collaboration, and reduced participation of communities in decision-making. These aspects are described later in the report (please see section 5.4.2). NELDs associated with local governance were observed after the typhoon. It was reported that the Nachikatsuura town office was unable to easily secure places to dispose disaster waste, as collaboration with local communities had declined because of inadequate hearing of community needs. In addition, the town office did not sufficiently provide avenues for local communities to express their opinions through interactive sessions.

Health, education and local governance represent different axis of a multi-dimensional space for measuring the effectiveness of practices to mitigate NELDs (Figure 5.5). As shown in the figure, practices could either equally satisfy all three axis (as in the case of practice A); some practices may tend to satisfy one axis more than others (as in the case of B that satisfies more of education than health and governance); and others satisfy none (as in the case of C that lies at the corner of the three axis). The mitigation practices preferred by stakeholders may depend on location-specific conditions and may not be determined by a desire to equal satisfy all axis. For example, in locations where educational services are lacking, practices that have high effectiveness on the education axis may be chosen.

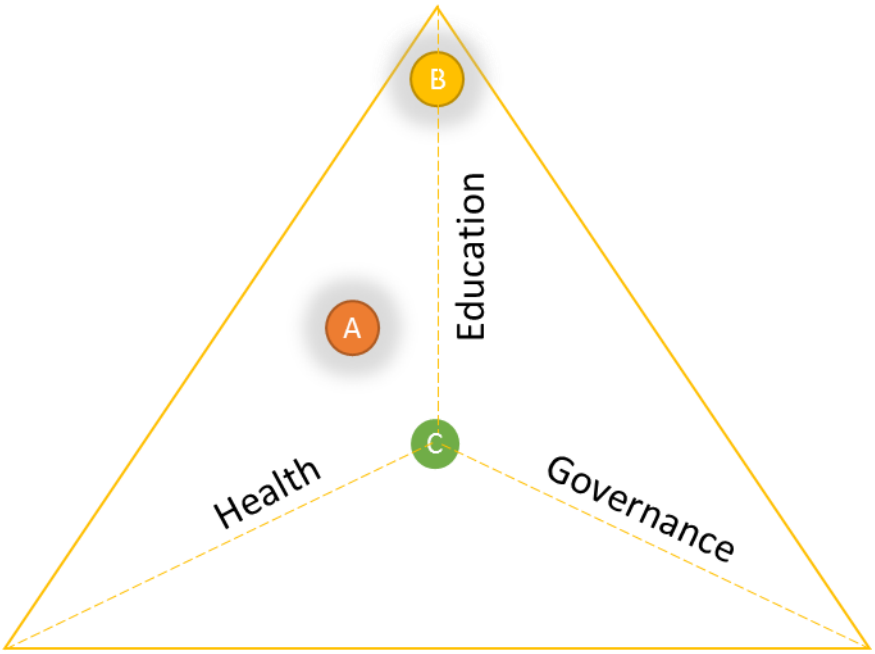


Figure 5.5 A multi-dimensional space of risk reduction practice
(Note: The closer a practice to a particular axis will be the higher its effectiveness in that particular domain.)

5.3.1.3 Practices for addressing NELDs

There is a growing need from policymakers, practitioners and donor agencies for significant investments in climate change resilience and adaptive capacity to mitigate loss and damage, including the NELDs (Anderson, 2011). Despite the growing need, there is a dearth of literature on practices that can effectively address the NELDs in the context of DRR and CCA demanding effective frameworks and tools to identify and evaluate DRR and CCA practices in decision-making (Carter *et al.*, 2007). Policymakers, practitioners and donor agencies need to identify and invest effective DRR and CCA practices, assess the outcomes of their investments and reassure whether their investments deliver measurable and verifiable results (Anderson, 2011).

There are significant challenges to identify and implement effective practices to address NELDs. CCA practices need to be relevant to local contexts (Mansanet-bataller, 2010) and vulnerabilities and exposures can be different, depending on socio-economic characteristics at the local level (Chapter 3). In addition, identifying the practices for NELDs is a challenge since a clear definition of NELDs has not been agreed among policymakers, practitioners and researchers, meaning that there are a wide range of interpretations of NELDs (Chapter 2). This makes it difficult to reach a consensus and

choose effective practices to respond to the NELDs. In this situation, adopting a robust decision-making approach, such as multi-criteria decision-making methods including the AHP, could facilitate deeper discussion among relevant stakeholders, leading to an agreement on NELD practices based on the current level of understanding (Prabhakar, 2014).

The expert and community consultations helped provide deeper insight into the practices that can address NELDs. Three relevant NELD practices were identified: 1) DRR policy and planning; 2) disaster compensation; and 3) shelter policy. The experts and communities felt that the local disaster management plan of Nachikatsuura can play a valuable role in reducing NELD-related risks by implementing the disaster preparedness, response and recovery components of the plan (Nachikatsuura Town, 2016). Disaster compensation was felt to be important, and was in fact provided to those who suffered death and injury, and whose houses were partially or completely destroyed (Wakayama Prefecture, 2011a). The shelter policy was also considered important to mitigating NELDs, as it secured safe locations for the local communities. Shelters can help reduce the psychosocial and infectious health effects of disasters by offering clean water, sanitation and communication facilities (Nachikatsuura Town, 2016).

5.3.2 The community perspective

Figure 5.6 to 5.18 present results of pairwise comparisons of criteria, indicators and practices from the perspective of the affected communities in Nachikatsuura (For the details, see Appendix I.4). To find possible associations between the demographic characteristics and AHP results, the survey results are discussed by gender, age and annual income.

Among those who returned the questionnaires, 78% were male and 18% were female. Youth, middle-aged and elderly were 5%, 38% and 53% respectively. Low income households were 23%. They worked in a public office, other offices, self-employed business, agriculture, or forestry and fisheries, or were employed part-time or were unemployed.

The respondents reported a variety of L&Ds including damages to houses, properties, lands, agricultural and fishery assets, and loss of income. The reported NELDs were

associated with health issues, loss of educational opportunity and disturbance to local governance.

In general, the results indicate that the demographic and socio-economic characteristics of the respondents did not influence the relative weights given for various criteria for prioritizing indicators and practices (Figure 5.6, 5.7, 5.8 and 5.9). The overall comparison matrix was consistent with a CR of 0.001. In addition, the CRs of the sub-category groups of gender, age and annual income were within an acceptable level with a CR in the range of 0.1-0.15. The CR was marginally higher among the responses from youth households, showing relatively lower agreement on the indicators and practices.

Societal value (C-3) appears to be the most important criterion for prioritizing indicators and practices, followed by relevance to DRR/CCA policy (C-2) and measurability and verifiability (C-1) in the context of Nachikatsuura town. These results are particularly interesting as social acceptability is an important issue for NELDs (Collins *et al.,* 2014). Gender, age and annual income followed a similar trend as that of the overall weights, and this indicates that these paramethers have no significant influence on the relative weightages given to indicators and practices (Figure 5.7, 5.8 and 5.9). This trend appears to be inconsistent with the observations made by Acedo *et al.* (2007), who reported that age and gender could significantly influence the decision. A plausible reason for the difference could be that Japanese society is more likely to emphasize relational harmony and interdependence in their selection (Pascale, 1978; Kitayama *et al.*, 2010).

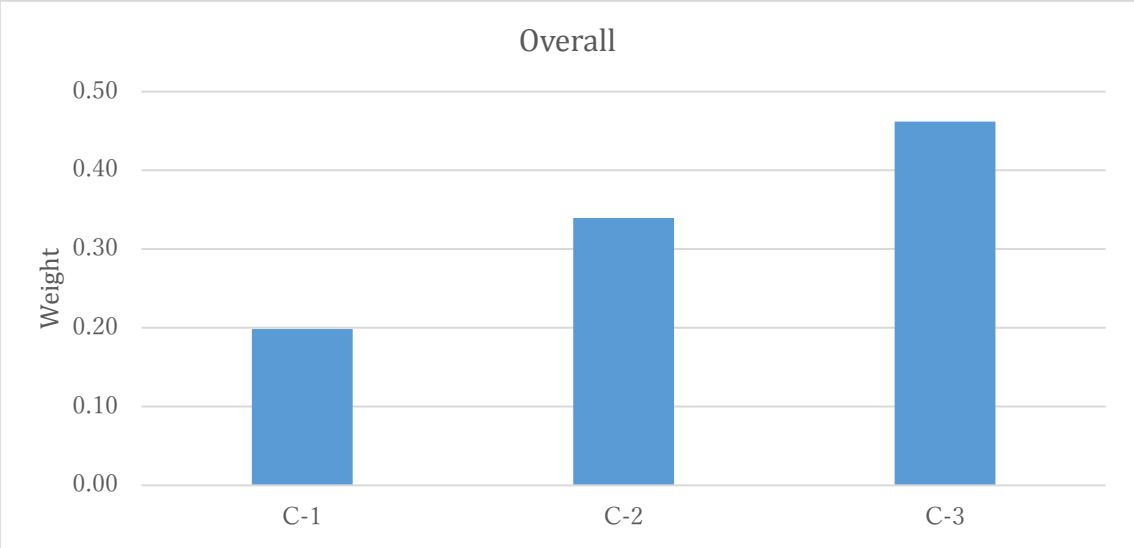


Figure 5.6 Pairwise comparison of criteria (overall)
(C-1: Measurability and verifiability; C-2: Relevance to DRR/CCA policy; C-3: Societal value; CR = 0.001)

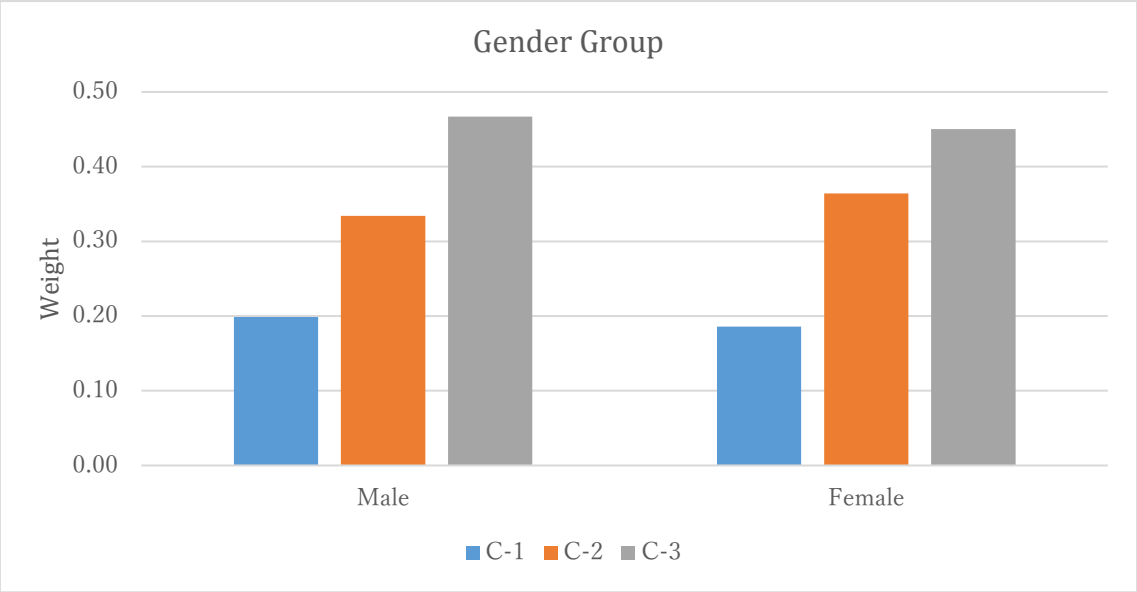


Figure 5.7 Pairwise comparison of criteria by gender group

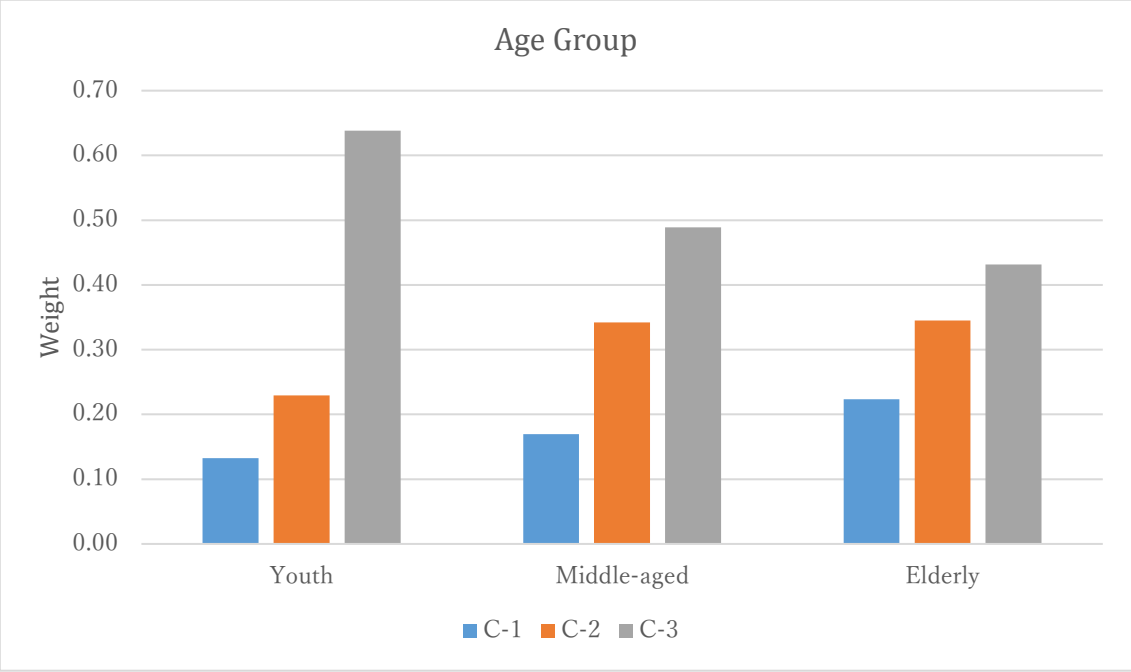


Figure 5.8 Pairwise comparison of criteria by age group

Figure 5.9 Pairwise comparison of criteria by income group

The respondents were asked to pair-wise compare among six indicators covering the NELDs on health, education and local governance identified through consultations (Figure 5.10). These indicators play crucial roles in characterizing the effectiveness of practices in mitigating the NELDs. There is no single indicator that can comprehensively

represent the effectiveness of a practice or a set of practices, and hence there is a need to identify a set of indicators that are collectively able to measure effectiveness on the effectiveness axis shown in Figure 5.5. The pairwise comparisons of indicators under each criterion showed CRs of 0.001, 0.003 and 0.003 for C-1, C-2 and C-3, respectively. Such a favorable consistency ratio indicates high agreement among the responses across all gender, age and economic classes. In addition, CR values in gender, age and annual income groups were at an acceptable level with a CR value of 0.1.

Reduced collaboration of local government with local communities (I-5) emerged as an important indicator among all the three groups of indicators, followed by less participation of community in decision-making (I-6) and mental diseases (I-1). These results are consistent with the observation that social acceptability is an important criterion, as there is a high degree of association between social acceptability and need for consultation within society (Sato *et al.*, 2005). In other words, societies that put high priority on social acceptability tend to prefer public consultation and compliance as part of the decision-making process. Hence, any practices and interventions that positively influence these indicators can make a significant contribution to mitigating the NELDs (JMRC, 2014).

Mental diseases, less collaboration and less community participation emerged as the top three indicators for all the gender, age and economic groups, except for the elderly households, where chronic diseases (I-2) replaced mental diseases as a preferred indicator (Figure 5.11, 5.12 and 5.13). This could be because the elderly are more likely to emphasize worsening of chronic diseases because of their higher exposure to them.

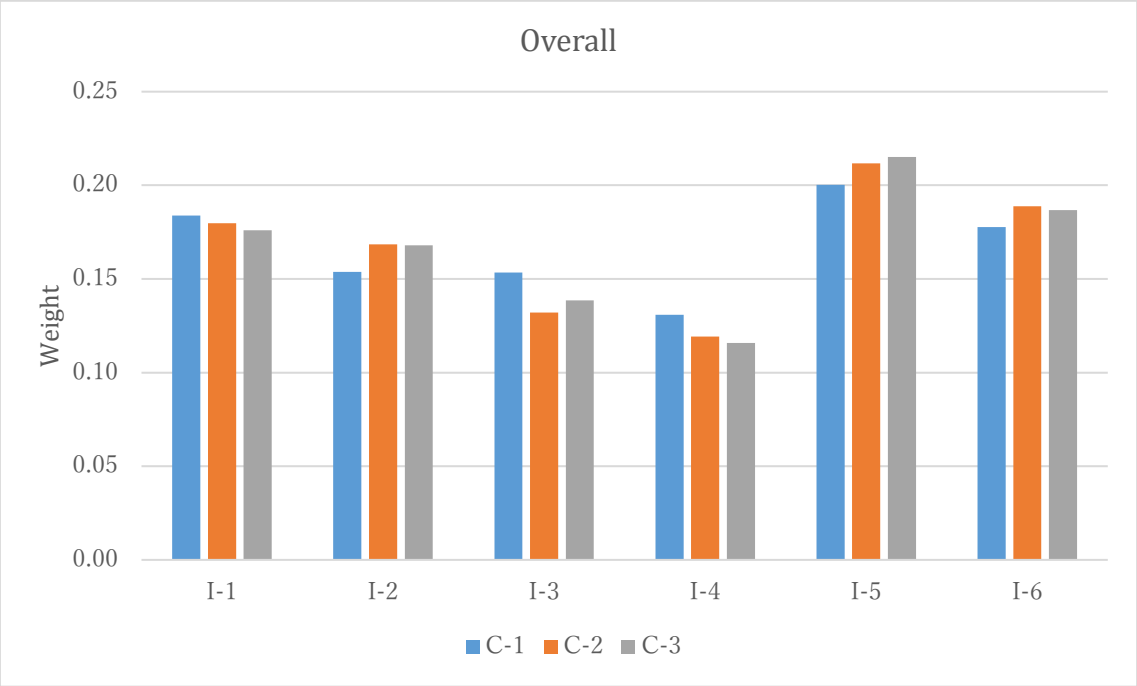


Figure 5.10 Pairwise comparison of indicators (overall)
(I-1: Mental diseases; I-2: Chronic diseases; I-3: Period of school discontinuation; I-4: Number of school discontinued; I-5: Less collaboration of local goverment; I-6: Less participation of community. CR (C-1) = 0.001; CR (C-2) = 0.003; CR (C-3) = 0.003)

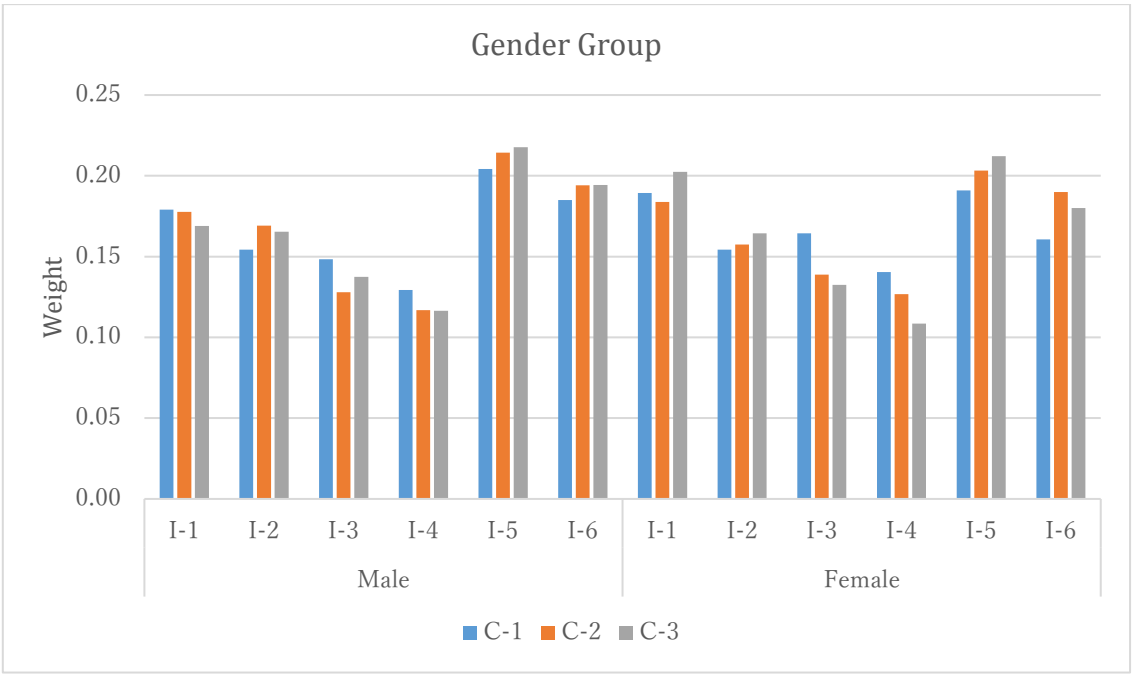


Figure 5.11 Pairwise comparison of indicators by gender group

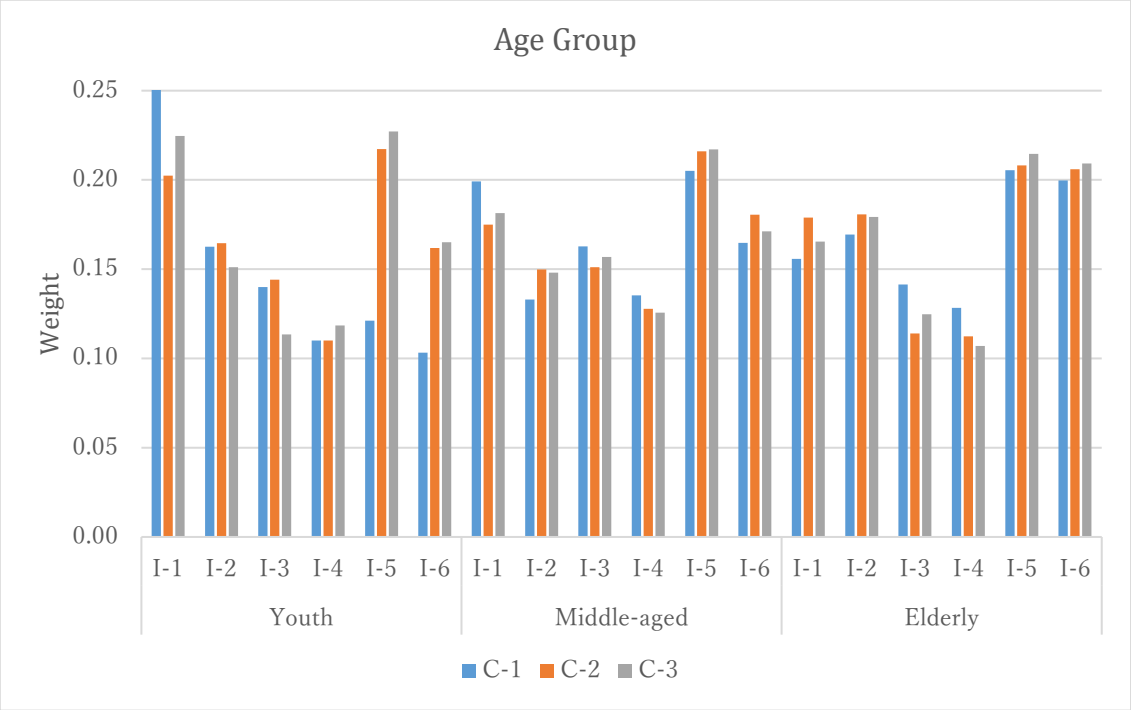


Figure 5.12 Pairwise comparison of indicators by age group

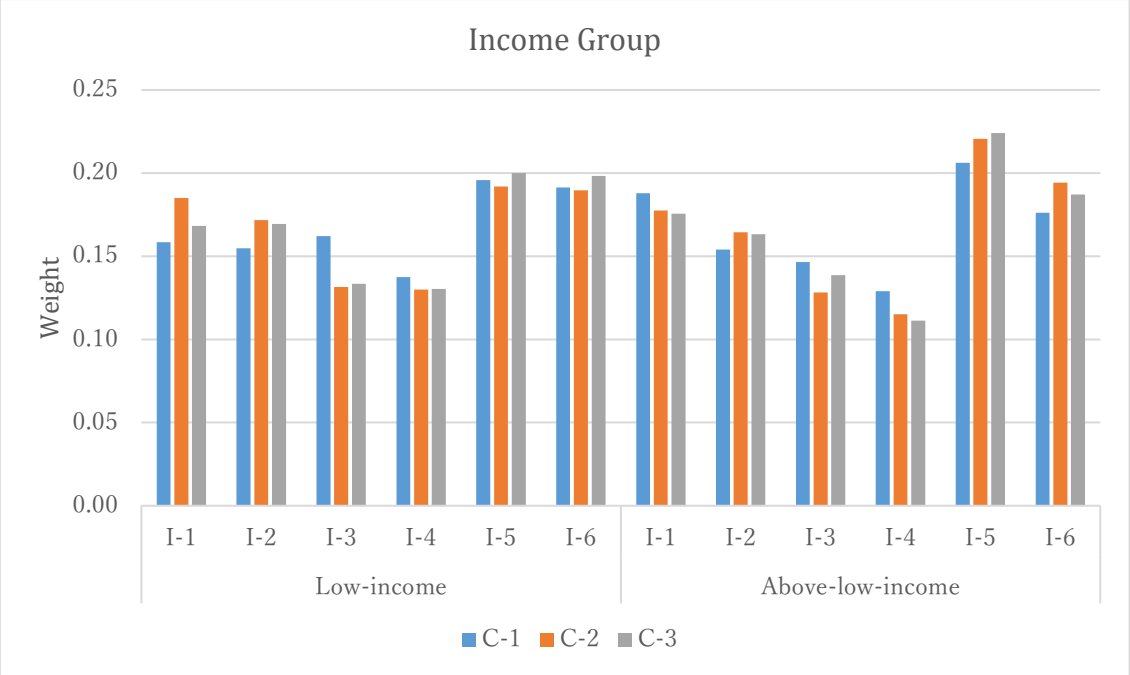


Figure 5.13 Pairwise comparison of indicators by income group

The ultimate objective of this study was to identify the practices that will better mitigate the NELDs in the context of the study location. Not all practices will be able to equally

satisfy all the indicators; hence, one of the means of assessing their effectiveness is to look at the performance across a set of indicators. The indicators presented previously to measure their effectiveness play critical roles in characterizing these practices. Shelter policy (P-3) was found to be the most effective practice, followed by DRR policy and planning (P-1) and disaster compensation (P-2). Overall, the results indicate a favorable CR for all the indicators for assessing the practices in question (Figure 5.15). Gender, age and annual income were at an acceptable CR of <0.1.

The shelter policy received high priority as in the study location the sex ratio favored males, there were many elderly and there were also low-income households (Figure 5.16, 5.17 and 5.18), all of whom stressed the importance of the shelter policy. The higher weightage of the majority of indicators for shelter policy is explained by the fact that shelters have helped communities to address health and education issues more than other practices.

There are slight differences within the gender and age groups in how the indicators explained the effectiveness of the practices. Females thought DRR policy and planning helps in governance-related issues, as indicated by high weightage in these indicators, than men. Similarly, youth thought DRR policy and planning help in education and governance than the elderly respondents, who opined that shelters provide greater education and governance benefits. Wealthier respondents agreed with the youth that DRR policy and planning impact education and governance more than the shelters. These results could be seen in terms of the social groups and their ability to think strategically. Several studies (Shah *et al.*, 2012; Yirka, 2012; and Spears, 2011) reported that wealthier social groups tend to think strategically and in terms of economic aspects in long-term decision-making, which is in line with the observations made in this study that they preferred investments in education and governance over shelters.

Figure 5.14 displays the overall decision tree for addressing the NELDs in Nachikatsuura. Societal value (C-3) appears to be dominant criterion for decision-making, and it resulted in emphasis on local governance indicators, such as collaboration of local government with local communities (I-5) and participation of community in decision-making (I-6), and health indicators, such as mental diseases (I-1). The local governance and health indicators in turn determined the shelter policy (P-3) to be the most effective policy to address the NELDs in Nachikatsuura.

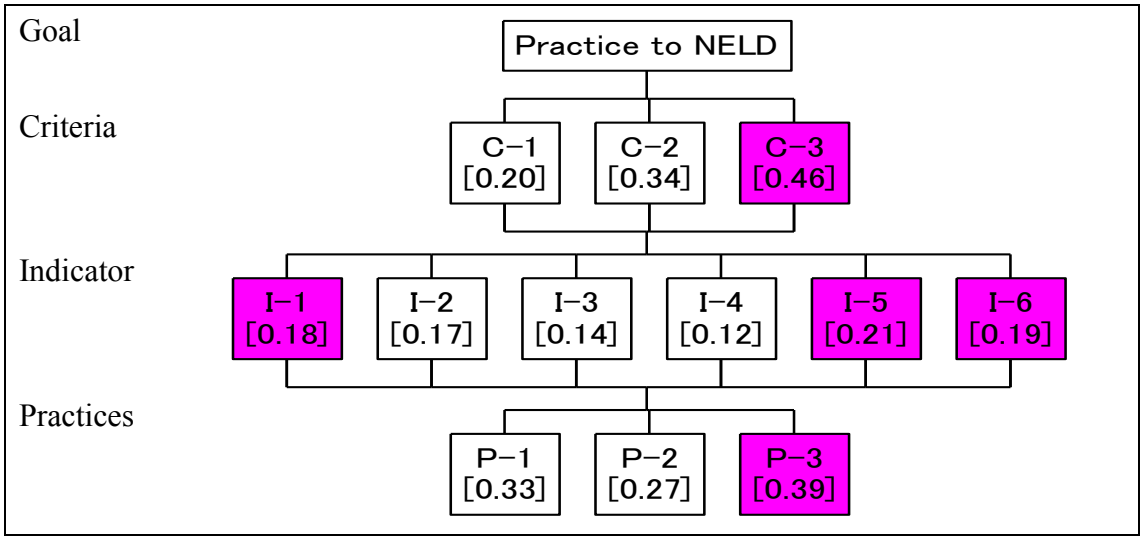


Figure 5.14 Overall weights from the perspective of the affected local communities

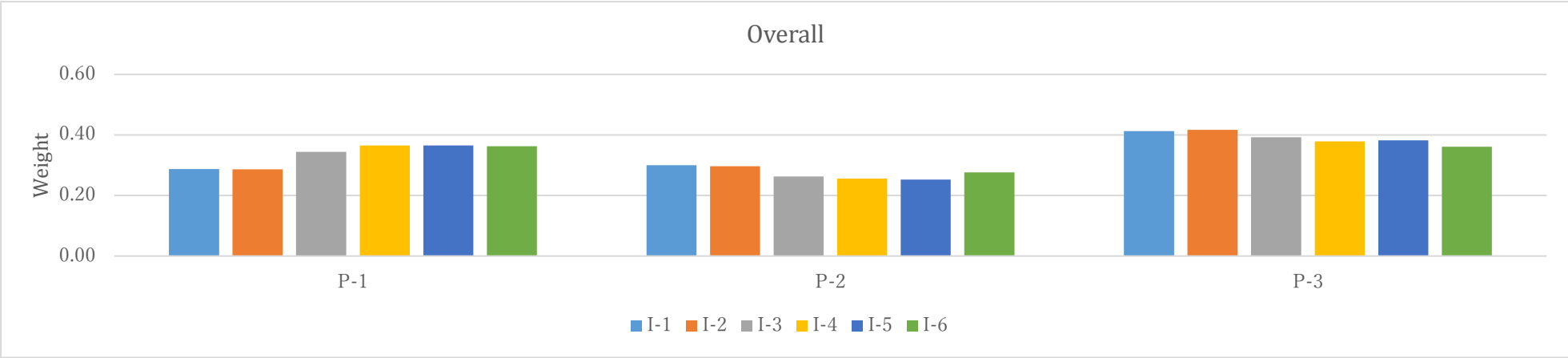


Figure 5.15 Pairwise comparison of practices (overall)

(P-1: DRR policy and planning; P-2: Disaster compensation; P-3: Shelter policy; CR (I-1) = 0.010; CR (1-2) = 0.005; CR (1-3) = 0.003; CR (1-4) = 0.003; CR (1-5) = 0.008; CR (1-6) = 0.009)

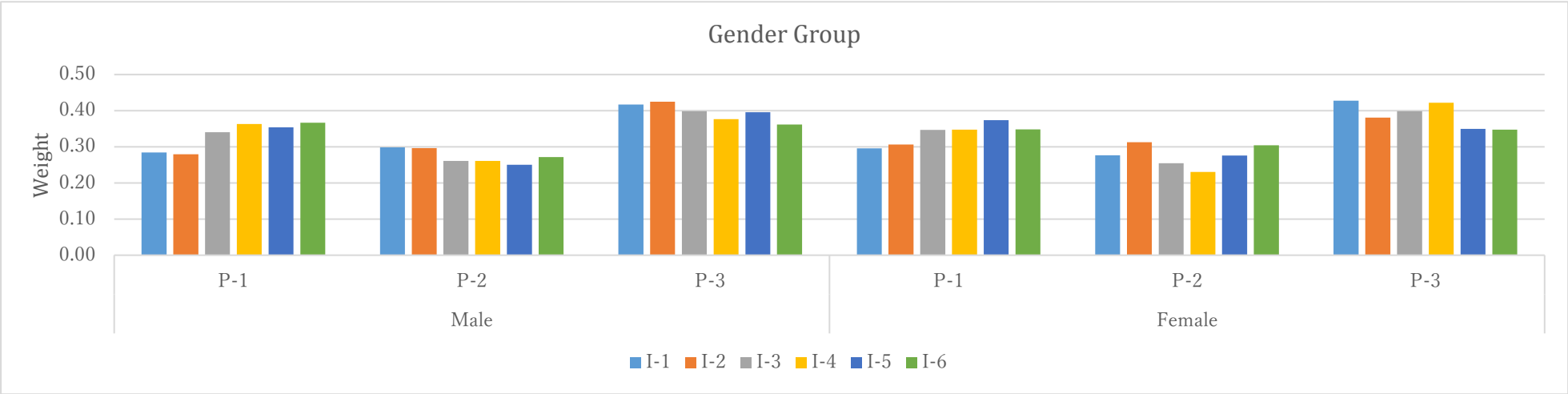


Figure 5.16 Pairwise comparison of practices by gender group

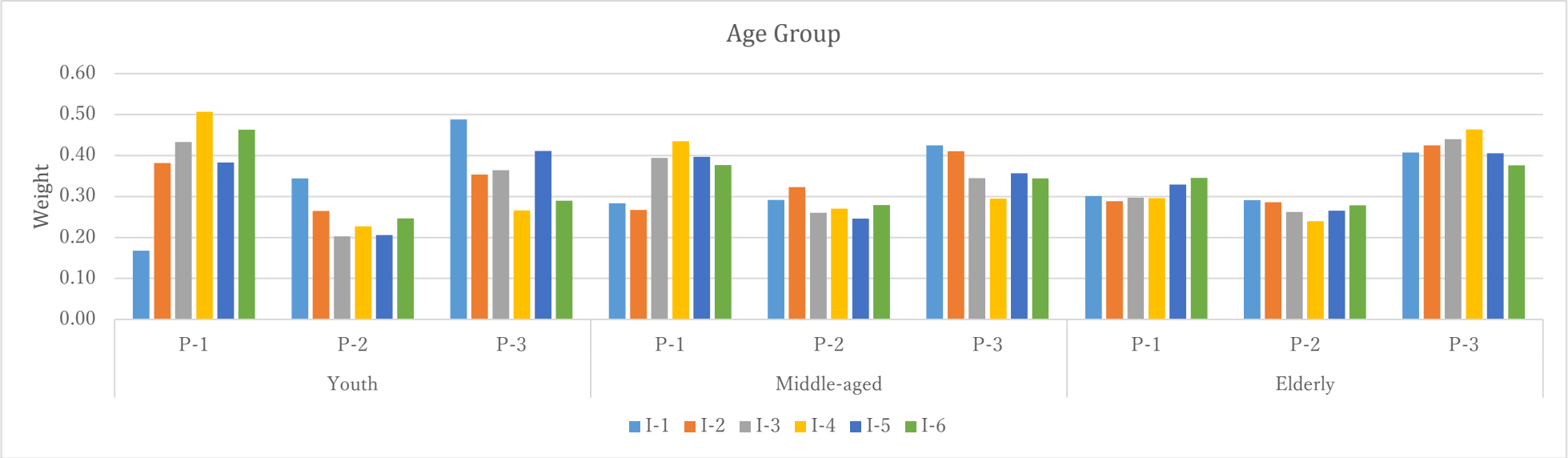


Figure 5.17 Pairwise comparison of practices by age group

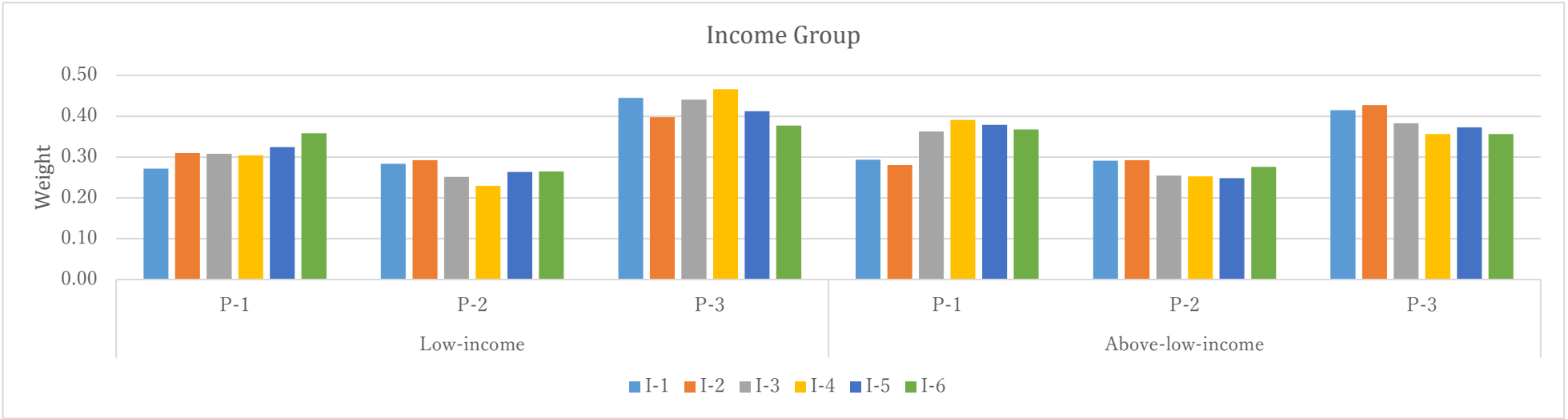


Figure 5.18 Pairwise comparison of practices by income group

5.3.3 The perspective of local government

Figure 5.20 to 5.22 show the results of pairwise comparisons of criteria, indicators under each criterion, and practices under each indicator from the perspective of the Nachikatsuura town officials (For the details, see Appendix I.5). The results had the high consistency in the study with a CR of 0.000. Similar to the community responses, government officials preferred societal value (C-3) was a dominant criterion, followed by relevance to DRR/CCA policy (C-2) and measurability and verifiability (C-1). Mental diseases (I-1) was ranked the most important indicator to assess the NELD effectiveness of practices, followed by local governance indicators such as less collaboration of local government with local communities (I-5) and health indicators such as chronic disease (I-2). The responses from town officials were similar to that of the community members except for the chronic diseases. The community and town officials also differed in their opinion on effective practice to address NELDs. Town officials identified DRR policy and planning (P-1) as the most important practice for addressing NELDs while communities preferred shelter policy. Figure 5.19 presents the overall decision tree for town officials and depicts the relatively higher importance given to health indicators, which explains the higher perceived effectiveness of DRR policy and planning.

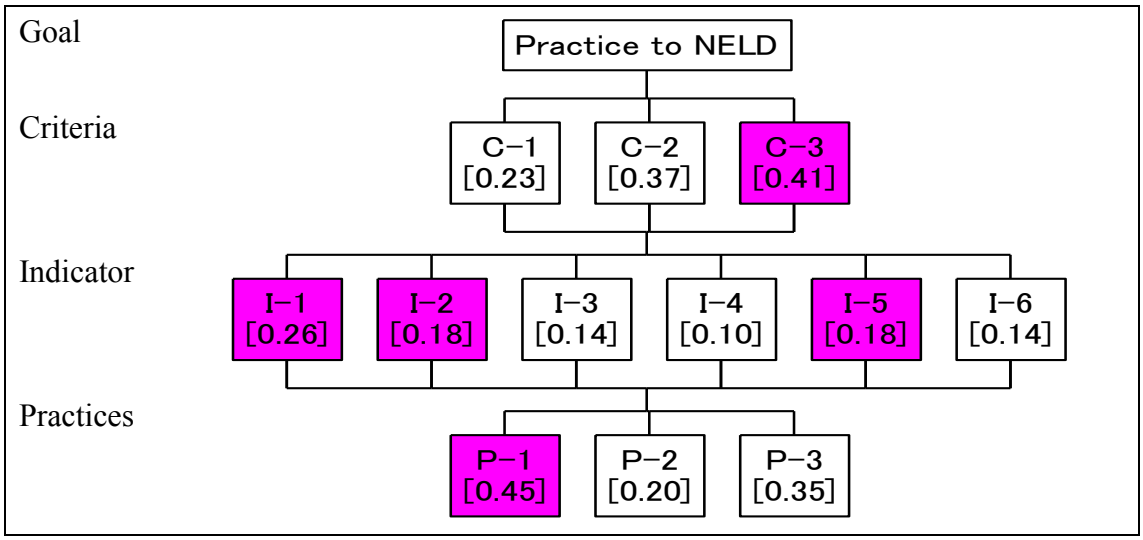


Figure 5.19 Overall weights from the perspective of local government

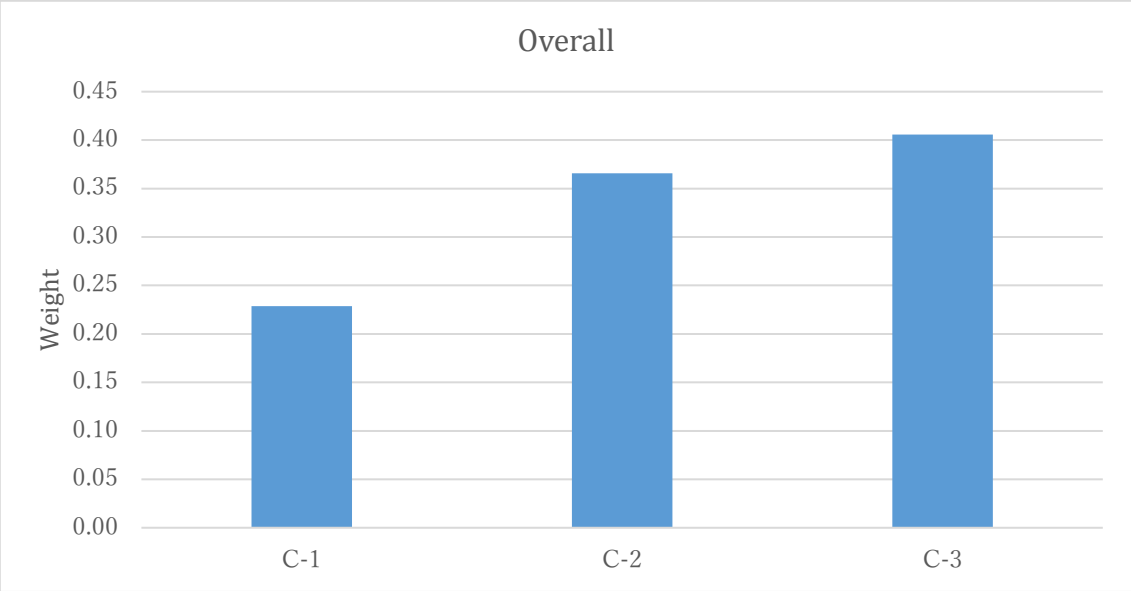


Figure 5.20 Pairwise comparison of criteria (overall)
(C-1: Measurability and verifiability; C-2: Relevance to DRR/CCA policy; C-3: Societal value; CR = 0.000)

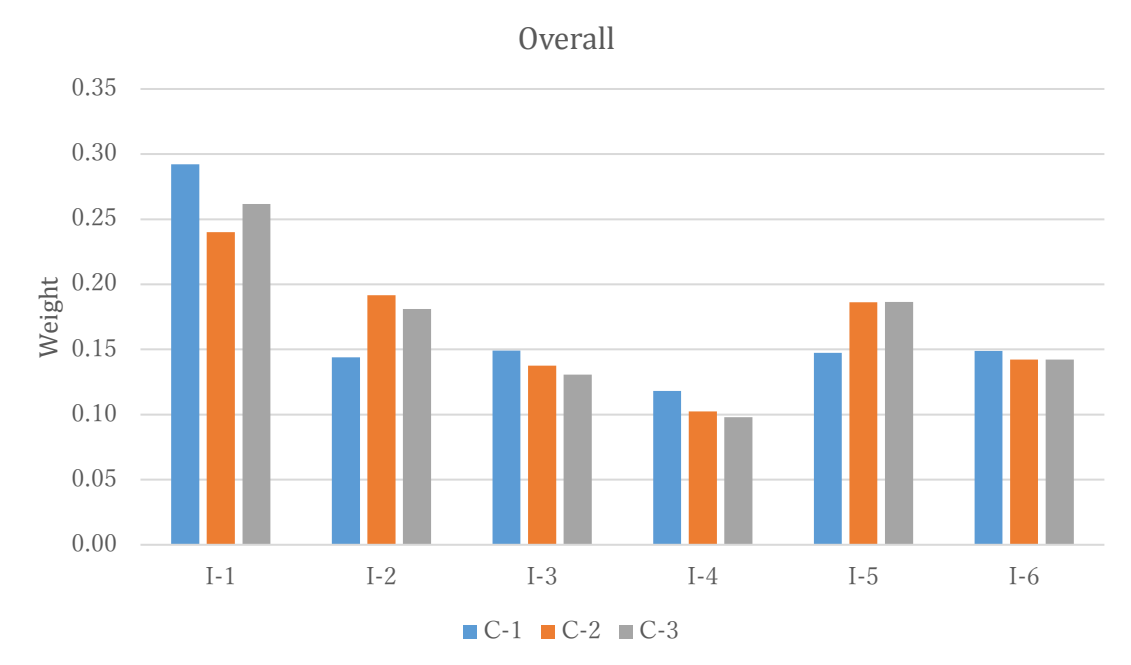


Figure 5.21 Pairwise comparison of indicators (overall)
(I-1: Mental diseases; I-2: Chronic diseases; I-3: Period of school discontinuation; I-4: Number of school discontinued; I-5: Less collaboration of local government; I-6: Less participation of community; CR (C-1) = 0.009; CR (C-2) = 0.007; CR (C-3) = 0.008)

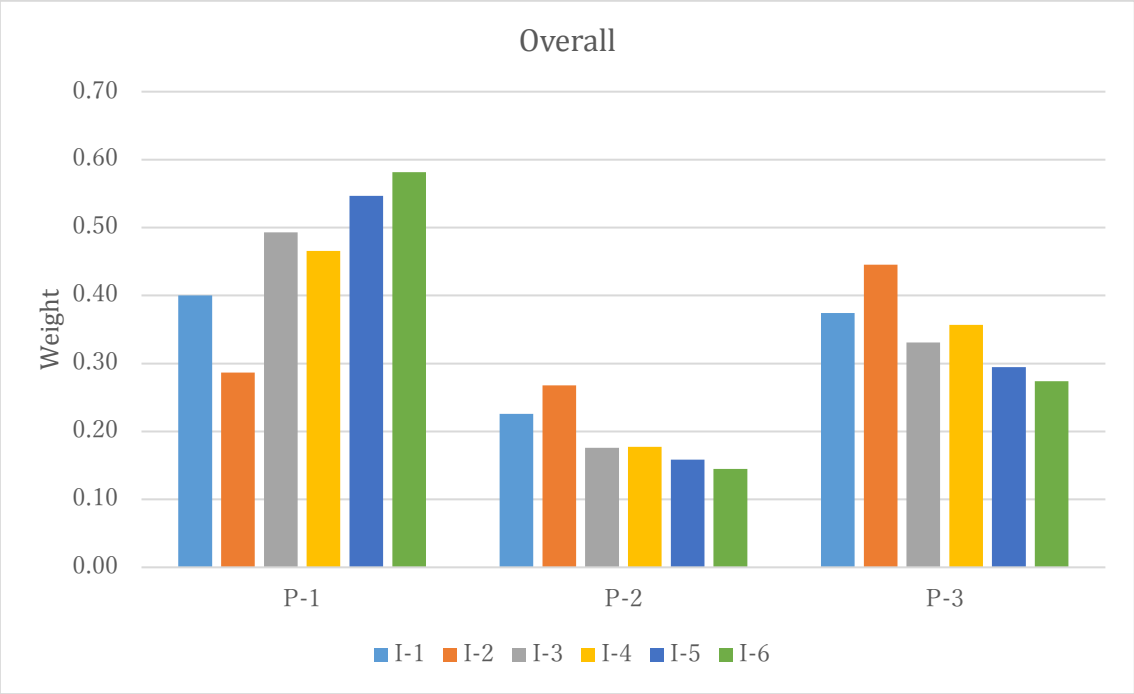


Figure 5.22 Pairwise comparison of practices (overall)
(P-1: DRR policy and planning; P-2: Disaster compensation; P-3: Shelter policy; CR (I-1) = 0.003; CR (I-2) = 0.000; CR (I-3) = 0.001; CR (I-4) = 0.001; CR (I-5) = 0.000; CR (I-6) = 0.001)

5.3.4 Assessing the current status

This section discusses the current status of practices identified in the study in the Nachikatsuura town and provides recommendations for the town, prefecture and national governments wherever applicable, to address issues identified in the previous section. The results indicate that both communities and town officials agree on the importance of addressing mental diseases (I-1) and issues affecting the collaboration of local government with local communities (I-5). Communities have identified their limited participation in decision-making (I-6) as a challenge. In terms of health issues, in addition to mental diseases, town officials also recognized the importance of addressing chronic diseases (I-2), especially keeping in view the increasing number of elderly residents. The results also reveal that the shelter policy (P-3) and DRR policy and planning (P-1) will help address these issues, even though the relative effectiveness differs depending on the demographic characteristic of respondents.

In this section, an effort has been made to describe the current status of mainstreaming these NELD indicators and practices into Nachikatsuura's existing disaster management (DM) plan, a part of which covers the shelter policy. Disaster data collection formats are also discussed. The discussion reveals that the mere presence of these practices may not suffice and that the details in their planning and implementation also determine their effectiveness.

5.3.4.1 Mental and chronic diseases

The town's DM plan clearly describes efforts to address mental diseases while chronic diseases were not specifically defined in the plan but may have been considered under 'illnesses' described in the DM plan. The DM plan includes the health and hygiene plan for windstorms and floods caused by typhoons, which lays down guidelines for public nurses on providing healthcare to individual households, and evacuation centers for addressing physical and mental illnesses in the aftermath of disasters (Nachikatsuura Town, 2016). The health and hygiene plan also contains the mental health and welfare policy plan to address long-term disaster impacts on mental health. The plan suggests mental-care counseling including visits to people living in temporary houses, formation of self-help groups among affected people, information gathering for identifying mental problems, and research and development of policies to address the identified problems. The plan gives special attention for the mentally disabled, who are more likely to become mentally unstable, the elderly, who are more likely to suffer a sense of isolation due to relocation to temporary houses, alcoholism, which may occur after disasters, underdeveloped children and the bereaved.

The town office is generally required to collect loss and damage data after the disaster using specific data collection formats and report the data to the prefectural government, which then reports to the Fire and Disaster Management Agency (FDMA) and other concerned government ministries as appropriate (MIC, 2014). However, the data formats do not require the collection of information on the number of local communities affected by illness including mental and chronic diseases (FDMA, 2001). Moreover, methodologies that could be used to establish cause and effect relationships between mental and chronic diseases and the typhoon are lacking. It is complicated by the fact that many of these NELDs continue to occur after several months and years of the natural disaster making it difficult to attribute them to a specific event. Consequently, any changes in numbers of mental and chronic disease cases cannot be attributed to the typhoon (Nachikatsuura Town, 2013).

Reports indicate that 125 mental health experts and several school counselors were dispatched to the affected areas in Nachikatsuura and other municipalities in Wakayama for providing physical and mental healthcare to local communities during and in the aftermath of the typhoon in September 2011 (Nachikatsuura Town, 2013). In addition, a telephone counseling hotline for mental-care was established (Wakayama Prefecture, 2011b).

Despite these efforts, the survey showed an ongoing need for enhanced mental and physical healthcare at evacuation centers and homes. Prolonged stay and poor amenities such as bedding at evacuation centers, loss of family members, insomnia, alcoholism, and anxiousness about securing a livelihood, employment and income in the future were found to be causes of mental stress among the affected. Interviews with the affected community members also indicated refusal to attend school for more than a year due to mental stress caused by environmental changes after the disaster. The mental diseases were not limited to the affected communities as the town officials were also affected due to work pressure. As a result, the prefectural and central governments were requested to support the town by providing additional manpower. Chronic diseases such as asthma, sciatica, hypertension and Alzheimer's dementia, and fatigue were also reported. These diseases were exacerbated by a lack of medicines and limited access to health facilities.

These observations supports the earlier health needs identified in the study. It is necessary for the town office to improve the shelter policy and the DM plan to address mental stress caused by disasters (Table 5.6). Increasing the number of mental health experts and providing long-term mental care would be positive steps. There is also a need for the town's DM plan to recognize chronic diseases as a major NELD. The shelter policy should be strengthened to improve medical preparedness at evacuation centers and ensure periodic and sufficient dispatch of medical experts as long as necessary after the disasters. It was also observed that the measurement and reporting frameworks for mental and chronic diseases need to be strengthened to collect sufficient information to aid decision-making.

5.3.4.2 Less collaboration and participation

Collaboration between the town office and communities is an important aspect of disaster risk management planning and such a need was well recognized by the town's DM plan. Community associations and voluntary organizations for disaster prevention played a crucial role in the aftermath of the disaster in terms of the operation of evacuation centers,

provision of food, post-disaster damage assessment and removal of disaster waste. Building consensus between the town office and local communities while carrying out these tasks is of paramount importance for effective recovery. Data related to local governance on government collaboration with communities for recovery and the number of interactive sessions for consensus-building between the town office and communities had not been included by the town office in the data collection formats (FDMA, 2001).

The survey results demonstrated challenges facing collaboration between the town office and communities especially in organizing evacuation centers. For instance, food was only provided in evacuation centers, due to insufficient collaboration with community associations. Those who were not evacuated faced difficulties in accessing food. In addition, lack of engagement of communities by the town office meant that the needs of the disabled and elderly were not adequately met and lack of collaboration with communities also posed problems in identifying disposal sites for disaster waste. As a result, some communities, as in the case of Iseki district, carried out debris removal without any help from the town office. Lack of dialogue between the town office and communities was reported to have negatively affected the recovery plans after the disaster. It should be understood that several of these issues emanated from a manpower shortage within the town office, which meant limited time for collaboration and lack of experience in responding to large-scale disasters.

Based on this experience, the prefectural and central governments need to have made provisions to support town offices to avoid manpower shortages (Table 5.6). They should also invest in strengthening the human resources and technical capacity of the town office to prepare for, cope with and recover from disasters. This evidence and experience suggests the need to strengthen the shelter policy and related components of the DM plan to enhance collaboration between the town office and communities in matters related to organization of evacuation centers, removal of debris and recovery planning.

In addition, it is vital for the town office to revise the DM plan to enable periodic opportunities for community consultations and dialogues, to obtain community opinions and for consensus-building. Relevant experts and facilitators familiar with the local socio-economic contexts should participate in these interactions to provide independent opinions as a way of avoiding conflicts between the communities and the town office.

5.3.4.3 School discontinuation

Both communities and the town officials gave lower priority to addressing prolonged school discontinuation and number of school discontinued than health and local governance issues. The data collection formats required information to be collected on the number of schools discontinued, but not on the period of school discontinuation (FDMA, 2001). Nevertheless, the town office has reported the period of school discontinuation and this can provide useful information for measuring the education loss faced by children.

The survey results showed that in particular female and youth households and low-income groups recognized the need to improve the shelter policy for addressing the inaccessibility of educational opportunities for children. Some schools such as the Ichinono Elementary School and Iseki Kindergarten directly suffered physical damages caused by debris flows and many schools were temporarily used as evacuation centers (Nachikatsuura Town, 2013). As a result, some schools were temporarily closed and children were forced to discontinue school or go to other schools under high mental stress from the disaster and worry about an uncertain future.

Hence, it is important for the town office to carefully consider the continuity of education for children when schools are closed due to physical damage or their use as evacuation centers (Table 5.6). The official data collection formats should be also improved to collect information about the period of school discontinuation which can be an indicator for measuring the loss of educational opportunity for children.

Table 5.6 Summary of recommendations to address NELDs

NELDs	Recommendations
Mental and chronic diseases	▪ Improve the town's shelter policy and DM plan to address mental stress through mobilizing more mental health experts and providing long-term mental care. ▪ Recognize chronic diseases as a major NELD and enhance the shelter policy for medical preparedness at evacuation centers. ▪ Strengthen the measurement and reporting frameworks for mental and chronic diseases to aid decision-making.

NELDs	Recommendations
Less collaboration and participation	▪ The prefectural and central governments should invest in improving the human resources and technical capacity of the town office for disaster recovery. ▪ Strengthen the town's shelter policy and DM plan to enhance collaboration between the town office and communities especially for adequate management of evacuation centers. ▪ Improve the town's DM plan to establish communication channels to obtain community opinions and for consensus-building. ▪ Seek participation of relevant experts and facilitators with independent opinions that can assist in avoiding conflicts between the communities and the town office.
School discontinuation	▪ Give careful attention to the continuity of education for children when schools are closed. ▪ Improve official data collection formats for the period of school discontinuation.

5.4 Conclusions

The NELDs caused by climate-related disasters are important challenges in Japan as the existing countermeasures are more focused on addressing physical damages. However, the NELDs, including loss of health, education, social capital and local governance, can be substantial. This study aimed at identifying and prioritizing key NELDs caused by the 2011 Typhoon No.12 and practices to address these NELDs for effective DRR and CCA. The study applied the AHP analysis to prioritize key NELD-related elements (i.e., criteria, indicators and practices), which were identified, evaluated and narrowed down through three sequential steps: 1) comprehensive literature review; 2) expert consultation; and 3) focus group discussion in the affected community. Questionnaire surveys were conducted to prioritize the key NELD-related elements targeting the affected communities and the town officials.

The study identified several similarities and differences between the preferences of the affected communities and town officials. The affected communities identified social value as an important criterion, collaboration of local government with local communities as an important indicator and shelter policy as an important practice to address NELDs. The results were similar to those of the town officials, except on practice, where DRR policy and planning was prioritized instead of shelter policy. It was found that mental diseases and shelter management are closely related, as improper and insufficient post-disaster relief and rehabilitation were found to be causes of mental diseases. This indicates a need to support vulnerable people amongst the affected households by mobilizing more mental health experts and providing long-term mental care. In addition, providing mental-care to the town officials is necessary as they face significant mental pressure in the aftermath of the disaster. There is also a need to recognize and address chronic diseases as a major NELD in the town's DM plan and strengthen the shelter policy in terms of medical preparedness at evacuation centers and periodic dispatch of medical experts.

It is crucial for the town office to improve the shelter policy and related DM plan in ways that strengthen collaboration between the town office and local communities. In particular, attention should be given to the appropriate management of evacuation centers through close coordination and communication with community associations, voluntary organizations and volunteer groups. It is imperative for the town office to improve the DM plan by establishing communication channels to seek opinions and for consensus-building with communities. Participation of relevant experts and facilitators in these communications would strengthen the DM plan in terms of providing independent opinions that can assist in avoiding conflicts between communities and the town office. The prefectural and central governments should make provisions for supporting town offices to avoid manpower shortages and strengthen their human resources and technical capacity to prepare for, cope with and recover from disasters. Furthermore, it is also necessary for the town office to enhance the shelter policy to ensure educational opportunities for children when schools are discontinued due to their use as evacuation centers.

Another concern is that the disaster data collection formats of the town office do not collect information on some important NELD indicators identified by this study, such as number of local communities affected by mental and chronic diseases, collaboration for recovery and dialogue for consensus-building between the town office and communities,

and period of school discontinuation. These indicators should be included in the data formats to ensure loss and damages are fully reported.

This chapter contributed to development of an effective framework to identify and prioritize key NELDs caused by the Typhoon No. 12 in the context of small rural town in Japan and find out important risk reduction practices for addressing the NELDs.

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CHAPTER 6 CASE STUDY: KOYRA UPAZILA

6.1 Introduction

Developing countries which are more vulnerable to adverse effects of climate change are facing an urgent challenge on loss and damages (L&Ds) caused by climate-related disasters (UNFCCC, 2014). So far, the Conference of Parties (COP) under United Nations Framework Convention on Climate Change (UNFCCC) have attempted to emphasize the importance of addressing the L&Ds through establishing the Warsaw International Mechanism to solve the L&Ds in 2013. However, responses to address non-economic loss and damages (NELDs) which could impact on health, social, cultural and environmental assets are lacking in terms of understanding, identification and prioritization of NELDs although many developing countries could suffer more NELDs than economic damages (UNFCCC, 2013). The low attention paid to NELDs can result in significant underestimation of the actual disaster losses, and this can induce insufficient investments in post-disaster recovery and limited decision-making on disaster risk reduction (DRR) and climate change adaptation (CCA) efforts, and lead to decrease in community resilience to climatic disasters (Morrissey and Oliver-Smith, 2013; IPCC, 2014). Addressing the L&Ds is a common challenge between the DRR and CCA communities but the DRR community has focused on the economic aspects while the CCA community has raised the need of addressing NELDs (Chapter 5).

Bangladesh is an unexceptional country that could face the L&Ds and NELDs. This country has increasingly suffered climatic events such as cyclones, floods, storm surges, water and soil salinity, and droughts (DDM, 2014). Specifically, Cyclone Aila in 2009 resulted in the most severe disaster that Bangladesh has suffered during recent years, followed by the Cyclone Sidr in 2007. The associated heavy rainfall, storm surges and flooding caused significant physical damages and human casualties. Southern coastal districts of Bangladesh, in particular Khulna and Satkhira, were affected by the cyclone, and Bangladesh reported a death toll of 190 people across 11 districts with about 4.8 million people affected (Walton-ellery, 2009).

While the government of Bangladesh has strengthened its post-disaster recovery from the cyclones, the countermeasures tend to focus on addressing physical economic damages, such as damages to houses, crops, agricultural land and livestock (DMB, 2010). NELDs

which last for months and even years after the disaster, such as deterioration in mental health, disruption to education and loss of community networks, have not been sufficiently addressed in the existing recovery measures (EMA, 2002). Thus, it is imperative for Bangladesh to put emphasis on NELDs since those could be more significant than economic damages, especially in remote rural areas vulnerable to climatic disasters.

Keeping the above in view, a survey-based study was conducted to identify and prioritize key NELDs caused by Cyclone Aila in 2009 in Khulna district and figure out important risk reduction practices. The aim of the survey is to provide the information on NELDs for their inclusion in DRR and CCA initiatives. The same methodology verified in the case study of Nachikatsuura town in Japan was applied to this Bangladesh case study. This chapter presents the results of important NELDs identified through the structured questionnaire survey with affected community members in Khulna. It also presents key differences in perspectives between affected local communities and the local government in NELDs, which have important implications for local level DRR and CCA. Finally, it provides recommendations for enhancing DRR and CCA-related policies and plans. To the best of our knowledge, this study is the first ever effort to identify and prioritize NELDs of cyclone in the coastal area of Bangladesh, and therefore might have a greater implication for disaster management policy of Bangladesh.

6.2 Methodology

The analytic hierarchy process (AHP) was used to prioritize key NELDs caused by Cyclone Aila in Koyra sub-district. Elements of AHP analysis for NELDs consisted of decision criteria, indicators and risk reduction practices. These elements were in order scrutinized through: comprehensive literature review; expert consultation; and focus group discussion (FGD) in the affected community. The methodology and relevant processes have been verified in the case study of Nachikatsuura town (Chapter 5). Afterward, a household questionnaire survey was conducted to prioritize key NELD-related elements from the perspectives of the affected local communities and the local government officials and also to identify the differences in the relative importance the two stakeholders give to various NELD elements.

6.2.1 Study location

Koyra sub-district (upazila) were selected as the study site for reasons including: serious L&Ds from Cyclone Aila (occurred on 25 May, 2009); geographic location as remote rural community; and richness of social, cultural and environmental assets which can be impacted by NELDs (Figure 6.1). Koyra is one of 9 sub-districts under Khulna district which is one of 10 districts under Khulna division as Bangladesh is divided into 7 administrative divisions (LGED-Khulna, 2017; Bangladesh National Portal, 2017). It is the largest but remote sub-district of Khulna district with an area of approximately 1,775 km^2, covering 952 km^2 of forest (Kumar *et al.*, 2010). The sub-district is composed of 7 unions (the smallest local administrative units) as Amadi, Bagali, Dakshin Debkasi, Koyra Sadar, Maharajpur, Maheshwaripur and Uttar Debkashi (LGED-Khulna, 2017a). It is also at the entrance of the Sundarbans, the largest mangrove forest in the world which holds heritage and biodiversity as well as abundant fish resources (Islam and Gnauck, 2008). The sub-district lies in humid, warm and tropical climate (Filho, 2013). The annual average temperature of Khulna district ranges from maximum 35.5°C to minimum 12.5°C, and the average annual precipitation is 1,710 mm as the rainfall is in generally heavier from the month of June to September (BBS, 2013; BBS, 2015).

The sub-district has a total population of 193,931 (male: 95,393; female: 98,538) with a household count of 45,750 (rural: 43,063; peri-urban: 2,687) as of 15th March 2011 (BBS, 2015). The literature showed 84% of male-headed households and 16% of female-headed households in this region (Abdullah *et al.,* 2016). The population distribution by age consists of about 18% for youth (Age: 20-29), 33% for middle-aged (Age: 30-59) and 9% for elderly (Age: more than 60) (BBS, 2015). In Khulna division, the threshold of poverty line is 1,226.21 Bangladeshi Taka (BDT) as monthly per capita income, and households below poverty line account for about 32% (BBS, 2011). The occupation in Koyra consists of agriculture (about 67%), such as cropping, livestock, forestry and fishery, and wage labor (about 20%), including industry, commerce, transport and communication, service and construction (Banglapedia, 2014).

Koyra is one of the worst affected sub-districts of Khulna district from Cyclone Aila in 2009 (USAID, 2009). The main cause of the damages was reported to be flooding and waterlogged condition, which resulted from the breakdown of embankment due to strong storm surge that accompanied the cyclone. Consequently, about 300,000 people of Khulna district were affected, 57 people died, and thousands of houses were fully

(49,000) or partially (27,000) destroyed (Saha, 2016). In addition, 7,392 acres of standing crops were damaged, 15,785 livestock was dead, and 597 km of embankment was damaged (Roy *et al.,* 2009). In Koyra, 6 unions out of 7 were affected as 1,700 affected households in Bagali, 5,800 in Dakshin Debkasi, 8,283 in Koyra Sadar, 5,300 in Maharajpur, 6,600 in Maheshwaripur and 9,361 in Uttar Debkashi (UNDP, 2009). There were high priority areas of concern for water and food, shelter, proper medication and sanitation facilitates, as well as restoration of roads and embankments (Roy *et al.,* 2009).

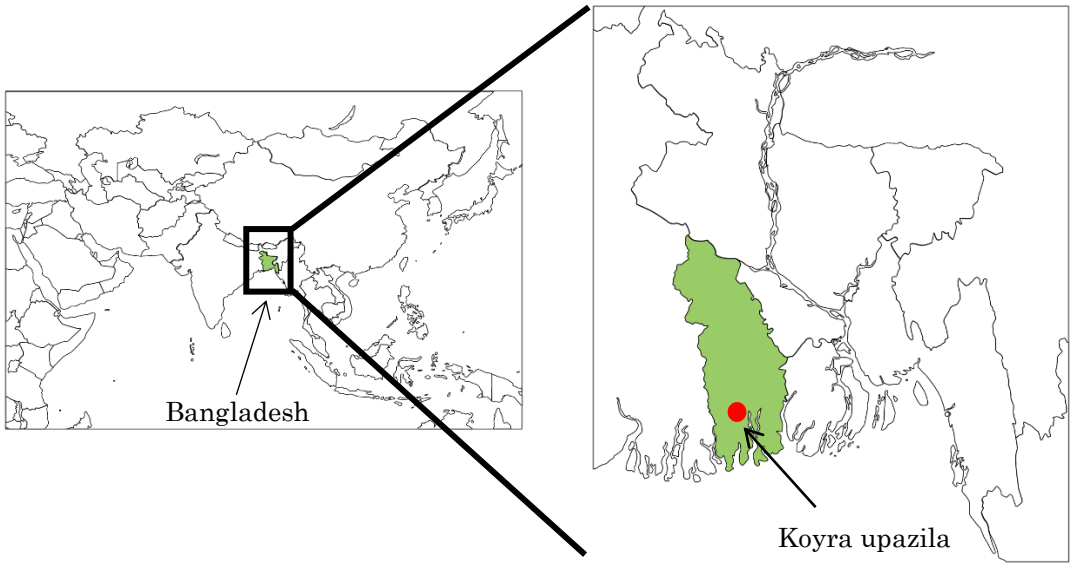

Figure 6.1 Koyra sub-district, Khulna district, Khulna division (Source: Prepared by Author from Sankakukei (2016))

6.2.2 Analytic hierarchy process

This study used the AHP to prioritize key NELDs caused by the Cyclone Aila in Koyra. Table 6.1 shows Saaty's fundamental judgement scales for pairwise comparison used in this study. Chapter 5 reveals the AHP is suitable for assessing NELDs caused by cyclones as it helps solving problems that are hierarchical in nature and helps in reconciling opinions of multiple stakeholders in deriving a common agreement. Microsoft Excel was used for the AHP analysis. The aggregation of individual priorities was done by geometric mean of individual priorities (Forman and Peniwati, 1998).

Table 6.1 Fundamental judgement scales for pairwise comparisons

Scale	Description
1	Equal importance of both options
3	Moderate importance of one over another
5	Strong importance for one over another
7	Very strong importance for one over another
9	Extreme importance for one over another

Source: Prepared by Author from Saaty (1990)

The elements of AHP analysis for NELDs included relevant decision-making criteria, indicators and risk reduction practices. Three sequential steps were taken to identify, examine and narrow scopes of the NELD-related elements: 1) comprehensive literature review; 2) expert consultation; and 3) FGD in the affected community (Figure 6.2). The literature in context of DRR and CCA was reviewed to understand the NELD aspects. A consultation workshop was conducted with 17 experts in June 2015 to understand key NELDs caused by the past recent cyclones and assess the suitability of the NELD-related elements identified from the literature in the context of Bangladesh. The workshop participants, such as academian and researchers, were chosen from NELD-related sectors, including DRR, CCA, food and agriculture, livelihood, water, meteorology and climatology, health, education, environment, gender, social development, governance and policy, socio-economics, indigenous knowledge and cultural heritage, and biodiversity and forestry. An initial list of NELD-related elements was presented, and then the experts were asked for their suggestions regarding their suitability and priority in terms of cyclones in Bangladesh (Table 6.2). Through the discussion, some of the areas, criteria, indicators and practices were excluded and included in the context of Bangladesh under mutual agreement. Then, FGDs were held in October 2016 to evaluate the key NELD elements vetted by the experts from the community perspective, among 10 affected community members of Uttar Bedkashi and Koyra Sadar for each, the most severely affected unions in Koyra (For the discussion sheet for community consultation, see Appendix II.1).

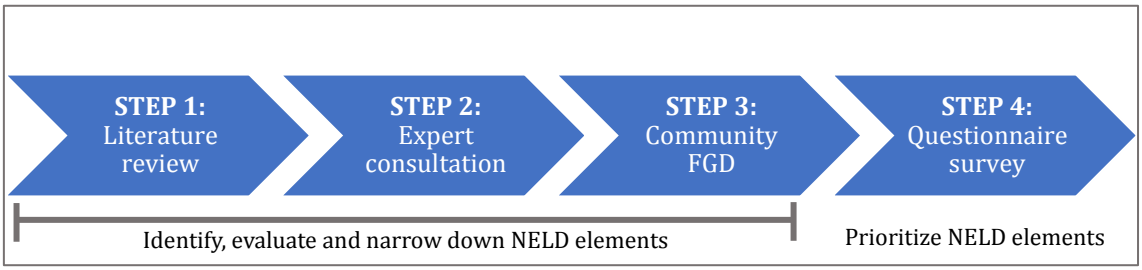

Figure 6.2 Workflow of study implementation

Table 6.2 Initial list of NELD criteria, indicators and practices for expert consultation

Decision-making criteria	
▪ Value given by society ▪ Significant impact on the larger well-being of family/society in the long-run ▪ Cost of measuring the indicator ▪ Policy relevance ▪ Relevance to DRR-CCA planning ▪ Measurability ▪ Verifiability ▪ Familiarity ▪ Exclusivity	
Impact areas	**Indicators**
Human life	▪ People killed
Human health	▪ People injured
	▪ People suffered infectious diseases
	▪ People suffered chronic diseases
	▪ People suffered mental diseases
	▪ People suffered malnutrition
Education	▪ School bullying
	▪ Schools discontinued
	▪ Children dropped out school
	▪ Children temporary discontinued school
Human mobility	▪ People displaced
Territory	▪ Decrease in place identity to the area felt by people
	▪ Decrease in lace dependence on the area felt by people
Social capital	▪ Less participation to local/social activities
	▪ Less acceptance of community leaders

	▪ Social hostilities ▪ Less ability to build consensus ▪ Decrease in cooperatives/membership in societies ▪ Households migrating (seasonally) ▪ Women with migrated husband
Cultural heritage	▪ Decrease in cultural identity to cultural heritage sites felt by people ▪ Decrease in cultural dependence on cultural heritage sites felt by people ▪ Cultural heritage ruined
Indigenous knowledge	▪ Less availability of indigenous knowledge ▪ Decrease in people with indigenous knowledge
Local governance	▪ Less collaboration ▪ Organizational conflicts ▪ Less ability to facilitate external coordination
Biodiversity/Ecosystem	▪ Decrease in species abundance ▪ Decrease in species diversity ▪ Decrease in area of forest ▪ Decrease in water availablilty in rivers and lakes
Risk reduction practices	
▪ Disaster insurance ▪ Disaster compensation ▪ Disaster preparedness planning ▪ Shelter management ▪ Land-use policy	

Source: Comprehensive literature review and expert judgement

6.2.3 Structure of the decision hierarchy

Figure 6.3 presents the hierarchy diagram of the AHP which reflected the identified key NELD-related elements. The goal of this AHP was set as ‘selection of best risk reduction practices for addressing NELDs caused by the Cyclone Aila. It assumes that the NELDs should be addressed for better post-disaster recovery. The indicators and practices that were identified from the literature review and were further vetted through consultations were introduced in the AHP analysis.

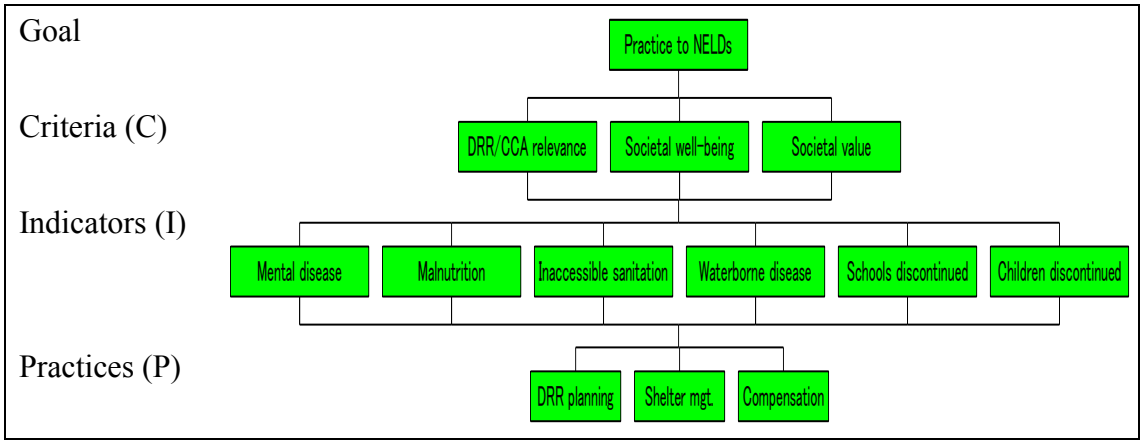

Figure 6.3 Hierarchy diagram of AHP analysis

The expert and community consultations have identified three important NELD impacts of the cyclone: 1) decline in health; 2) inaccessible water and sanitation; and 3) loss of educational opportunity for children. For each of these impact areas, the two most important indicators were listed and prioritized for inclusion in the AHP analysis.

6.2.4 Questionnaire survey

Questionnaire surveys was carried out to prioritize key NELD-related elements (i.e., criteria, indicators and practices) from two perspectives of the affected local communities and the local government and also to find out the differences between the two stakeholders' opinions on the relative importance they give to various NELD elements (For the questionnaire survey sheets, see Appendix II.2 and II.3). Affected households and local government officials who are engaged in DRR, public health, water and sanitation, and education participated in the questionnaire survey. The questionnaire survey was conducted at the household level for communities and at the individual level for local government officials of unions under Koyra sub-district, with the help of some trained enumerators.

The sample size for the questionnaire survey was determined 237 by the formula ($n = [t^2 \times p(1-p)]/m^2$] where n is sample size; t is confidence level (1.96); p is estimated prevalence (37,044 affected households/45,750 total households); and m is confidence interval (0.05)) (UNDP, 2009; BBS, 2012). More samples were added in the required sample size (237) to prevent potential errors from respondents and eventually a total of 247 was face to face interviewed. A stratified random sampling was conducted to ensure representative participation according to the socio-economic profile of the sub-district.

The stratification was done according to household's status in terms of gender, age, and monthly per capita income (Table 6.3). Households above poverty-line (i.e., above low-income households) could be included since the monthly per capital income per household in Khulna district is more than 1,226.21 BDT (BBS, 2011). A total of 26 respondents from local government officials at the union level from the disaster management, pubic health and education departments were interviewed with a structured questionnaire.

Table 6.3 Sample size for the households

Gender		**Age**		**Monthly per capita income**	
Male:	199 (81%)	Youth	73 (30%)	Low:	84 (34%)
Female:	48 (19%)	Middle-aged	133 (54%)	Above low:	163 (66%)
		Elderly:	41 (16%)		
Total: 247					

The questionnaire surveys were conducted in November and December 2016. The questionnaire form were developed with thorough explanation and clearer and easier terms in consultation with local university and relevant experts. Households and local government officials were visited and interviewed, and the answers were filled out in the questionnaire forms by interviewers on site. The results were presented by comparing between the perspectives of the affected local communities and the local government officials. The Consistency Ratio (CR), the consistency of pairwise comparisons, was used as an acceptable level of 20% or less to test the uniformity of results across the responses (Saaty, 1990; Bhushan and Rai, 2004). A high inconsistency ratio may not be exception in this study since abstract parameters were used from the nature of NELDs, particularly for non-professional people (Chapter 5). The results are presented as geometric mean of all scores given by individual's pairwise comparisons.

6.3 Results and Discussion

6.3.1 NELD criteria, indicators and practices

6.3.1.1 NELD criteria

Three criteria identified to prioritize NELD indicators and practices were: 1) relevance to DRR/CCA policy and planning; 2) impact on societal well-being in the long-run; and 3)

compliance with the societal value. Relevance to DRR/CCA policy and planning means whether or not the identified NELD indicators and practices are applicable within the DRR/CCA policy and planning domains. Long-term societal well-being represents whether or not the identified indicators and practices are attributed to recovering individual's happiness and social quality after the disaster (Kittiprapas, 2009). Compliance with societal value refers to the extent to which the identified indicators and practices are socially relevant so that the society needs to accept.

6.3.1.2 NELD indicators

Two most crucial NELD indicators were identified from three important NELD impact areas of the cyclone (health, water and sanitation, and education) in the context of the study location in Bangladesh, through expert and community consultations (Table 6.4). In this section, literature relevant to the identified indicators is presented to provide a deeper understanding on these indicators.

Table 6.4 List of criteria, indicators and practices prioritized in this study through expert and community consultations

Criteria	Indicators	Practices
Relevance to DRR/CCA policy and planning	Mental diseases	Disaster preparedness policy and planning
Impact on societal well-being	Malnutrition	Cyclone shelter policy
Compliance with societal value	Inaccessible sanitation	Disaster compensation
	Waterborne diseases	
	Number of school discontinued	
	Children temporary discontinued school	

Health: Deterioration of health is a significant impact of NELDs caused by cyclones and can manifest in the form of physical injury, infectious diseases and mental illnesses (Hajat *et al.*, 2003). The two most relevant indicators identified were: mental diseases; and malnutrition. Mental diseases such as post-traumatic stress and depression in the post-disaster period has been reported in the literature (Krug *et al.*, 1998; Paul *et al.*, 2010).

Malnutrition of children can be worsen through a food shortage resulting from damages to crops and reduced access to fish (UNFCCC, 2013; Haque *et al.*, 2012).

Water and sanitation: Inaccessibility to quality water and sanitation is one of the important challenges on NELDs, especially in developing countries since the undeveloped and vulnerable water and sanitation systems are further damaged by the cyclone. The two most pertinent NELD indicators identified were: inaccessible sanitation; and waterborne diseases. Open latrines and poor sanitation are common in rural Bangladesh, and local people suffer inaccessibility to the water and sanitation systems due to the breakdown caused by cyclones (Haque *et al.*, 2012). Waterborne diseases such as diarrhea have been occurs after cyclones due to the lack of safe drinking water (Cash *et al.*, 2013). It is reported that at least 95 % of the affected and waterlogged areas in Khulna district was out of the safe sanitation coverage, and in Koyra at least 10,000 people suffered diarrhea (Roy *et al.*, 2009).

Education: Loss of educational opportunity for children is also an imperative NELD, and it is caused by discontinuation of education due to the cyclone. The two most pertinent NELD indicators identified were: the number of school discontinued; and children temporary discontinued school. It is widely reported that negative impacts of climatic events on child education are significant especially in developing countries since about 65 percent of children and women will be affected by climate-related disasters in the next decade (UNICEF, 2012). The damage data collected at the sub-district office indicated 9 educational institutes were fully damaged, and 70 were partially damaged in Koyra.

Figure 6.4 shows that health, water and sanitation, and education represent different axes of a multi-dimensional space where risk reduction practices could fall according to their effectiveness. The closer a practice to a particular axis will be the higher its effectiveness in that particular domain. For instance, in the case of practice ‘A’, health, water and sanitation, and education could be equally satisfied; ‘B’ could fulfill more education than health, and water and sanitation; and ‘C’ could contribute to none. The preference of practices by stakeholders may depend on location-specific conditions.

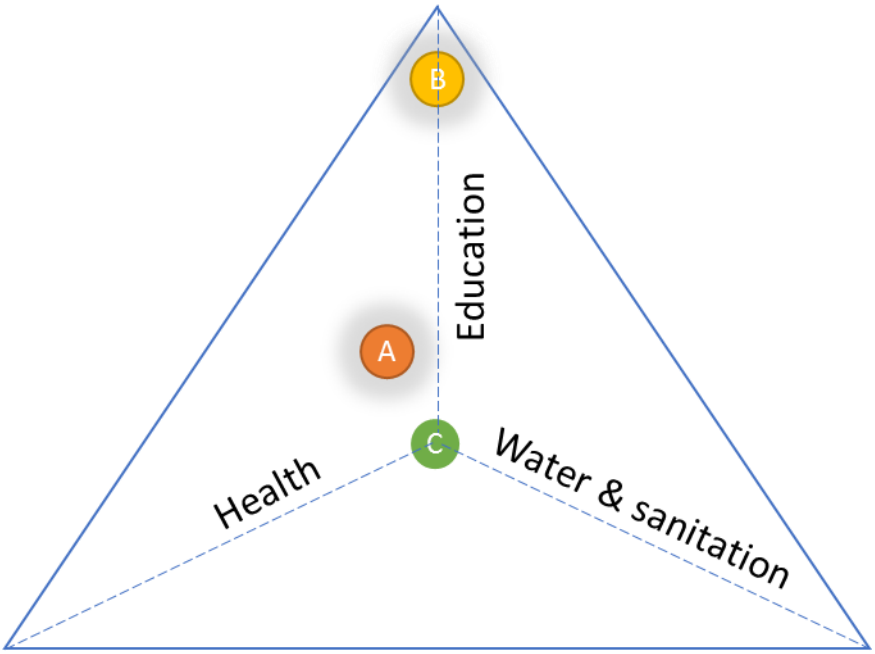

Figure 6.4 A multi-dimensional space of risk reduction practices

6.3.1.3 Practices for addressing NELDs

There are increasing demands from policymakers, practitioners and donor agencies to identify and invest effective DRR and CCA practices to mitigate L&Ds, including the NELDs (Anderson, 2011). However, challenges lie in lack of a clear definition of NELDs, difficulty to clarify the practices for NELDs, and necessity of practices relevant to local context but not universal (Mansanet-bataller, 2010). This leads to bottleneck to reach a consensus and select practices to respond to NELDs. In this circumstance, expert and community consultations and multi-criteria decision-making methods including AHP used in this study can be effective to provide deeper insights among relevant stakeholders and to arrive at a mutually beneficial agreement on the practices that can address NELDs.

Three relevant practices were identified as important means of addressing NELDs: 1) disaster preparedness policy and planning; 2) cyclone shelter policy; and 3) disaster compensation. The interview with local authorities showed that there are few relevant policies at the local level but local administrative units of sub-district and union in general follow the national policies. The experts and communities demonstrated that the disaster management plan can play an imperative role in reducing NELD-related risks by implementing the disaster preparedness, response, recovery and rehabilitation (DMB, 2010). The cyclone shelter policy was recognized important to mitigate NELDs, as it secured safe locations for the local communities. Shelters can help reduce the health,

water and sanitation effects of disasters by offering safe water, sufficient food, proper toilet and sanitation (MDMR, 2012). Disaster compensation, post-disaster financial assistance of cash payment for damages, was also considered important for households who lost family members, and whose houses, sanitation, agriculture and livestock were damaged in order to recover from the L&Ds from cyclone (BCAS, 2015; DDM, 2017).

6.3.2 The community perspective

Figure 6.5 to 6.17 present results of pairwise comparisons of criteria, indicators and practices from the perspective of affected communities in Koyra sub-district (For the details, see Appendix II.4). To find possible associations between the demographic characteristics and AHP results, the survey results are discussed by gender, age and monthly per capita income.

Among the respondents, 81% were male and 19% were female. Youth, middle-aged and elderly were 30%, 54% and 16% respectively. Below poverty-line households were 34% while those with above poverty-line were 66%. Respondents' occupations included salaried employment, small businesses, daily laborer, farmer, fishermen, van puller, motor cycle driver and unemployed.

The respondents reported a variety of L&Ds including damages to houses, properties, agricultural lands, crop yields, livestock and loss of salary and income. The reported NELDs included health issues, inaccessibility to water and sanitation, and loss of educational opportunity.

The overall comparison matrix of criteria was consistent with a CR of 0.000. In addition, the CRs of the sub-category groups of gender, age and income were within acceptable level with a CR in the range of 0.000-0.015. The CR was especially slightly higher among the responses from elderly households.

Societal value (C-3) appears to be the most important criterion for prioritizing indicators and practices, followed by societal well-being (C-2) and relevance to DRR/CCA policy and planning (C-1). These results imply that social acceptability is one of the important issues in NELDs (Collins *et al.*, 2014). Gender (male only), age and income groups followed similar trend as that of the overall weights, and this demonstrates that these parameters have no significant influence on the relative weightages given to indicators

and practices (Figure 6.6, 6.7 and 6.8). On the other hand, female households put highest emphasis on societal well-being (Figure 6.6). This is partially in line with the observations made by Acedo *et al.* (2007), who showed that the age and gender could have significant impact on decision-making.

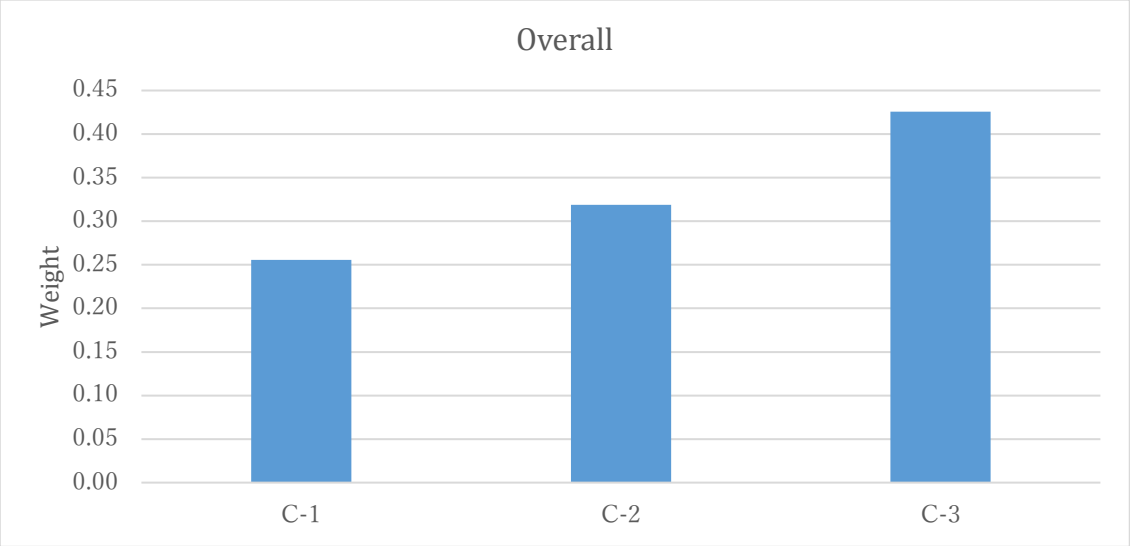

Figure 6.5 Pairwise comparison of criteria (overall)
(C-1: Relevance to DRR/CCA; C-2: Societal well-being; C-3: Societal value; CR = 0.000)

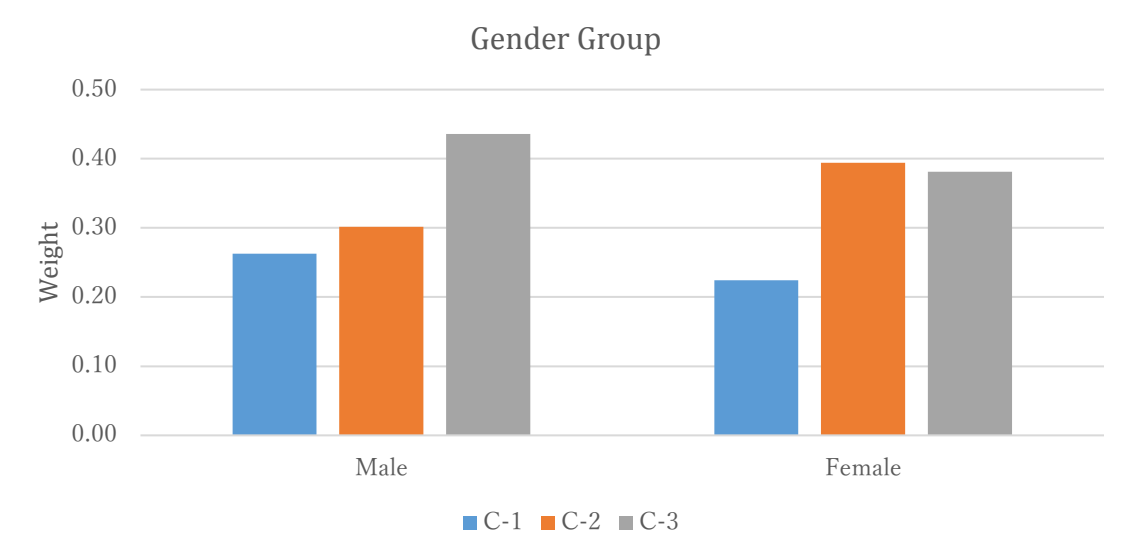

Figure 6.6 Pairwise comparison of criteria on gender group

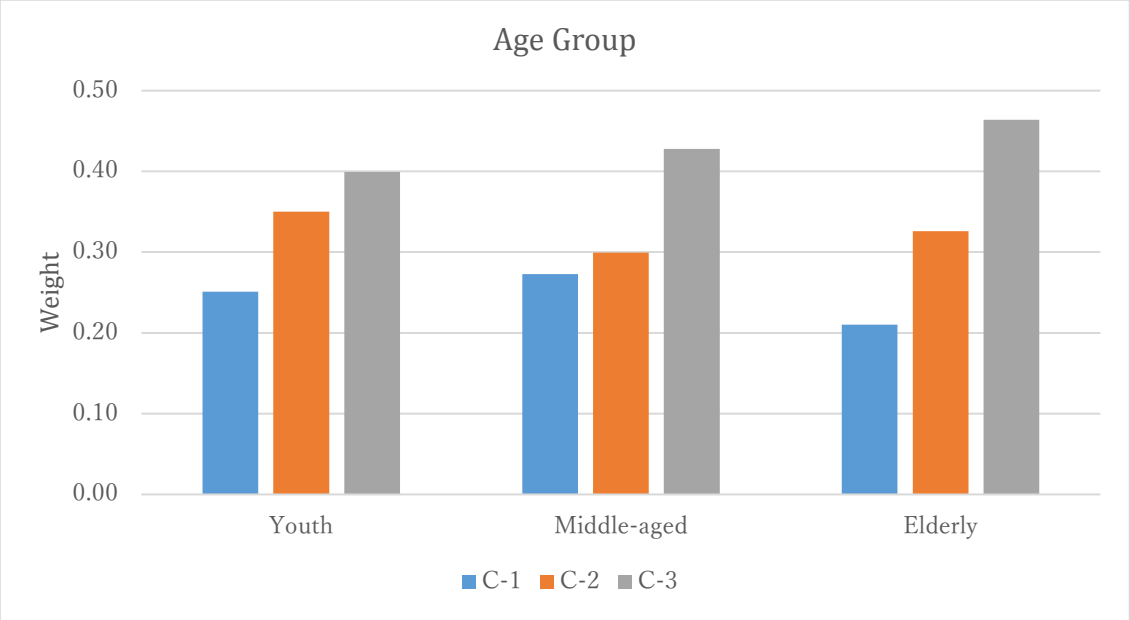

Figure 6.7 Pairwise comparison of criteria on age group

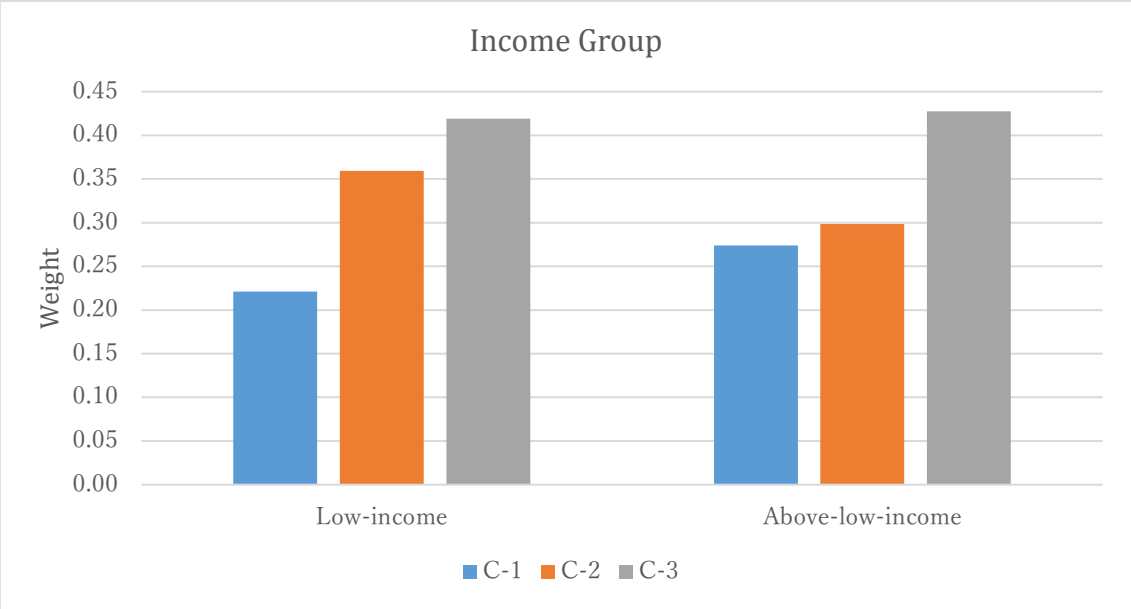

Figure 6.8 Pairwise comparison of criteria on income group

The respondents were requested to make pair-wise comparison among six indicators related to NELD impacts on health, water and sanitation, and education (Figure 6.9). These indicators play a vital role in determining effective practices for mitigating the NELDs.

The overall pairwise comparisons of indicators under each criterion showed CRs of 0.024, 0.012 and 0.012 for C-1, C-2 and C-3 respectively. Such a favorable consistency ratio appears to be high agreement among the responses across all gender, age and income groups. In addition, CR values in gender, age and income sub-groups were at an acceptable level with a CR value of 0.1.

Overall, inaccessible sanitation (I-3) emerged as an important indicator among all the three groups of indicators, followed by waterborne diseases (I-4) and mental diseases (I-1). The top three indicators received high priority among male, female, youth, elderly and low income sub-groups (Figure 6.10, 6.11 and 6.12). On the other hand, schools discontinued (I-5) was a preferred indicator in place of mental diseases among middle-aged and higher income sub-groups. It may be for the reason that they are more likely to emphasize education of children since they could economically afford to spend for education.

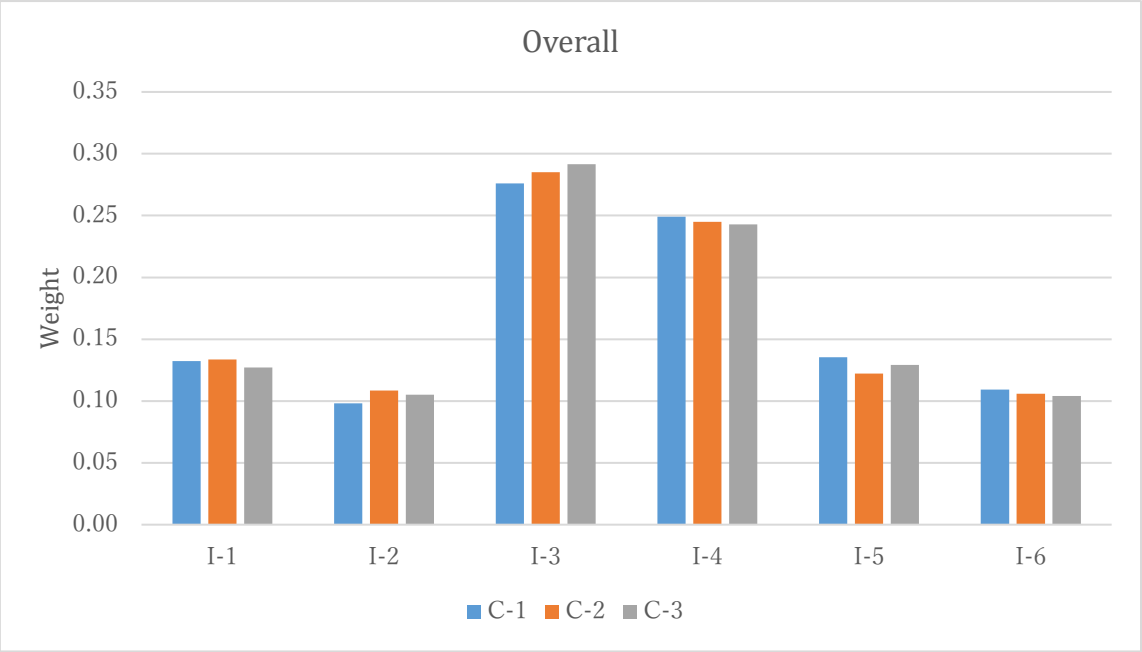

Figure 6.9 Pairwise comparison of indicators (overall)
(I-1: Mental disease; I-2: Malnutrition; I-3: Inaccessible sanitation; I-4: Waterborne diseases; I-5: Schools discontinued; I-6: Children discontinued; CR (C-1) = 0.024; CR (C-2) = 0.012; CR (C-3) = 0.012)

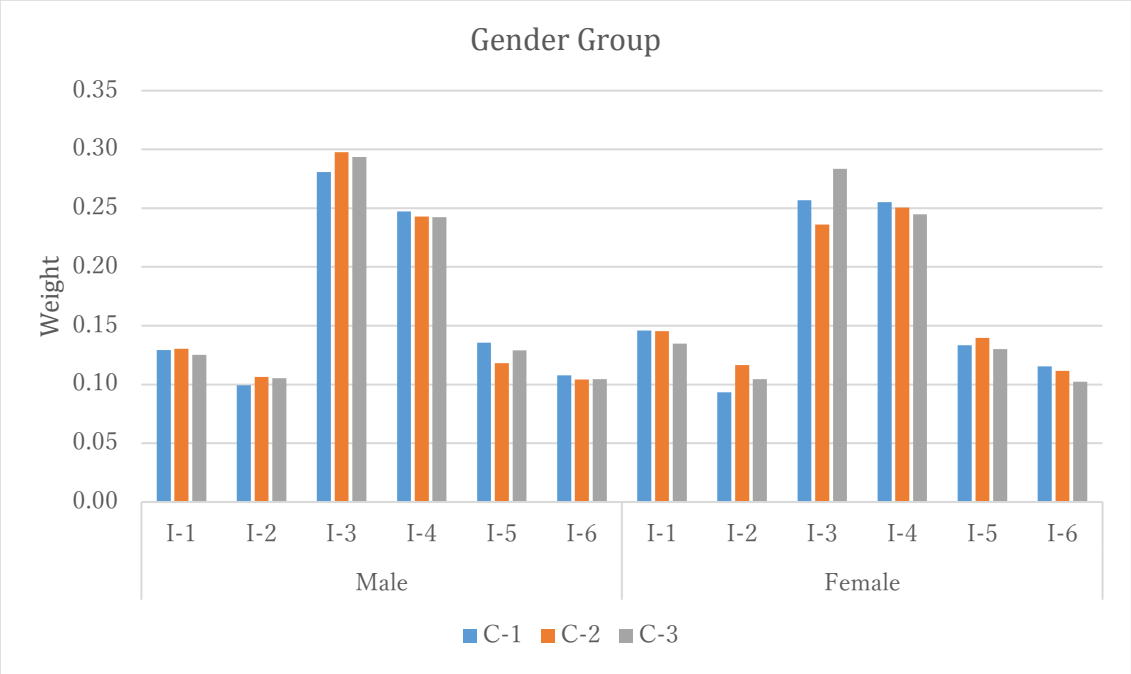

Figure 6.10 Pairwise comparison of indicators on gender group

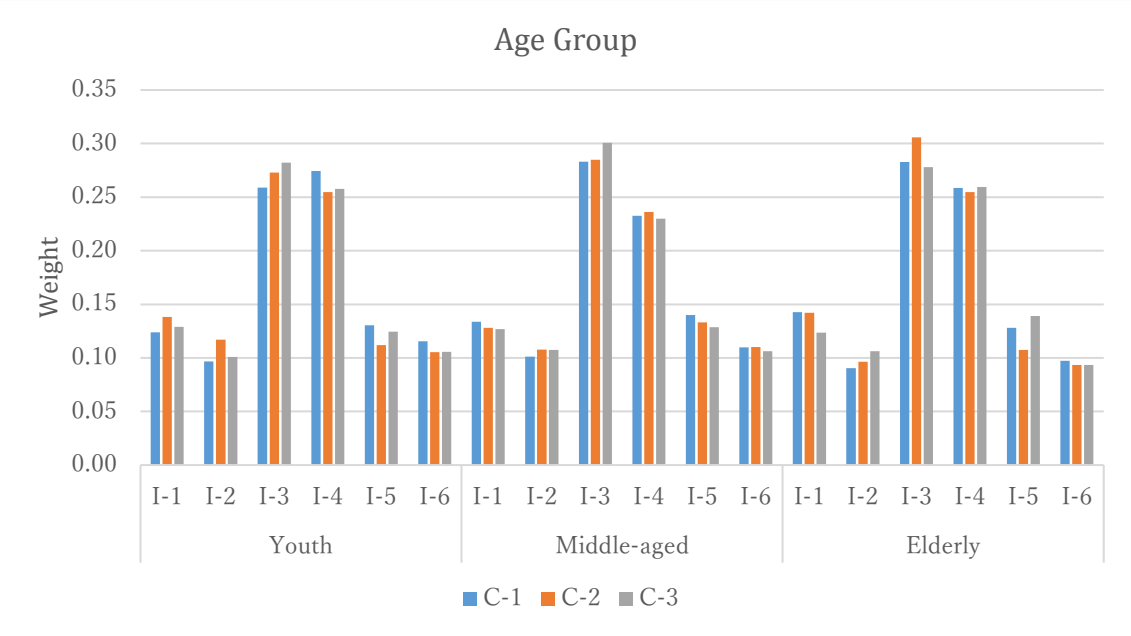

Figure 6.11 Pairwise comparison of indicators on age group

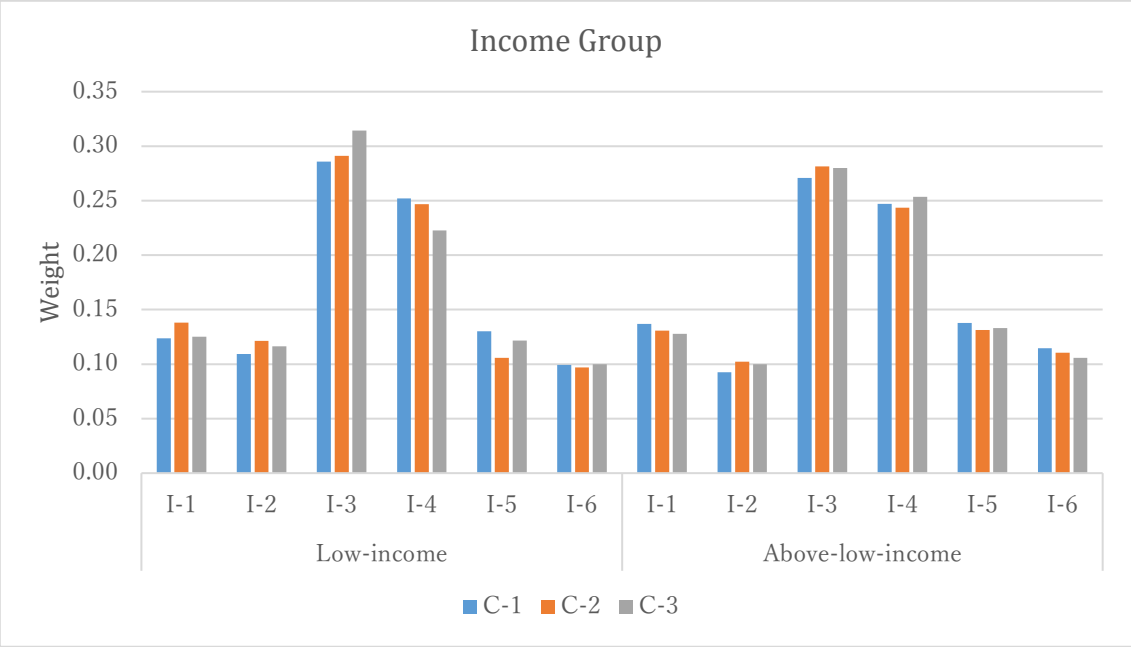

Figure 6.12 Pairwise comparison of indicators on income group

The final goal of this study is to identify better practices that will alleviate the NELDs in the context of the study location. Not all practices will be able to equally contribute to all the indicators identified as key NELDs. Thus, observing the performance across a set of indicators is a way to find effective practices. Overall, the results present a favorable CR for all the indicators for evaluating the effectiveness of practices in question (Figure 6.14). Gender, age and income sub-groups were at an acceptable CR of <0.1.

Disaster preparedness policy and planning (P-1) was found to be the most effective practice, followed by disaster compensation (P-3) and shelter policy (P-2). These results are consistent among all the gender, age and income groups. The DRR policy and planning in particular received high priority among male, youth and higher income groups (Figure 6.15, 6.16 and 6.17). Higher weightage of majority for DRR policy and planning explains the fact that the DRR policy and planning have helped communities to address health, water and sanitation, and education issues better than other practices.

The Figure 6.13 exhibits the overall decision tree for addressing the NELDs in Koyra sub-district. Societal value (C-3) was principal criterion for decision-making. It led to more emphasis on water and sanitation indicators including inaccessible sanitation (I-3) and waterborne diseases (I-4), and a health-related indicator of mental diseases (I-1). It

was in turn determined that the DRR policy and planning (P-1) was the most effective practice to address the NELDs in Koyra.

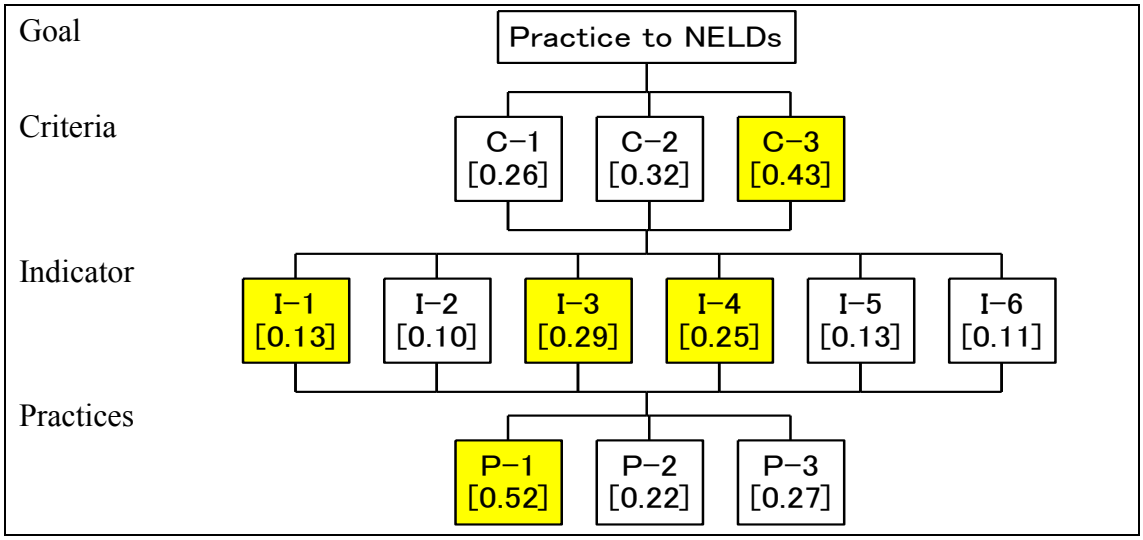

Figure 6.13 Overall weights from the perspective of affected communities

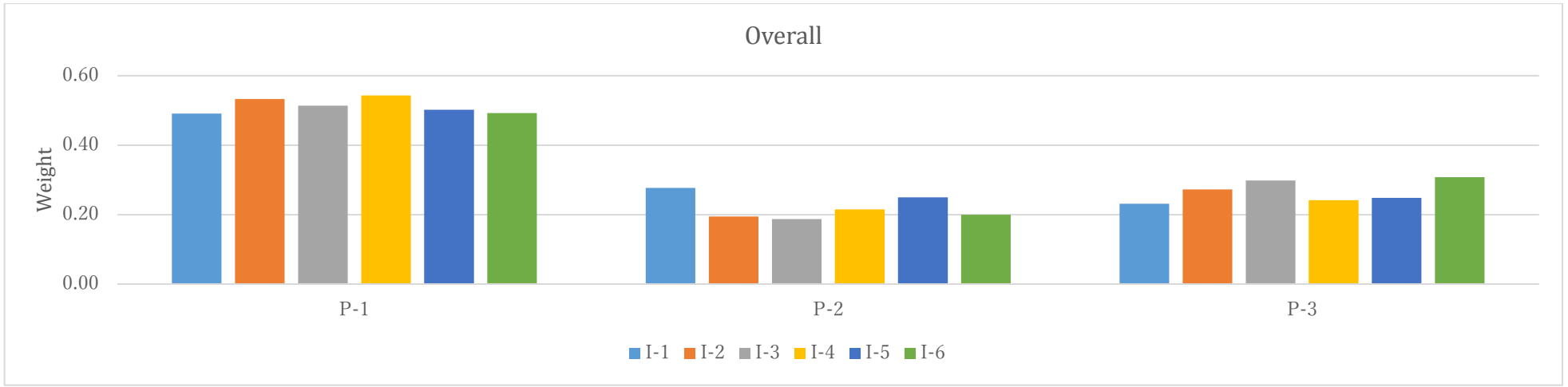

Figure 6.14 Pairwise comparison of practices (overall)

(P-1: Preparedness planning; P-2: Cyclone shelters; P-3: Disaster compensation; CR (I-1) = 0.008; CR (1-2) = 0.016; CR (1-3) = 0.003; CR (1-4) = 0.003; CR (1-5) = 0.001; CR (1-6) = 0.001)

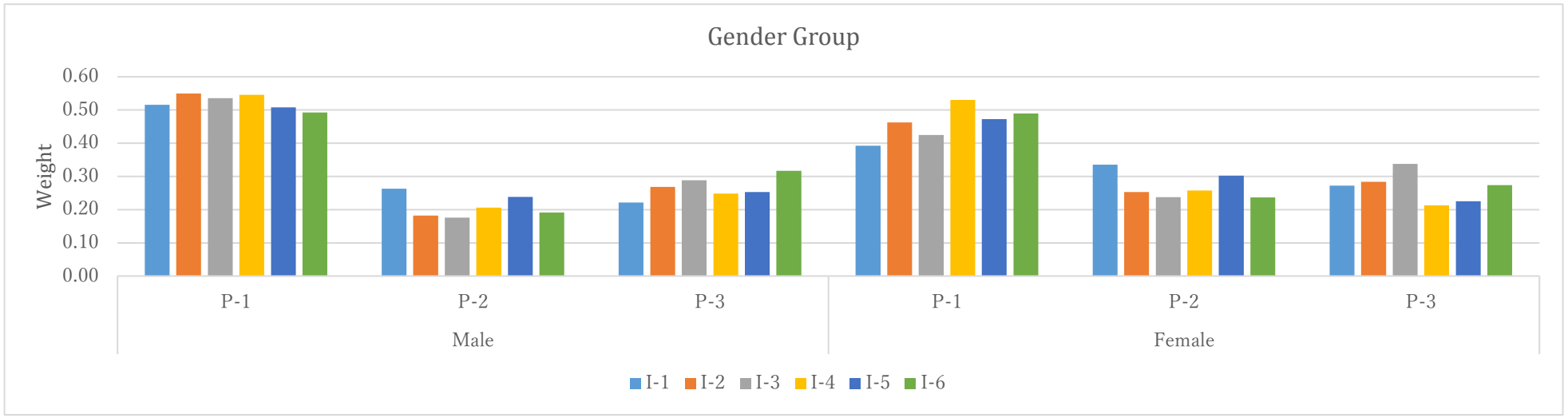

Figure 6.15 Pairwise comparison of practices on gender group

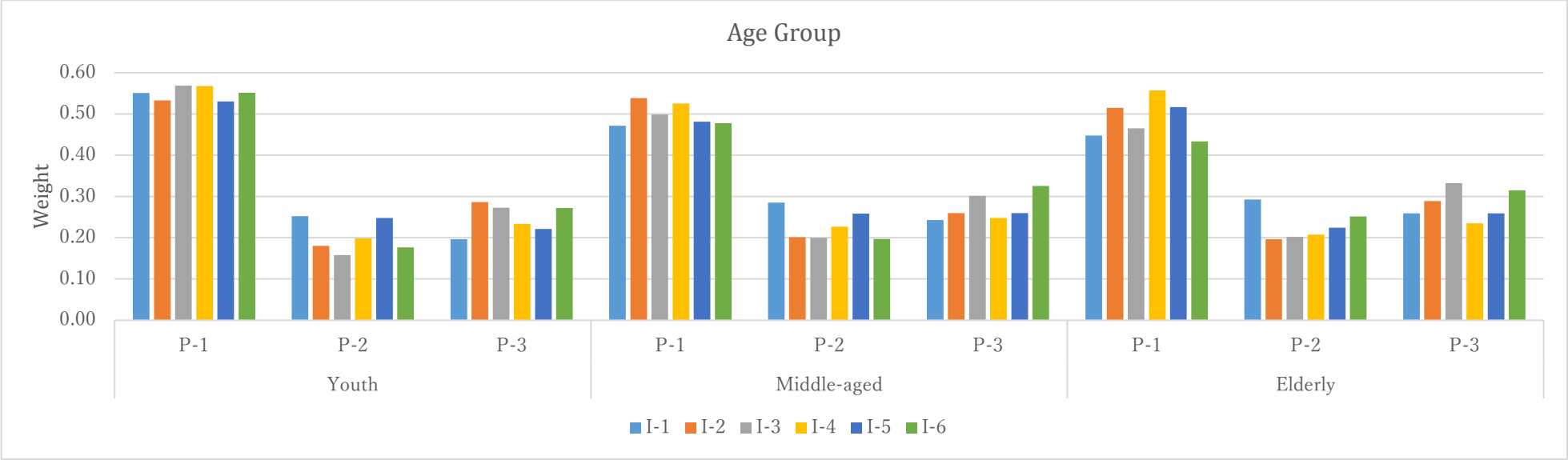

Figure 6.16 Pairwise comparison of practices on age group

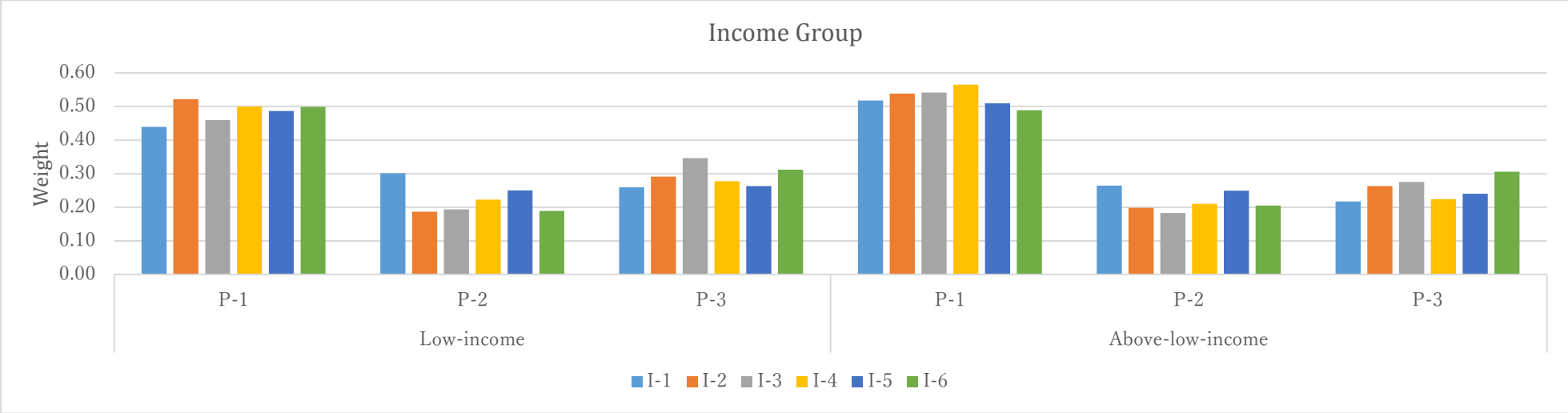

Figure 6.17 Pairwise comparison of practices on income group

6.3.3 The perspective of local government

Figure 6.19 to 6.21 show the results of pairwise comparisons of criteria, indicators under each criterion, and practices under each indicator from the perspective of local government officials at the union level (For the details, see Appendix II.5). The comparison matrix of criteria was consistent with a CR of 0.024. Different from the community responses, the officials preferred relevance to DRR/CCA policy and planning (C-1) as a dominant criterion, followed by societal value (C-3) and societal well-being (C-2).

Waterborne diseases (I-4) as a water and sanitation indicator were ranked the most important indicator to assess the effectiveness of practices, followed by inaccessible sanitation (I-3), and schools discontinued (I-5) as an education indicator. The responses from the officials were similar with that of the community members, except for the schools discontinued.

The community and local government officials were also similar in their opinion on effective practice to address the NELDs. DRR policy and planning (P-1) was found to be the most effective practice, followed by disaster compensation (P-3) and shelter policy (P-2). The Figure 6.18 displays the overall decision tree for local government officials and shows that water and sanitation indicators were more highly important and that DRR policy and planning was the most effective practice to address the NELDs.

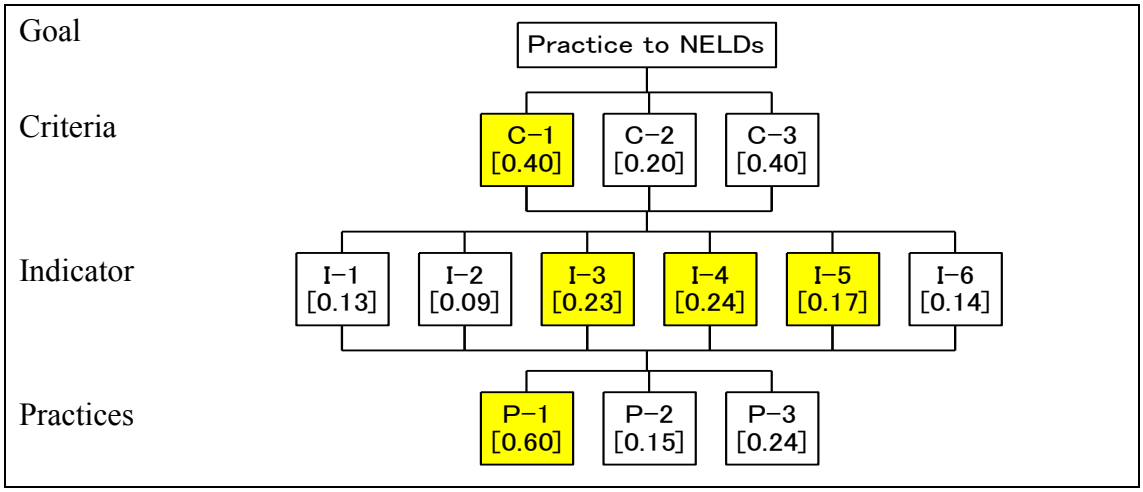

Figure 6.18 Overall weights from the perspective of local government

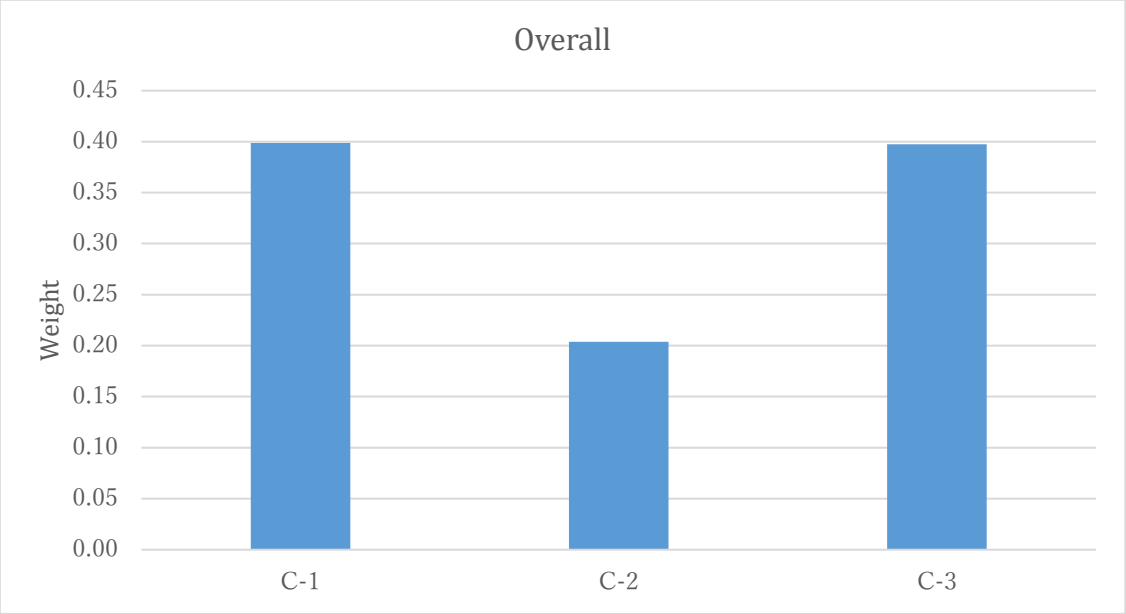

Figure 6.19 Pairwise comparison of criteria (overall)

(C-1: Relevance to DRR/CCA; C-2: Societal well-being; C-3: Societal value; CR = 0.024)

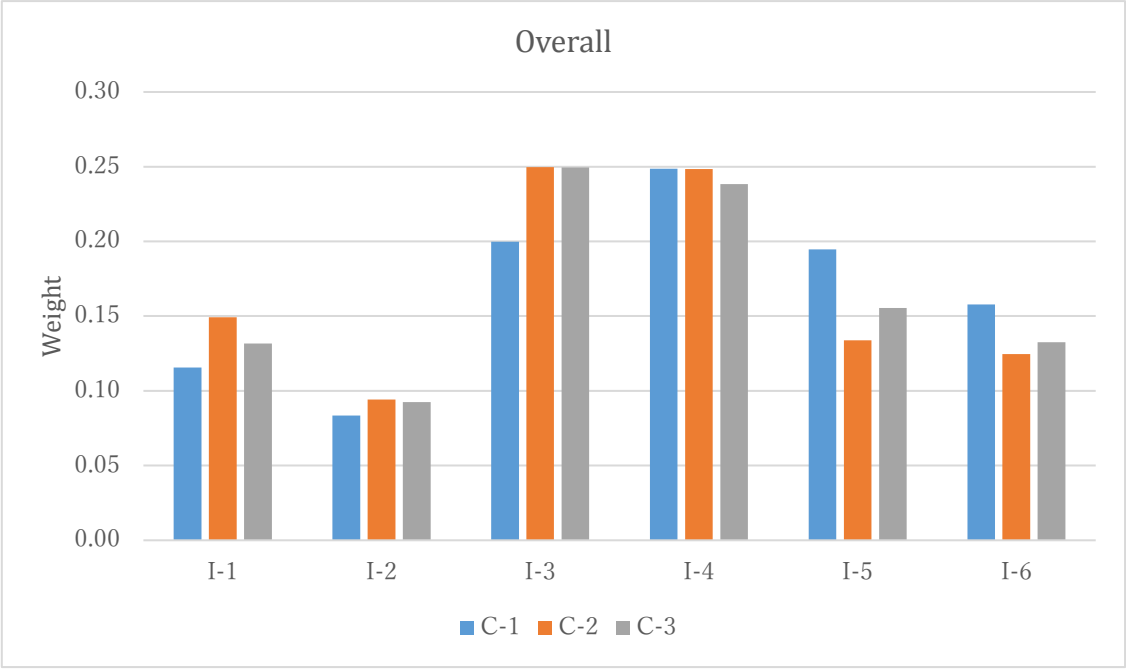

Figure 6.20 Pairwise comparison of indicators (overall)

(I-1: Mental disease; I-2: Malnutrition; I-3: Inaccessible sanitation; I-4: Waterborne diseases; I-5: Schools discontinued; I-6: Children discontinued; CR (C-1) = 0.020; CR (C-2) = 0.033; CR (C-3) = 0.011)

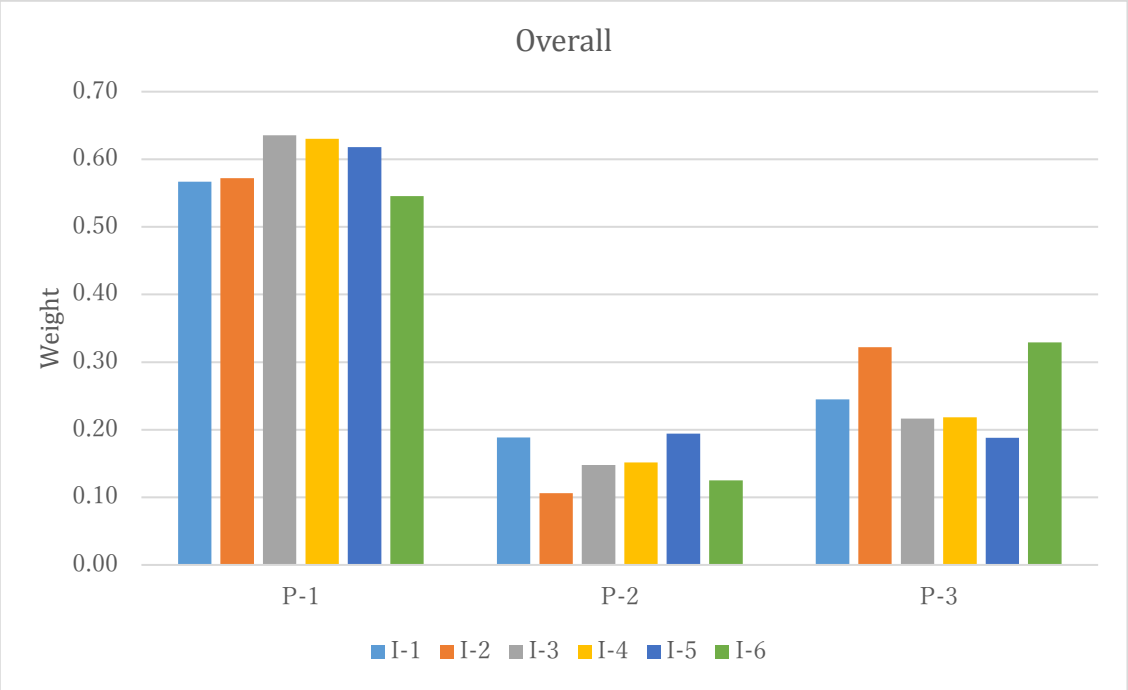

Figure 6.21 Pairwise comparison of practices (overall)
(P-1: Preparedness planning; P-2: Cyclone shelters; P-3: Disaster compensation; CR (I-1) = 0.001; CR (I-2) = 0.002; CR (I-3) = 0.031; CR (I-4) = 0.001; CR (I-5) = 0.002; CR (I-6) = 0.015)

6.3.4 Assessing the current status

Results indicate that both communities and local government officials agree on the importance of addressing issues with inaccessible sanitation (I-3) and waterborne diseases (I-4). Furthermore, communities have identified mental diseases (I-1) as a challenge. Government officials also recognized the importance of addressing schools discontinued (I-5), especially keeping in view the increasing number of middle-aged and higher income sub-groups. It also became clear that practices such as DRR policy and planning (P-1) will help addressing these issues.

This section demonstrates the current status of incorporating these NELD indicators and practices into existing national DRR plan and policy and disaster data collection formats that Koyra's local authorities follow. The discussion proves that mere presence of these practices may not be sufficient and that effective detailed planning and implementation are also essential.

6.3.4.1 Inaccessible sanitation and waterborne diseases

The National Plan for Disaster Management 2010-2015 clearly describes key target efforts of water supply and sanitation while waterborne diseases such as diarrhea were not defined in the plan but may have been considered in emergency response operations that help to reduce illness. The national plan is a comprehensive disaster management plan to address natural and human induced hazards including cyclones and storm surges, and sets down disaster management plans for sub-districts and unions (DMB, 2010). Thus, Koyra sub-district and its union offices are needed to address water and sanitation issues caused by the Cyclone Aila in accordance with the national plan. In addition, the national government is responsible for providing curative and preventive health service to the affected areas soon after the disaster by sending medical teams led by the district civil surgeons and sub-district health administrators (DDM, 2017b).

After the disaster happens, the union councils (Union Parishads), 'the smallest rural administrative unit in Bangladesh' (Cons, 2016), are generally required to collect loss and damage data, led by the Union Parishad Chairman and Upazila Disaster Management Committee. Form-D, a disaster data collection format for assessing L&Ds, is used, and the Upazila Nirbahi Officer (UNO) reports the data to the Emergency Operation Center (EOC) at the Ministry of Food and Disaster Management through the Deputy Commissioner (DC) within 24 hours after a disaster happens (Chapter 3). However, the Form-D has not included the data related to water and sanitation, such as the number of inaccessible sanitation and the number of people suffered waterborne diseases.

The survey results showed the continuous need for enhancing responses to inaccessible sanitation and waterborne diseases. Most of areas in Koyra were inundated under water even after the cyclone. Sanitation facilities such as sewerage system, toilet system and its superstructure and septic tank were completely or partially destroyed due to storm surge, floods and waterlogged conditions caused by the cyclone. As a result, community members had no place to rebuild sanitary latrines as there was dirty water all around them. They also had to live in the shelter or on the road where the sanitation facilities were poor since many of them used the same sanitation facilities. In addition, waterborne diseases, such as diarrhea, skin disease, scabies, itching, dysentery, cholera, typhoid and allergy, were reported, and polluted and stagnant water, extreme saline water, and lack of clean drinking water were found to be causes of waterborne diseases among the affected as the area was inundated under water where human excreta and other domestic waste got mixed.

The above observations support the earlier water and sanitation needs identified in the study. Therefore, it is important for the national government to enhance national disaster management plan that Koyra sub-district and its union offices follow to address inaccessible sanitation caused by disasters (Table 6.5). Increasing the number of temporary sanitary latrines and providing clearer sanitation facilitates at the shelter or at community would be helpful. There is also a need for the national plan to clearly consider waterborne diseases as a key NELD. Provision for safe and clean drinking water including visits to people living in shelters and out of doors is essential to reduce rampancy of waterborne diseases. Moreover, the measurement and reporting frameworks for the number of inaccessible sanitation and the number of people suffered waterborne diseases are imperative to collect adequate information for aid decision-making.

6.3.4.2 Mental diseases and malnutrition

Proper responses to address mental diseases and malnutrition are essential for disaster risk management. The national disaster management plan clearly recognizes the importance of addressing mental diseases and stipulates provision of trauma counseling after the disaster. On the other hand, malnutrition was not specified in the national plan but may have been considered under 'food security' described as a key target issue in the plan. The data related to health issues, such as the number of people suffered mental diseases and malnutrition, has not been included in the Form-D.

The survey results demonstrated the need for enhanced mental healthcare and response to malnutrition. The major causes of significant mental stress were related to failure to meet fundamental needs for livelihood, such as a lack of foods and no place to live, L&Ds of houses, homesteads, properties, livestock and crops, loss of family members and relatives, anxiousness about securing employment and income in the future. As a result, the affected became mentally depressed, tensed and unstable and posed an obstacle to normally performing works and social activities as before the cyclone. Furthermore, it was reported that malnutrition was caused by a lack of pure drinking water and a shortage of balanced diet, such as vegetables and fishes, as well as loss of income. Poor sanitation system compounded inaccessibility to quality water.

Based on these findings, it is necessary for the national government to improve national disaster management plan to address mental diseases caused by the cyclone by increasing mental health experts who can help reducing mental stresses for especially those who are more likely to become mentally vulnerable, such as the disabled, elderly, women and

children (Table 6.5). Provision for long-term and sustainable mental care at shelters and by home visit should be enhanced. The national plan also needs to recognize malnutrition as a major NELD concern. The data about the number of people suffered mental diseases and malnutrition should be collected for measuring NELDs on health.

6.3.4.3 School discontinuation

Communities gave lower priority to addressing the number of schools discontinued and children temporary discontinued school than health, water and sanitation issues. On the other hand, local government officials emphasized the importance of addressing schools discontinued. In fact, the national disaster management plan delineates resumption of educational institutions, such as primary, secondary and Islamic schools (madrasah), as a disaster recovery effort. The Form-D adequately included the number of school discontinued, which can provide useful information for measuring the educational loss of children, but not the number of children temporary discontinued school.

The survey results showed that some schools directly suffered physical damages caused by storm surge, flood and water logging, and other schools were used as cyclone shelters. As a result, some schools were temporarily closed for 6 months after the cyclone. In addition, children were forced to temporarily discontinue school due to damaged road communication to school, migration and financial support for their households as they had to work to earn their livelihood besides parents.

Thus, the national disaster management plan is needed to be strengthened by carefully paying attention to the continuity of education for children when educational institutes were physically damaged or used as shelters and also by providing livelihood supports for children to continue school without concerns about family circumstances (Table 6.5). The data for the number of children discontinued school should be collected for assessing the education loss faced by children.

Table 6.5 Summary of recommendations to address NELDs

NELDs	Recommendations
Inaccessible sanitation and waterborne diseases	▪ Enhance national disaster management plan to address inaccessible sanitation through mobilizing more temporarily sanitary latrines and providing clearer sanitation facilitates.

NELDs	Recommendations
	▪ Recognize waterborne diseases as a key NELD and strengthen the national plan for provision for safe and clean drinking water. ▪ Improve measurement and reporting frameworks for inaccessible sanitation and waterborne diseases to collect proper information for aid decision-making.
Mental diseases and malnutrition	▪ Strengthen the national plan to address mental diseases by sending more mental health experts and by providing long-term and sustainable mental care. ▪ Regard malnutrition as a major NELD concern. ▪ Improve disaster data collection for mental diseases and malnutrition to measure NELDs on health.
School discontinuation	▪ Enhance the national plan to address the continuity of education for children by providing livelihood supports for children to continue school. ▪ Improve disaster data collection for children discontinued school to assess NELDs on educational opportunity for children.

6.4 Conclusions

This study strived to identify and prioritize key NELDs caused by the 2009 Cyclone Aila and practices to address the NELDs for effective DRR and CCA. The study location was Koyra sub-district, Khulna district. The study applied the AHP analysis to prioritize key NELD-related criteria, indicators and practices, which were in order examined through: comprehensive literature review; expert consultation; and FGD in the affected community. Questionnaire surveys were conducted to prioritize the key NELD-related elements, targeting the affected communities and local government officials.

The study identified several similarities and differences between the preferences of the affected communities and local government officials. The affected communities identified societal value as an important criterion, inaccessible sanitation as an important indicator and the DRR policy and planning as an important practice to address NELDs. The results were similar to those of the government officials, except on criterion and

indicator, where relevance to DRR/CCA policy and planning was ranked as the most important criterion instead of societal value, and schools discontinued was prioritized instead of mental diseases.

It was shown that inaccessible sanitation and DRR policy and planning are closely linked, as insufficient post-disaster recovery was found to be causes of inaccessible sanitation. This raises a need to support vulnerable people amongst the affected households by mobilizing more temporarily sanitary latrines and providing clearer sanitation facilitates at the shelter or at community. There is also a need to recognize and address waterborne diseases as a major NELD in the national disaster management plan and strengthen the plan in terms of provision for safe and clean drinking water at shelters and out of doors. In addition, it is important for the national government to improve the national disaster management plan to strengthen the efforts against mental diseases. Mobilizing more mental health experts for those who can become mentally vulnerable, such as the disabled, elderly, women and children, and providing long-term and sustainable mental care at shelters and by home visit should be reinforced. There is a demand to give attention to malnutrition as a major NELD concern. Moreover, it is essential to enhance the national disaster management plan in ways that ensure educational opportunities for children when schools are discontinued and provide livelihood supports for children to continue school without concerns about family circumstances.

Finally, a challenge demonstrates that the Form-D, a disaster data collection format of the Form-D, does not collect information on some important NELD indicators identified by this study, such as the number of local communities affected by inaccessible sanitation, waterborne diseases, mental diseases and malnutrition, and the number of children discontinued school. These indicators should be inserted in the Form-D to ensure L&Ds are sufficiently reported.

This chapter applied same methodology used in the case study of Nachikatsuura town and contributed to identification of key NELDs caused by the Cyclone Aila in the context of remote rural area in Bangladesh.

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CHAPTER 7 CONCLUSION

7.1 Key findings

7.1.1 Key NELDs in Japan and Bangladesh case studies

The Japan case study identified and prioritized key non-economic loss and damages (NELDs) caused by the 2011 Typhoon No.12 that Nachikatsuura town faced in its post-disaster recovery and eventually found the followings chosen as the top three NELD indicators from the perspectives of the affected local communities and the town officials (Table 7.1):

Table 7.1 Summary of key NELDs from the Japan case study

NELD impacts	NELD indicators	Community	Local gov't
Local governance	▪ Less collaboration of local government with local communities	✓	✓
	▪ Less community participation in decision-making	✓	
Health	▪ Mental diseases	✓	✓
	▪ Chronic diseases		✓

Note: Local gov't = Nachikatsuura town officials, ✓ = prioritized

On the other hand, the Bangladesh case study figured out key NELDs caused by the 2009 Cyclone Aila that Koyra uapzila was threatened in its post-disaster recovery and ultimately showed the following NELD indicators as three most important from the perspectives of the affected local communities and the local government officials (Table 7.2):

Table 7.2 Summary of key NELDs from the Bangladesh case study

NELD impacts	NELD indicators	Community	Local gov't
Water and sanitation	▪ Inaccessible sanitation	✓	✓
	▪ Waterborne diseases	✓	✓
Health	▪ Mental diseases	✓	
Education	▪ Schools discontinued		✓

Note: Local gov't = Koyra local government officials, ✓ = prioritized

7.1.2 Similarities and differences in the case studies

The findings from Japan and Bangladesh case studies indicate that both of them emphasized the importance of addressing mental diseases. On the other hand, key features in each country context show that Japan's local communities highlighted the need for addressing local governance issues for post-disaster recovery, such as less collaboration of local government with local communities and less community participation in decision-making. In contrast, Bangladesh's local communities raised the demand for addressing water and sanitation issues, such as inaccessible sanitation and waterborne diseases.

7.2 Recommendations

Based on the above, here are several recommendations to local and national governments for addressing NELD-related issues identified in Japan and Bangladesh case studies.

For Japan:

- Municipal governments that would suffer NELDs from typhoons as Nachikatsuura town did should strengthen their shelter policy and disaster management plan to enhance collaboration with local communities, particularly for proper management of evacuation centers, and communication channels to obtain community opinions and for consensus-building.
- They also should improve their shelter policy and disaster management plan to support households and their officials who suffered mental diseases in the aftermath of the disaster and to address chronic diseases in terms of medical preparedness at evacuation centers.

- Relevant prefectural and central governments should make provisions for supporting affected municipal governments to avoid manpower shortages for post-disaster recovery and invest in strengthening their human resources and technical capacity to effectively prepare for, cope with and recover from disasters.

For Bangladesh:

- The central governments should enhance their national disaster management plan for local governments, such as sub-districts and their unions which would suffer NELDs from cyclones as Koyra sub-district did, to address inaccessible sanitation and waterborne diseases with respect to provision for safer and cleaner sanitation facilities and drinking water.
- They should also strengthen their disaster management plan for providing enhanced mental health services care against mental diseases caused by cyclones and for ensuring educational opportunities for children when schools are discontinued or they cannot continue school due to their family circumstances.

For both Japan and Bangladesh:

- Disaster data collection formats should capture important NELD indicators to ensure that loss and damages are fully reported and to incorporate NELDs in decision-making process for post-disaster recovery.

7.3 Further research scope

This study identified and prioritized key NELDs in the context of the study location and identified important practices that could address these impacts. As a further research scope, it is important to develop an assessment framework to quantify key NELD indicators in terms of monetary values and to figure out the total loss and damages, including both economic and non-economic aspects.

APPENDIX

Appendix I: Japan

1. Discussion sheet for community consultation

質問１．被害の種類（何が失われたか？）
2011 年台風 12 号被害について、**「再び同じ生活を取り戻そうとした場合に重要にもかかわらず、対策が不十分な分野」**を以下の選択肢から３つ選び、最も重要なものを「１」、２番目に重要なものを「２」、３番目に重要なものを「３」として記入して下さい。
なお、初動期は「直後～数日」、応急対応期は「数日～数カ月」、復旧・復興期は「数カ月～」を指します。

	対策が不十分である分野	順位			
		初動期	応急対応期	復旧・復興期	総合
1	人命				
2	健康（肉体・精神面）				
3	安全な水利用・公衆衛生面				
4	教育の機会				
5	行動の自由（強制退去・転居）				
6	地域への愛着				
7	地域・社会のまとまり（社会性）				
8	文化、文化財・伝統的知恵の存在価値				
9	自治体の機能（ガバナンス）				
10	生物多様性・生態系サービス				

質問２．対策を考えるときの基準（何を基準に対策を考えるべきか？）
2011 年台風 12 号被害への対策を考えるときの判断基準として何を重要視してほしいか、重要なものを以下の選択肢から３つ選び、最も重要なものを「1」、２番目に重要なものを「２」、３番目に重要なものを「３」として記入して下さい。

	対策を考えるときの基準	順位
1	社会全体から見て重要か（社会的価値）	
2	社会の幸せになるか	
3	費用対効果	
4	防災対策として妥当か	
5	対策の効果が明確にわかるか	
6	その対策に精通しているか	
7	対策が重複してないか	
8	被害を減らすために適切か	
9	対策をとるための情報や資料があるか	

	対策を考えるときの基準	順位
10	一部の人のみを対象としてないか	

質問３．被害の原因（どういった原因で失われたのか？）
質問１で選択した３つの項目に着目し、その原因として最も関連するものを以下の選択肢から３つ選び、最も関連するものを「１」、２番目に関連するものを「２」、３番目に関連するものを「３」として記入して下さい。
※追加質問：その他の主要原因はあるか？何番目になるか？

1. 人命への被害

	原因	順位
1	災害直接死	
2	災害関連死	

2. 健康（肉体的・精神的）への被害

	原因	順位
1	怪我	
2	感染症・伝染病（風邪、腸炎など）	
3	慢性疾患（糖尿病、高血圧症など）の悪化	
4	精神的ストレスや疾患（心の病）	
5	身体の障害	
6	生殖機能の障害	

3. 安全な水利用・公衆衛生面への被害

	原因	順位
1	トイレ等が利用できない	
2	安全な飲料水が利用できない	
3	水系感染症（下痢など）	

4. 教育の機会への被害

	原因	順位
1	校則に縛られなくなる	
2	学校閉鎖した学校が多い	
3	中退が多い	
4	一時休学が多い	
5	卒業者が少ない	
6	不登校が多い	
7	学校閉鎖の期間が長い	

5. 行動の自由への被害

	原因	順位
1	強制退去者が多い	
2	強制退去の期間が長い	
3	転居者が多い	

	原因	順位
4	女性の世帯主が多い	
5	ひとけが少ない	
6	集団移転	

6. 地域への愛着への被害

	原因	順位
1	地域への愛着・親しみがなくなる	
2	地域に依存しなくなる	

7. 地域・社会のまとまり（社会性）への被害

	原因	順位
1	地域行事・お祭り等への参加が減る	
2	自治会長への反発が増える	
3	住民間の対立が増える	
4	地域で合意がなかなか得られない	
5	地域で組合等の数が減る	
6	地域行事の場が減る	
7	犯罪が増える	
8	転職者が増える	
9	地域格差	
10	家庭の崩壊	

8. 文化、文化財及び伝統的知恵の存在価値への被害

	原因	順位
1	文化財への愛着・親しみがなくなる	
2	文化財に依存しなくなる	
3	文化財の損傷	
4	伝統的知恵があまり使われなくなる	
5	伝統的知恵をもった住民が減る	
6	伝統行事（お寺行事等）が減る	

9. 自治体の機能（ガバナンス）への被害

	原因	順位
1	部署間の連携体制がみられない	
2	組織内での対立・意見の不一致が増える	
3	地域や住民との連携体制がみられない	
4	業務の内容や結果等、住民への適切な説明がない	
5	業務の状況がみえにくい	
6	政策決定に地域があまり関与していない	
7	被災地域に支援が行き届いていない	
8	行政サービスが止まる	

10.生物多様性・生態系サービスへの被害

	原因	順位
1	動物や植物の数が減る	
2	動物や植物の種類が減る	
3	緑地の面積が減る	
4	水質が悪化する	
5	絶滅の恐れのある動物や植物の数が減る	
6	災害により動物や植物が破壊されたあと、新たな生命が宿る生息場所が誕生するような機会（生物の撹乱）がない	

質問４．被害への対策（強化すべき対策はどれか？）

2011 年台風 12 号被害を解決するために､強化すべき対策を以下の選択肢から３つ選び、最も強化すべきものを「１」、２番目に強化すべきものを「２」、３番目に強化すべきものを「３」として記入して下さい。

※追加質問：その他の対策はあるか？何番目になるか？

	被害への対策	順位
1	災害保険	
2	災害補償	
3	防災対策・計画	
4	避難所対策	
5	土地利用対策	

2. Questionnaire survey sheets for households

2011 年台風 12 号被害についての世帯調査

アンケート調査票

質問 1.　2011 年の台風１２号であなたが受けられた被害についてお聞かせください。

以下の質問は、台風が去った直後ではなく、3 か月ほど経った 12 月初旬ごろのことを思い出してお答えください。

(1) 台風 12 号によってあなた自身は、どんな被害を受けましたか？　以下の金銭的な被害の中で、あなたが受けた被害全てに○印をつけてください。

1. 家屋　2. 所有物（車など）　3. 土地　4. 農林水産物
5. 事業収入　6. 給与　7. その他（　　）　8. 被害はない

(2) その被害額を全て合わせると総額いくらぐらいになりますか？　おおよそで結構ですので、1 つに○印をつけてください。

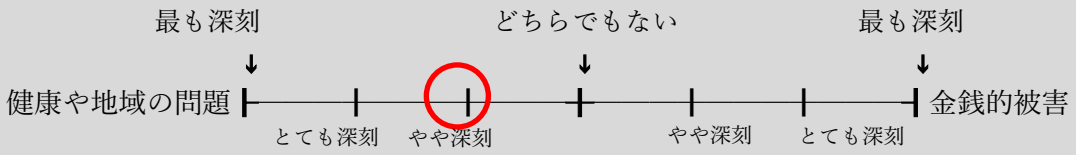
1. 200 万円未満　2. 200～400 万円　3. 400～600 万円　4. 600～800 万円
5. 800～1,000 万円　6. 1,000 万以上　7. 被害はない

(3) 台風 12 号によって、金銭的被害以外にあなたの健康や地域について問題を感じましたか？　あなたが感じた問題全てに○印をつけてください。

1. あなた又は家族の健康を害した　2. 小中学校などが休校になった
3. 町役場等の自治体が機能しない等の理由で、自治体と地域間の連携がみられなかった　4. 特にない

(4) こうした健康や地域の問題は、(1) でお答えいただいた金銭的被害と比べてどのくらい深刻でしたか？　以下の例にしたがって、深刻さの程度に○印をつけてください。

記入例：健康や地域の問題が金銭的被害よりも「やや深刻」な場合



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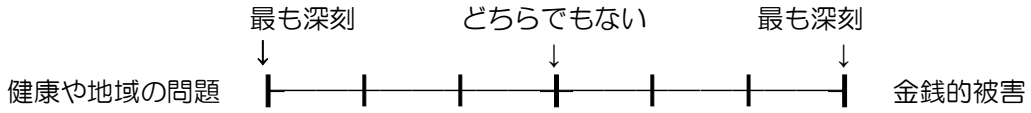


(5) こうした健康や地域の問題には、どのような対策が役立つと思われますか？（あてはまるもの全てに○）

1. 災害保険　2. 災害補償　3. 防災対策・防災計画
4. 避難所対策　5. 土地利用対策　6. その他（　　）

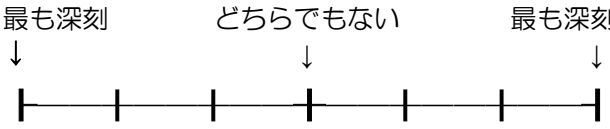
(6) 台風 12 号が起こる前から、あなたが個人または地域活動として行っていた対策はありますか？（あてはまるもの全てに○）

1. 災害保険　2. 災害補償　3. 防災対策・防災計画
4. 避難所対策　5. 土地利用対策　6. その他（　　）

（7）台風 12 号が起こってから、あなたが個人または地域活動として行うようになった対策はありますか？（あてはまるもの全てに○）

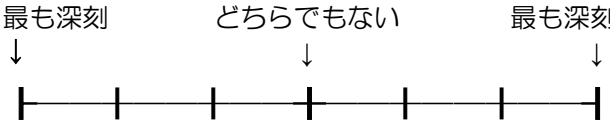
1. 災害保険　2. 災害補償　3. 防災対策・防災計画
4. 避難所対策　5. 土地利用対策　6. その他（　　）

（8）台風 12 号の被害として、以下のこと（イ～ホ）は、あなたの周りの方をみてどの程度深刻でしたか？台風 12 号であなたの周りの方が感じていた**「精神的な苦痛（ストレスや心の病）」**と比べてお答えください。（深刻さの程度に○）



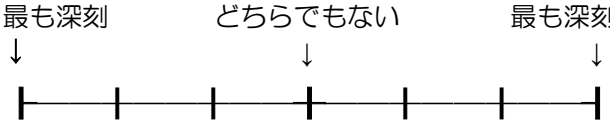
（イ）慢性疾患（糖尿病、高血圧症などの持病）の悪化 ― 精神的な苦痛（ストレスや心の病）
（ロ）（小中学校など）休校期間が長かったこと ― 精神的な苦痛（ストレスや心の病）
（ハ）（小中学校など）休校した学校数が多かったこと ― 精神的な苦痛（ストレスや心の病）
（ニ）町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと ― 精神的な苦痛（ストレスや心の病）
（ホ）政策決定において地域の関与ができなかったこと ― 精神的な苦痛（ストレスや心の病）

（9）同じく、**「慢性疾患（糖尿病、高血圧症などの持病）の悪化」**と比べてどうでしたか？



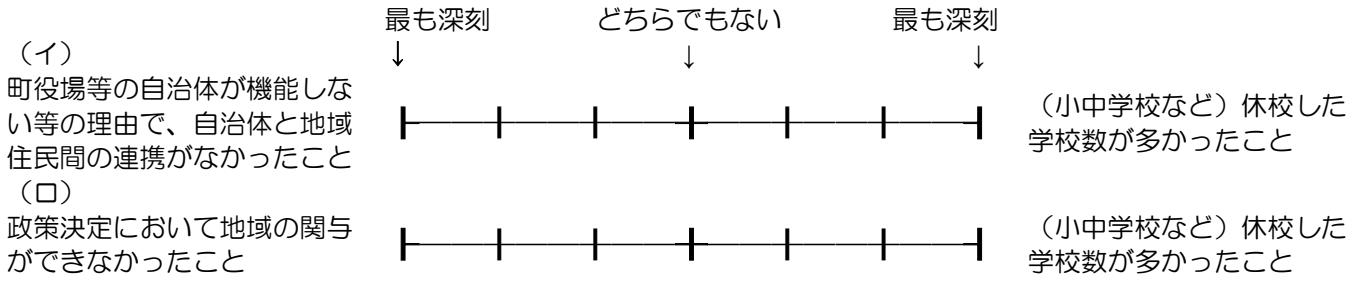
（イ）（小中学校など）休校期間が長かったこと ― 慢性疾患の悪化
（ロ）（小中学校など）休校した学校数が多かったこと ― 慢性疾患の悪化
（ハ）町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと ― 慢性疾患の悪化
（ニ）政策決定において地域の関与ができなかったこと ― 慢性疾患の悪化

（10）同じく、**「（小中学校など）休校期間が長かったこと」**と比べてどうでしたか？

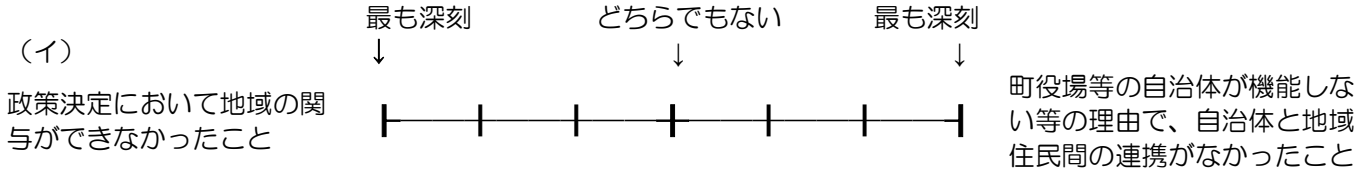


（イ）（小中学校など）休校した学校数が多かったこと ― （小中学校など）休校期間が長かったこと
（ロ）町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと ― （小中学校など）休校期間が長かったこと
（ハ）政策決定において地域の関与ができなかったこと ― （小中学校など）休校期間が長かったこと

（11）同じく、**「（小中学校など）休校した学校数が多かったこと」**と比べてどうでしたか？



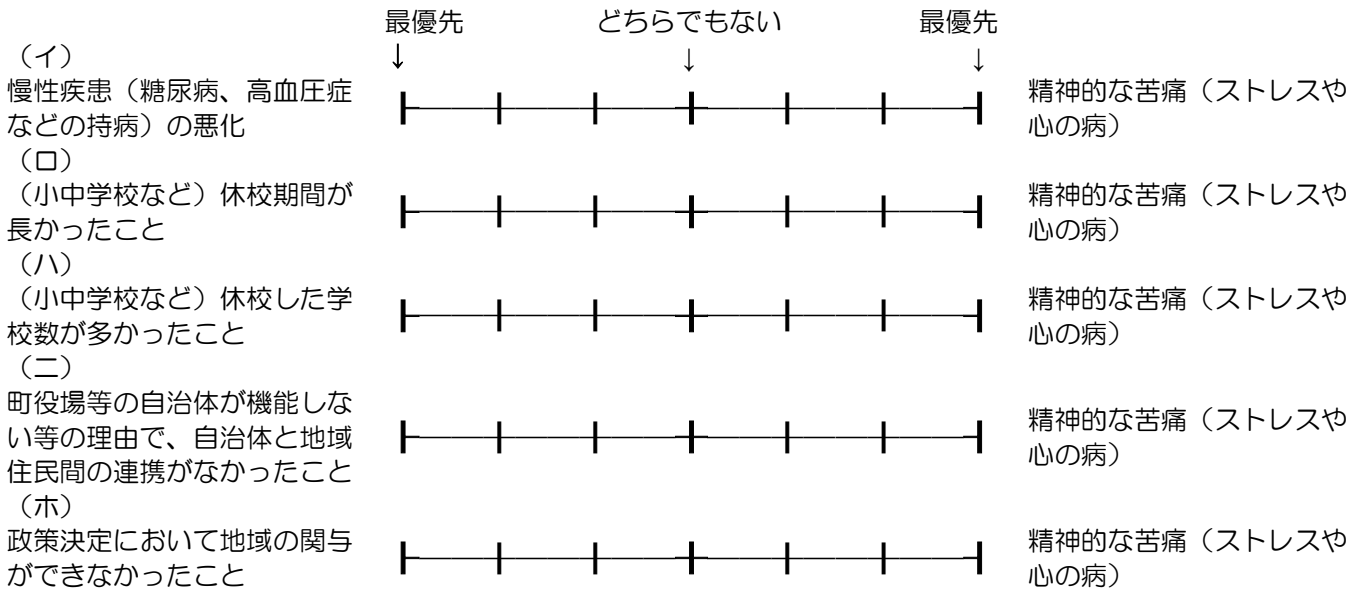
（12）同じく、**「町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと」**と比べてどうでしたか？



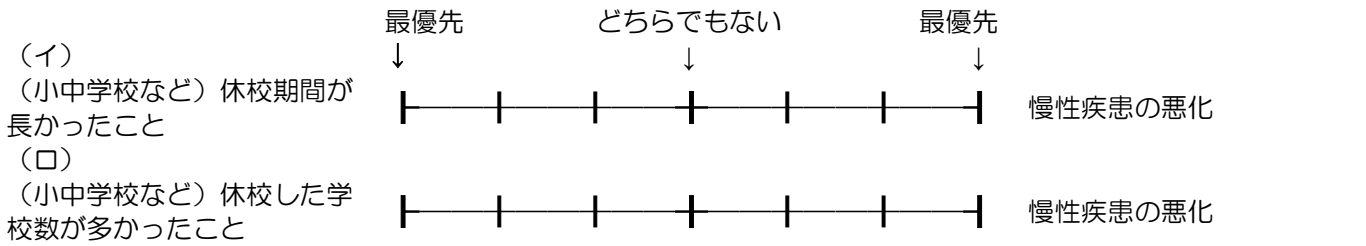
質問 2.　次の台風に備えた防災対策のなかで、優先して行政が取り組むべきことは何だと思われましたか？

台風 12 号が去ってから 3 か月後の 12 月初旬ごろを思い出してお答えください。

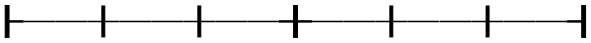
（1）次の台風に備えた防災対策のなかで、以下のこと（イ～ホ）は、行政がどの程度優先して取り組むべきだと思いましたか？台風 12 号であなたが感じていた**「精神的な苦痛（ストレスや心の病）」**と比べてお答えください。（優先度の程度に○）



（2）同じく、**「慢性疾患（糖尿病、高血圧症などの持病）の悪化」**と比べてどうでしたか？

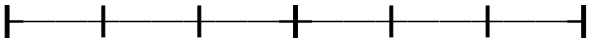


（ハ）
町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと



慢性疾患の悪化

（ニ）
政策決定において地域の関与ができなかったこと

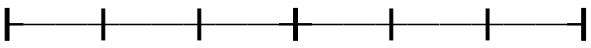


慢性疾患の悪化

（3）同じく、**「（小中学校など）休校期間が長かったこと」**と比べてどうでしたか？

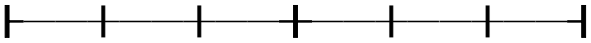
最優先　どちらでもない　最優先

（イ）
（小中学校など）休校した学校数が多かったこと



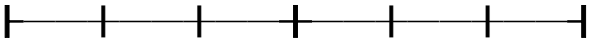
（小中学校など）休校期間が長かったこと

（ロ）
町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと



（小中学校など）休校期間が長かったこと

（ハ）
政策決定において地域の関与ができなかったこと

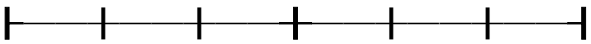


（小中学校など）休校期間が長かったこと

（4）同じく、**「（小中学校など）休校した学校数が多かったこと」**と比べてどうでしたか？

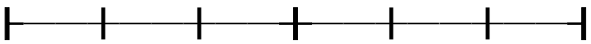
最優先　どちらでもない　最優先

（イ）
町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと



（小中学校など）休校した学校数が多かったこと

（ロ）
政策決定において地域の関与ができなかったこと

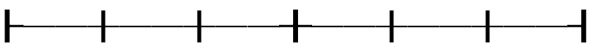


（小中学校など）休校した学校数が多かったこと

（5）同じく、**「町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと」**と比べてどうでしたか？

最優先　どちらでもない　最優先

（イ）
政策決定において地域の関与ができなかったこと



町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと

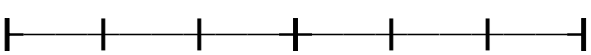
質問 3.　台風１２号からの復興・生活再建に向けて、優先して社会全体が取り組むべきことについてお聞かせください。

台風 12 号が去ってから 3 か月後の 12 月初旬ごろを思い出してお答えください。

（1）台風 12 号からの復興・生活再建に向けて、以下のこと（イ～ホ）は、社会全体がどの程度優先して取り組むべきだと思いましたか？台風 12 号であなたが感じていた**「精神的な苦痛（ストレスや心の病）」**と比べてお答えください。（優先度の程度に○）

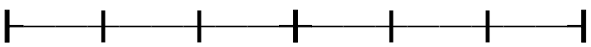
最優先　どちらでもない　最優先

（イ）
慢性疾患（糖尿病、高血圧症などの持病）の悪化



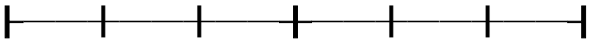
精神的な苦痛（ストレスや心の病）

（ロ）
（小中学校など）休校期間が長かったこと



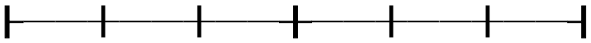
精神的な苦痛（ストレスや心の病）

（ハ）
（小中学校など）休校した学校数が多かったこと



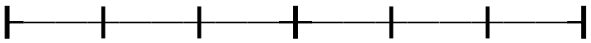
精神的な苦痛（ストレスや心の病）

（ニ）
町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと



精神的な苦痛（ストレスや心の病）

（ホ）
政策決定において地域の関与ができなかったこと

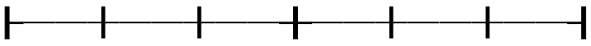


精神的な苦痛（ストレスや心の病）

（2）同じく、**「慢性疾患（糖尿病、高血圧症などの持病）の悪化」**と比べてどうでしたか？

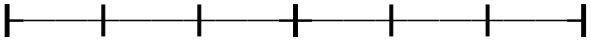
最優先　どちらでもない　最優先

（イ）
（小中学校など）休校期間が長かったこと



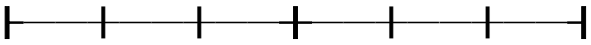
慢性疾患の悪化

（ロ）
（小中学校など）休校した学校数が多かったこと



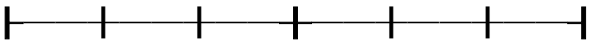
慢性疾患の悪化

（ハ）
町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと



慢性疾患の悪化

（ニ）
政策決定において地域の関与ができなかったこと

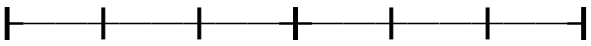


慢性疾患の悪化

（3）同じく、**「（小中学校など）休校期間が長かったこと」**と比べてどうでしたか？

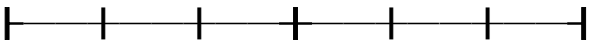
最優先　どちらでもない　最優先

（イ）
（小中学校など）休校した学校数が多かったこと



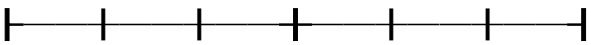
（小中学校など）休校期間が長かったこと

（ロ）
町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと



（小中学校など）休校期間が長かったこと

（ハ）
政策決定において地域の関与ができなかったこと

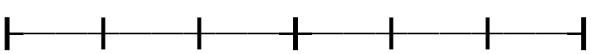


（小中学校など）休校期間が長かったこと

（4）同じく、**「（小中学校など）休校した学校数が多かったこと」**と比べてどうでしたか？

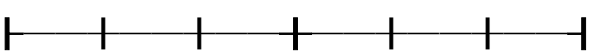
最優先　どちらでもない　最優先

（イ）
町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと



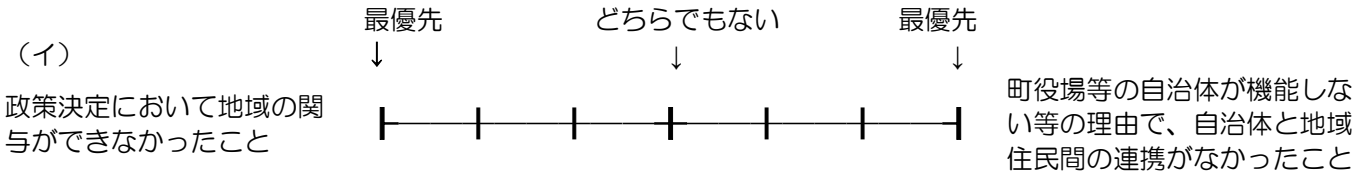
（小中学校など）休校した学校数が多かったこと

（ロ）
政策決定において地域の関与ができなかったこと



（小中学校など）休校した学校数が多かったこと

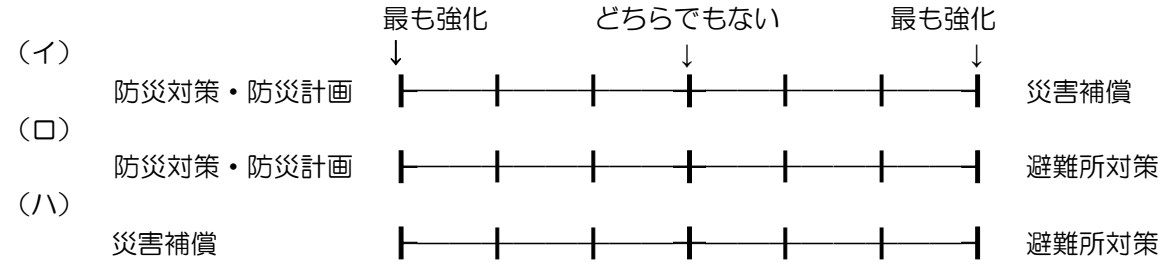
(5) 同じく、**「町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと」**と比べてどうでしたか？



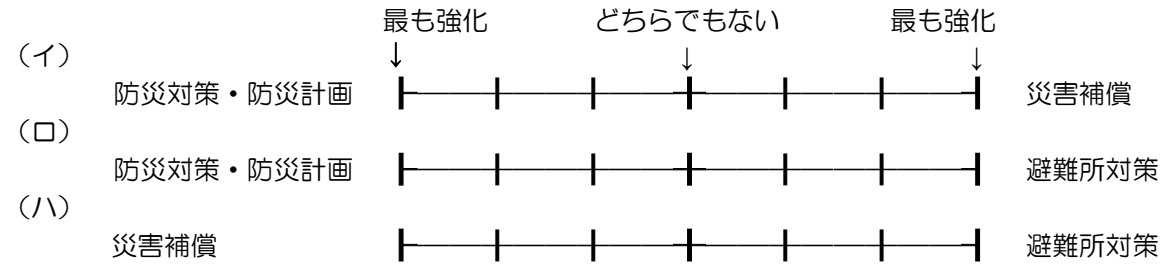
質問 4.　台風１２号被害からの復興・生活再建に向けて、行政が強化すべき対策は何だと思われましたか？

台風 12 号が去ってから 3 か月後の 12 月初旬ごろを思い出してお答えください。

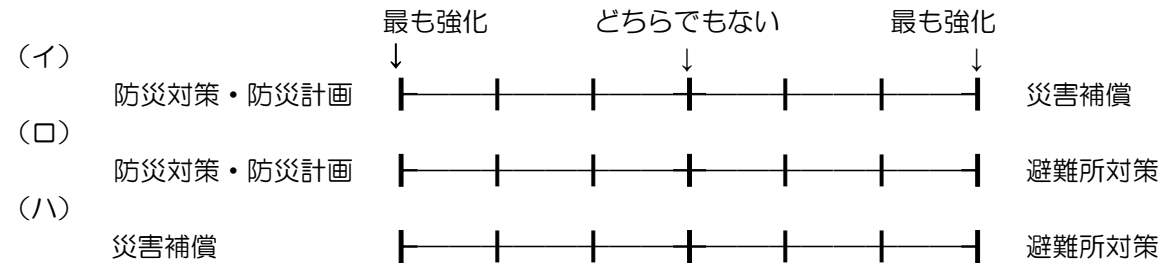
(1) 台風 12 号であなたが感じていた**「精神的な苦痛（ストレスや心の病）」**に対処するために、以下の対策は、どちらを、どのくらい強化すべきだと思いましたか？（強化の程度に○）



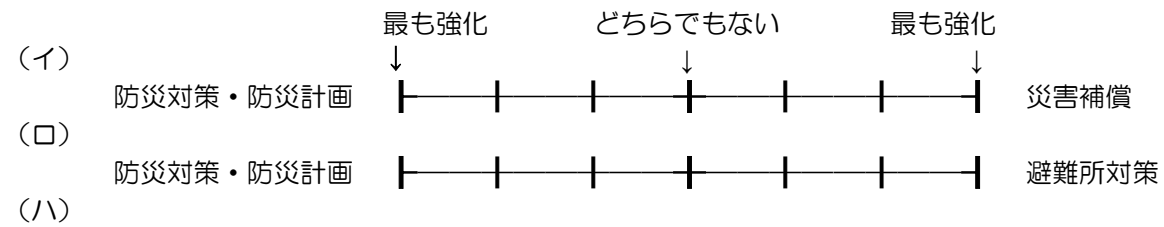
(2) 同じく、**「慢性疾患（糖尿病、高血圧症などの持病）の悪化」**に対処するためには、どうでしたか？



(3) 同じく、**「（小中学校など）休校期間が長かったこと」**に対処するためには、どうでしたか？

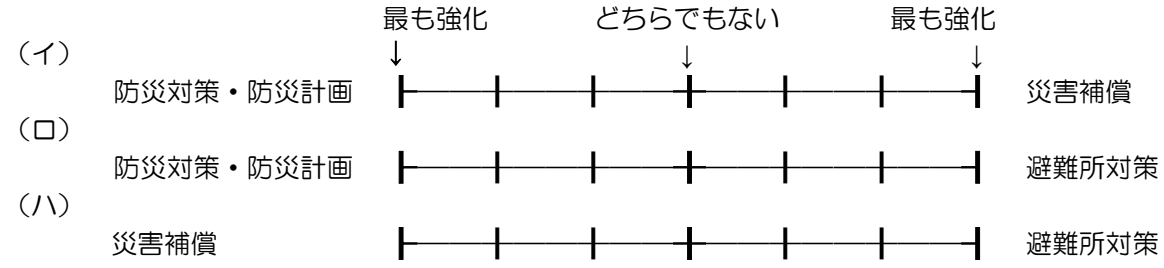


(4) 同じく、**「（小中学校など）休校した学校数が多かったこと」**に対処するためには、どうでしたか？

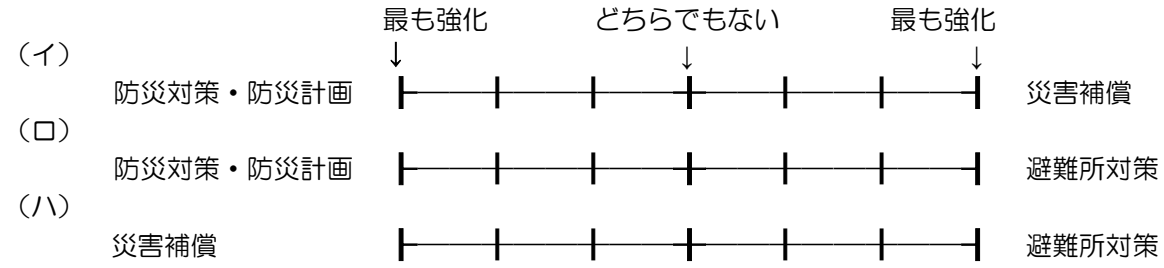


災害補償 ├──┼──┼──┼──┼──┼──┤ 避難所対策

(5) 同じく、**「町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと」**に対処するためには、どうでしたか？

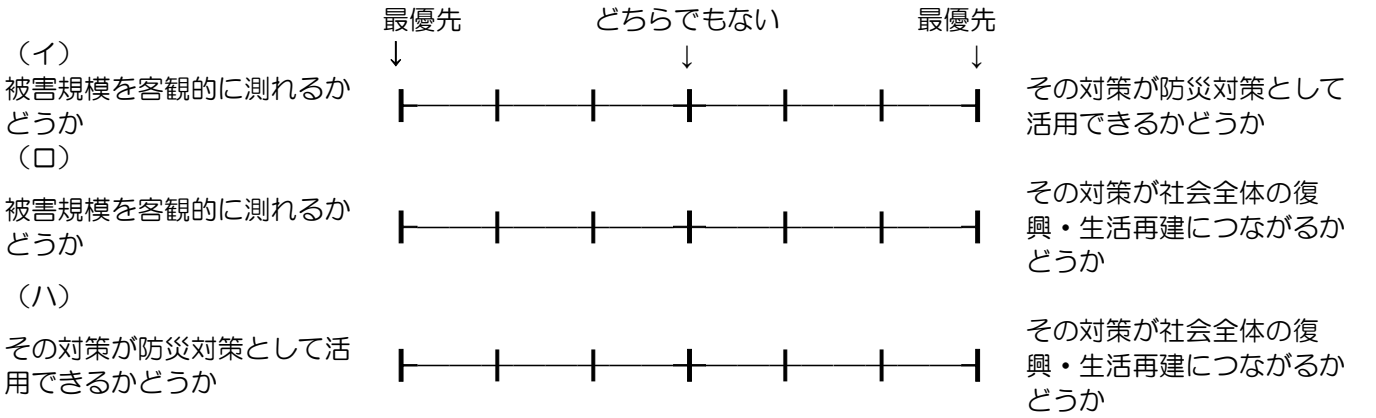


(6) 同じく、**「政策決定において地域の関与ができなかったこと」**に対処するためには、どうでしたか？



質問 5.　台風被害の対策を決める際に、行政が優先すべき決定基準についてお聞かせください。

(1) 台風被害の対策を決める際に、以下の決定基準は、どちらを、どのくらい優先すべきだと思いますか？（優先度の程度に○）



質問 6.　台風 12 号であなたが受けられた被害の状況についてお聞かせください。

台風 12 号が去ってから 3 か月後の 12 月初旬ごろを思い出してお答えください。

(1) 台風 12 号によって、あなた自身またはご家族は、以下の被害を受けましたか？（1 つに○印、該当箇所におおよその数をご記入ください。）

（イ） 精神的な苦痛（ストレスや心の病）

1. かなり受けた　2. ある程度受けた　3. どちらとも言えない　4. あまり受けなかった　5. 全く受けなかった

通院した日数（　　）日　　欠勤した日数（　　）日

（ロ） 慢性疾患（糖尿病、高血圧症などの持病）の悪化

1. かなり受けた　2. ある程度受けた　3. どちらとも言えない　4. あまり受けなかった　5. 全く受けなかった
通院した日数（　　）日　　欠勤した日数（　　）日

(2) 台風 12 号によって、あなたのご家族が通う小中学校などの学校は休校しましたか？（1 つに○、該当箇所におおよその数を記入）

（イ） 休校した期間

1. かなり長かった　2. 長かった　3. どちらとも言えない　4. 短かった　5. 休校しなかった
休校した期間（　　）日

（ロ） あなたの周りの休校した学校数

1. かなり多かった　2. 多かった　3. どちらとも言えない　4. 少なかった　5. 全くなかった
休校した学校数（　　）

(3) 台風 12 号によって、あなた自身またはご家族は、以下のことは多いと思いましたか？（1 つに○、該当箇所におおよその数を記入）

（イ） 町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携ができなかったこと

1. かなり多かった　2. 多かった　3. どちらとも言えない　4. 少なかった　5. 全くなかった

（ロ） 政策決定において地域が関与できなかったこと

1. かなり多かった　2. 多かった　3. どちらとも言えない　4. 少なかった　5. 全くなかった

（ハ） あなたの周りで町内の他の地区に転出（引越し）された方

1. かなり多かった　2. 多かった　3. どちらとも言えない　4. 少なかった　5. 全くなかった
世帯数（　　）件

（ニ） あなたの周りで町外に転出（引越し）された方

1. かなり多かった　2. 多かった　3. どちらとも言えない　4. 少なかった　5. 全くなかった
世帯数（　　）件

以下の台風１２号被害の原因・理由についてご意見等あれば、ご自由にお書きください。

「精神的な苦痛（ストレスや心の病）」について
（　　）

「慢性疾患（糖尿病、高血圧症などの持病）の悪化」について
（　　）

「（小中学校など）休校期間が長かったこと」について
（　　）

「（小中学校など）休校した学校数が多かったこと」について
（　　）

「町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと」について
（　　）

「政策決定において地域の関与ができなかったこと」について
（　　）

「町内の他の地区・町外に転出（引越し）されたこと」について
（　　）

その他、台風 12 号被害についてご意見等あれば、ご自由にお書きください。
（　　）

質問 7. あなた自身についてお聞きします。

(1) あなたの性別をお聞かせください。(1 つに○)

1. 男性　　2. 女性

(2) あなたの年齢をお聞かせください。

満（　　）歳

(3) あなたのご職業をお聞かせください。(1 つに○。兼業の方は主なものを選択してください。)

1. 会社員　2. 公務員　3. 自営業　4. 農林水産業
5. 派遣社員　6. パート・アルバイト　7. 団体職員　8. 主婦・主夫
9. 学生　10. その他（　　）　11. 現在は仕事をしていない

(4) ご結婚されていますか？(1 つに○)

1. 既婚　　2. 未婚

(5) あなたが最後に卒業した学校は次のうちどれですか？(1 つに○)

1. 中学校　2. 高等学校　3. 専門学校　4. 短大・高専
5. 大学　6. 大学院　7. その他（　　）

(6) あなたには、現在、同居されているご家族がいますか？(あてはまるもの全てに○)

1. 配偶者　2. 父・母　3. 義父・義母　4. 祖父・祖母
5. 乳児・幼児　6. 小学生　7. 中学生　8. 高校生
9. 大学生・専門学校生　10. 就職・自立している子ども　11. その他（　　）

(7) あなたが現在同居されているご家族は、あなたご自身も含めて、何人ですか?

（　　）人

(8) 世帯主の性別をお聞かせください。(1 つに○)

1. 男性　　2. 女性

(9) 世帯主の年齢をお聞かせください。

満（　　）歳

(10) あなたのご家族の年齢をお聞かせください。(1 つに○)

1. 全員 65 歳以上　2. 65 歳以上と 18 歳未満の未婚者　3. その他（1.と 2.以外）

(11) あなたの世帯構成についてお聞かせください。(1 つに○)

1. ひとり暮らし　2. 夫婦のみ　3. 夫婦と子
4. 三世代（親と子と孫）　5. 母子・父子　6. その他（　　）

(12) あなたのご家族全体の年収（税込み）についてお聞かせください。(1 つに○)

※立ち入ったことをお聞きしますが、経済学的な分析に必要な情報ですので、恐れ入りますがご回答願います。

1. 200 万円未満　2. 200～400 万円　3. 400～600 万円　4. 600～800 万円
5. 800～1,000 万円　6. 1,000～1,200 万円　7. 1,200～1,400 万円　8. 1,400 万円以上

アンケートへのご協力、誠にありがとうございました。

3. Questionnaire survey sheets for local government

2011 年台風 12 号被害についての調査（行政職員の視点）

アンケート調査票

質問 1.　2011 年の台風１２号であなたの町が受けた被害についてお聞かせください。

以下の質問は、台風が去った直後ではなく、3 か月ほど経った 12 月初旬ごろのことを思い出し、行政職員の視点からお答えください。

（1）台風 12 号によってあなたの町は、どのような被害を受けましたか？　以下の金銭的な被害の中で、あなたの町が受けた被害全てに○印をつけてください。

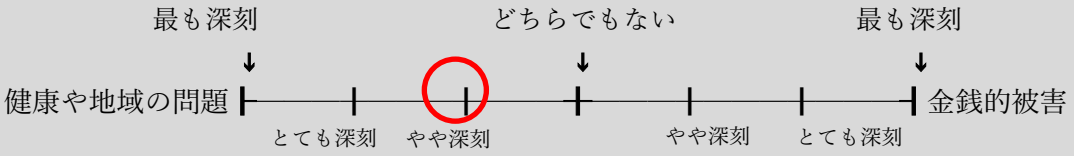
1. 家屋　2. 所有物（車など）　3. 土地　4. 農林水産物
5. 事業収入　6. 給与　7. その他（　　）　8. 被害はない

（2）台風 12 号によって、金銭的被害以外に健康や地域について問題を感じましたか？　あなたが感じた問題全てに○印をつけてください。

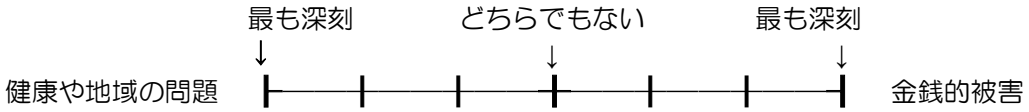
1. 住民の健康を害した　2. 小中学校などが休校になった
3. 町役場等の自治体が機能しない等の理由で、自治体と地域間の連携がみられなかった　4. 特にない

（3）こうした健康や地域の問題は、（1）でお答えいただいた金銭的被害と比べてどのくらい深刻でしたか？　以下の例にしたがって、深刻さの程度に○印をつけてください。

記入例：健康や地域の問題が金銭的被害よりも「やや深刻」な場合



（イ）



（4）こうした健康や地域の問題には、どのような対策が役立つと思いますか？（あてはまるもの全てに○）

1. 災害保険　2. 災害補償　3. 防災対策・防災計画
4. 避難所対策　5. 土地利用対策　6. その他（　　）

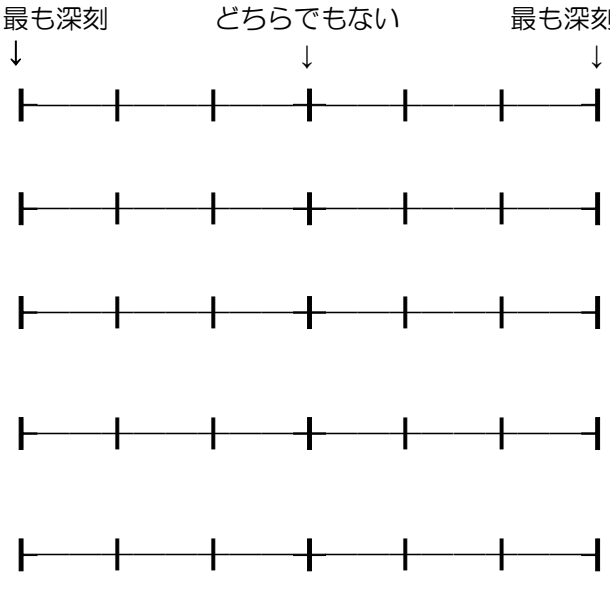
（5）台風 12 号が起こる前から、個人または地域や町の活動として行っていた対策はありますか？（あてはまるもの全てに○）

1. 災害保険　2. 災害補償　3. 防災対策・防災計画
4. 避難所対策　5. 土地利用対策　6. その他（　　）

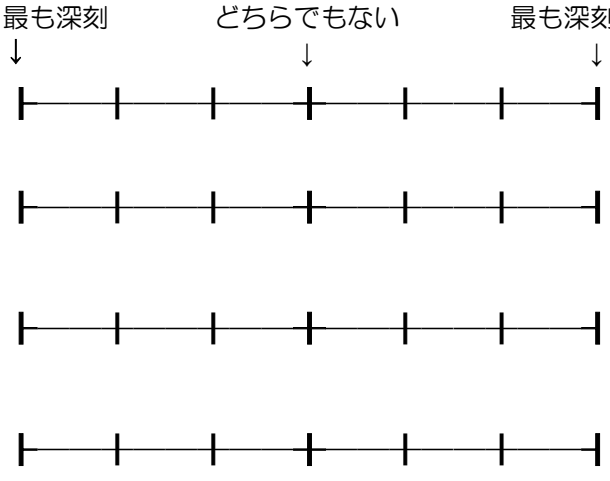
(6) 台風 12 号が起こってから、個人または地域や町の活動として行うようになった対策はありますか？（あてはまるもの全てに○）

1. 災害保険　2. 災害補償　3. 防災対策・防災計画
4. 避難所対策　5. 土地利用対策　6. その他（　　）

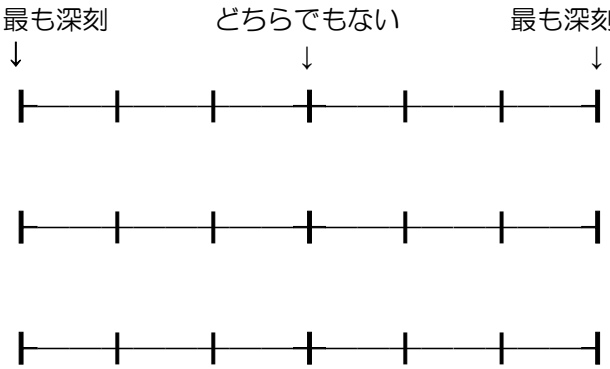
(7) 台風 12 号の被害として、以下のこと（イ～ホ）は、あなたの町にとってどの程度深刻でしたか？台風 12 号であなたの町が感じていた**「精神的な苦痛（ストレスや心の病）」**と比べてお答えください。（深刻さの程度に○）



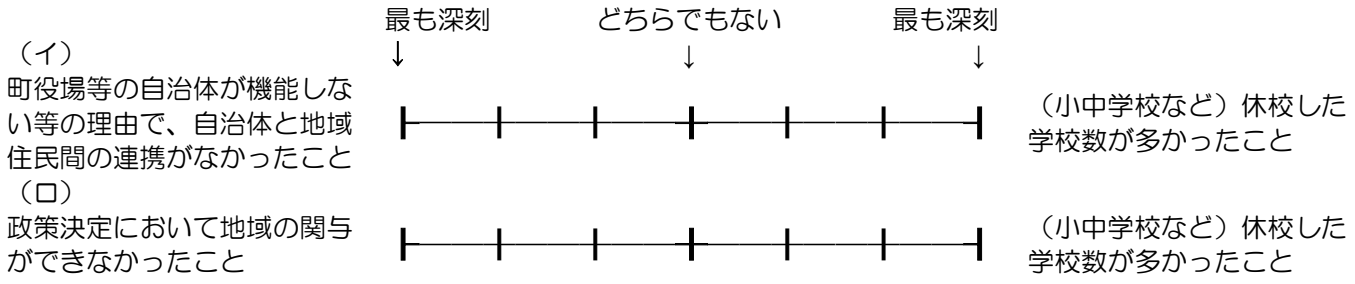
(8) 同じく、**「慢性疾患（糖尿病、高血圧症などの持病）の悪化」**と比べてどうでしたか？



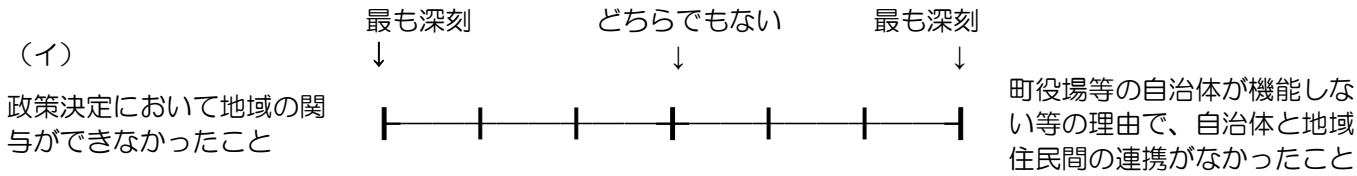
(9) 同じく、**「（小中学校など）休校期間が長かったこと」**と比べてどうでしたか？



（10）同じく、**「（小中学校など）休校した学校数が多かったこと」**と比べてどうでしたか？



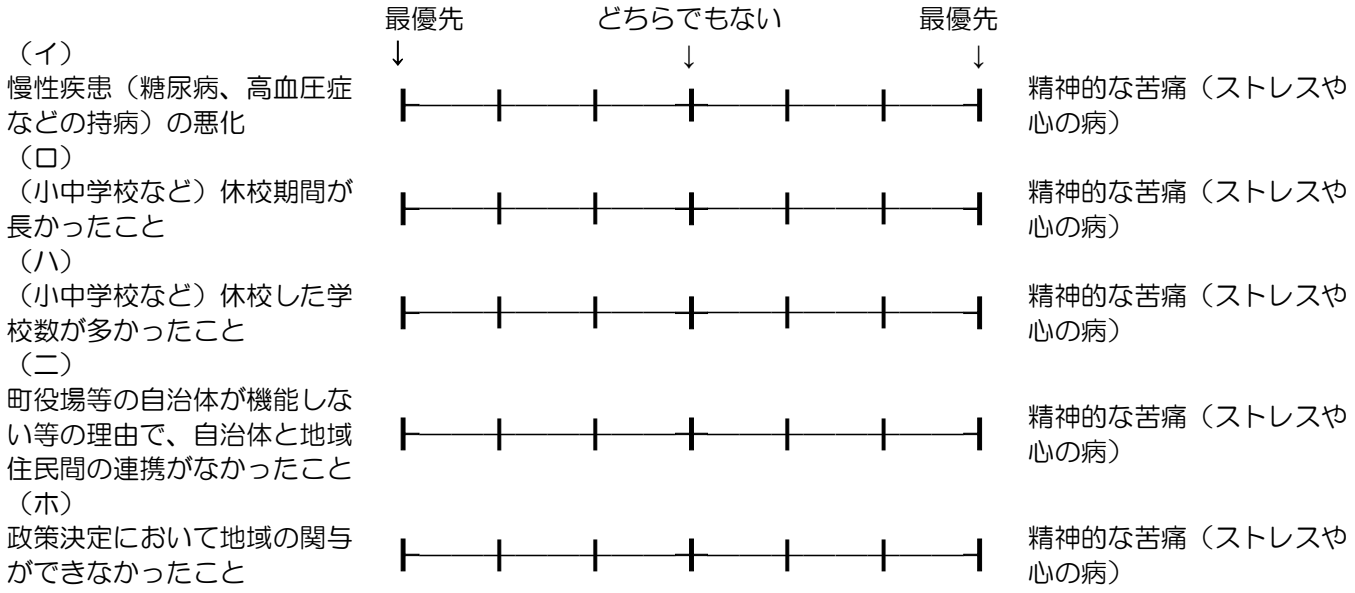
（11）同じく、**「町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと」**と比べてどうでしたか？



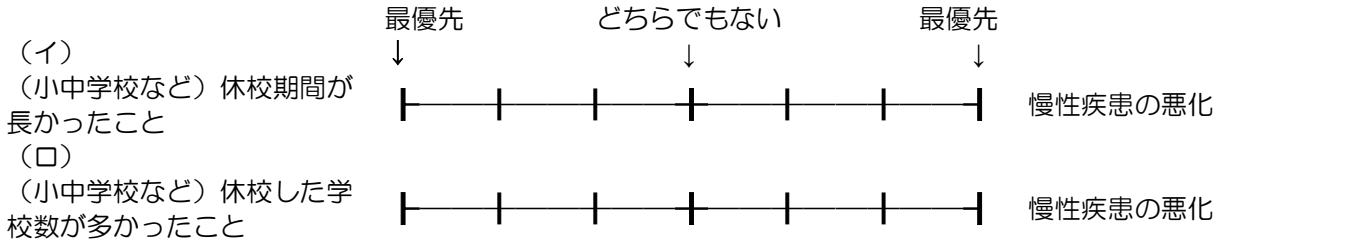
質問 2.　次の台風に備えた防災対策のなかで、優先して行政が取り組むべきことは何だと思いましたか？

台風 12 号が去ってから 3 か月後の 12 月初旬ごろを思い出し、行政職員の視点からお答えください。

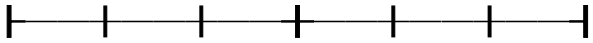
（1）次の台風に備えた防災対策のなかで、以下のこと（イ～ホ）は、行政がどの程度優先して取り組むべきだと思いましたか？台風 12 号であなたの町が感じていた**「精神的な苦痛（ストレスや心の病）」**と比べてお答えください。（優先度の程度に○）



（2）同じく、**「慢性疾患（糖尿病、高血圧症などの持病）の悪化」**と比べてどうでしたか？

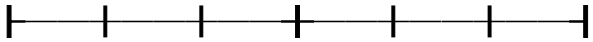


（ハ）
町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと



慢性疾患の悪化

（ニ）
政策決定において地域の関与ができなかったこと

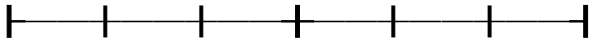


慢性疾患の悪化

（3）同じく、**「（小中学校など）休校期間が長かったこと」**と比べてどうでしたか？

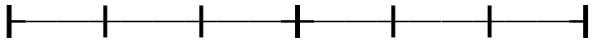
最優先　どちらでもない　最優先

（イ）
（小中学校など）休校した学校数が多かったこと



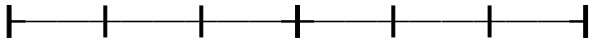
（小中学校など）休校期間が長かったこと

（ロ）
町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと



（小中学校など）休校期間が長かったこと

（ハ）
政策決定において地域の関与ができなかったこと

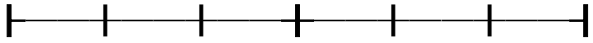


（小中学校など）休校期間が長かったこと

（4）同じく、**「（小中学校など）休校した学校数が多かったこと」**と比べてどうでしたか？

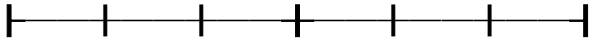
最優先　どちらでもない　最優先

（イ）
町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと



（小中学校など）休校した学校数が多かったこと

（ロ）
政策決定において地域の関与ができなかったこと

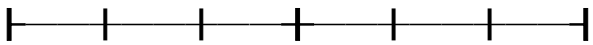


（小中学校など）休校した学校数が多かったこと

（5）同じく、**「町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと」**と比べてどうでしたか？

最優先　どちらでもない　最優先

（イ）
政策決定において地域の関与ができなかったこと



町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと

質問 3.　台風１２号からの復興・生活再建に向けて、優先して社会全体が取り組むべきことは何だと思いましたか？

台風 12 号が去ってから 3 か月後の 12 月初旬ごろを思い出してお答えください。

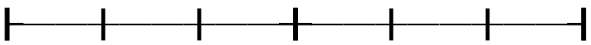
（1）台風 12 号からの復興・生活再建に向けて、以下のこと（イ～ホ）は、社会全体がどの程度優先して取り組むべきだと思いましたか？台風 12 号であなたの町が感じていた**「精神的な苦痛（ストレスや心の病）」**と比べてお答えください。（優先度の程度に○）

最優先　どちらでもない　最優先

（イ）
慢性疾患（糖尿病、高血圧症などの持病）の悪化

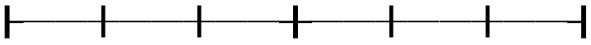
精神的な苦痛（ストレスや心の病）

（ロ）
（小中学校など）休校期間が長かったこと



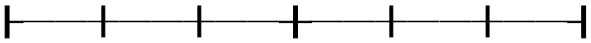
精神的な苦痛（ストレスや心の病）

（ハ）
（小中学校など）休校した学校数が多かったこと



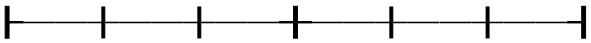
精神的な苦痛（ストレスや心の病）

（ニ）
町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと



精神的な苦痛（ストレスや心の病）

（ホ）
政策決定において地域の関与ができなかったこと

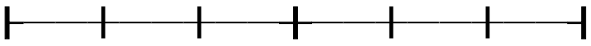


精神的な苦痛（ストレスや心の病）

（2）同じく、**「慢性疾患（糖尿病、高血圧症などの持病）の悪化」**と比べてどうでしたか？

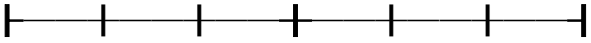
最優先　どちらでもない　最優先
↓　↓　↓

（イ）
（小中学校など）休校期間が長かったこと



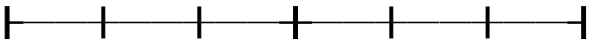
慢性疾患の悪化

（ロ）
（小中学校など）休校した学校数が多かったこと



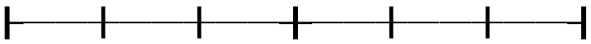
慢性疾患の悪化

（ハ）
町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと



慢性疾患の悪化

（ニ）
政策決定において地域の関与ができなかったこと

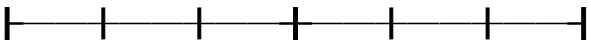


慢性疾患の悪化

（3）同じく、**「（小中学校など）休校期間が長かったこと」**と比べてどうでしたか？

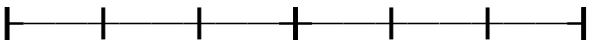
最優先　どちらでもない　最優先
↓　↓　↓

（イ）
（小中学校など）休校した学校数が多かったこと



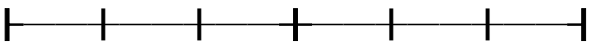
（小中学校など）休校期間が長かったこと

（ロ）
町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと



（小中学校など）休校期間が長かったこと

（ハ）
政策決定において地域の関与ができなかったこと

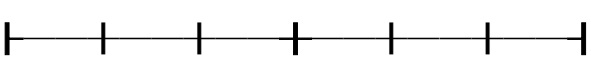


（小中学校など）休校期間が長かったこと

（4）同じく、**「（小中学校など）休校した学校数が多かったこと」**と比べてどうでしたか？

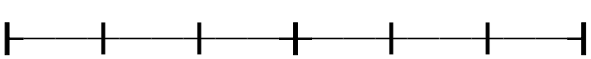
最優先　どちらでもない　最優先
↓　↓　↓

（イ）
町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと



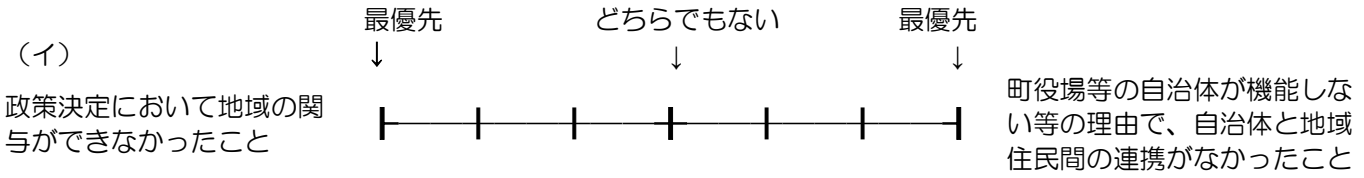
（小中学校など）休校した学校数が多かったこと

（ロ）
政策決定において地域の関与ができなかったこと



（小中学校など）休校した学校数が多かったこと

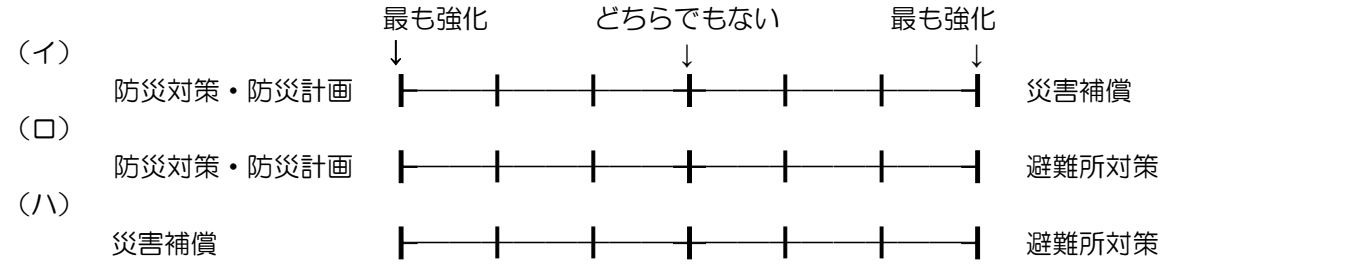
(5) 同じく、**「町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと」**と比べてどうでしたか？



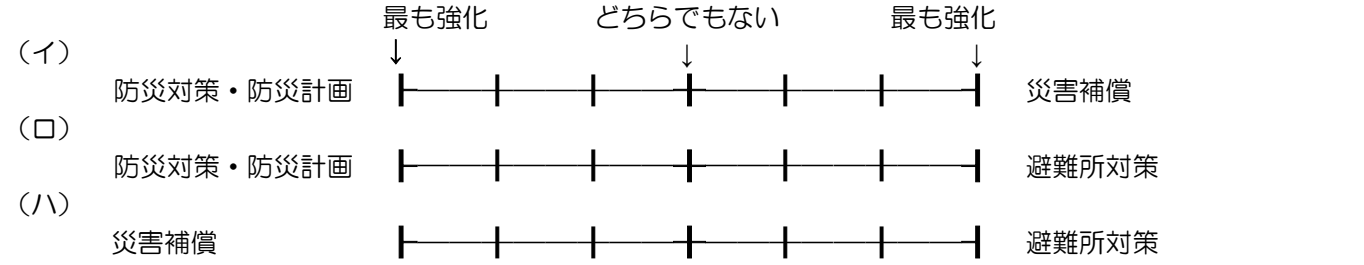
質問 4.　台風１２号被害からの復興・生活再建に向けて、行政が強化すべき対策は何だと思いましたか？

台風 12 号が去ってから 3 か月後の 12 月初旬ごろを思い出し、行政職員の視点からお答えください。

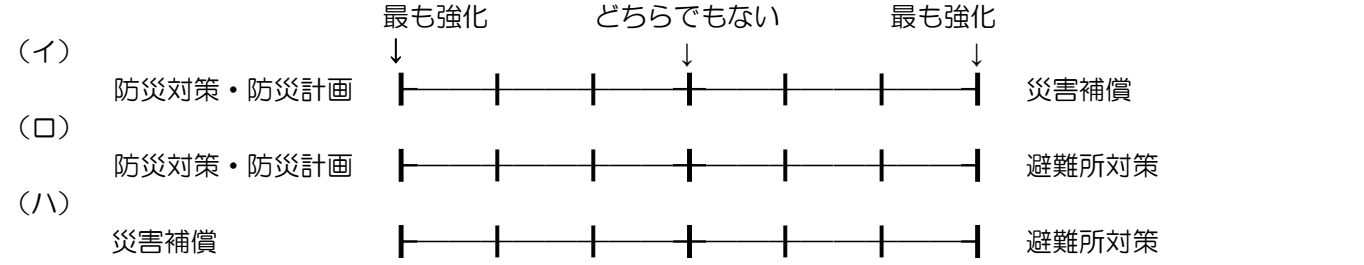
(1) 台風 12 号であなたの町が感じていた**「精神的な苦痛（ストレスや心の病）」**に対処するために、以下の対策は、どちらを、どのくらい強化すべきだと思いましたか？（強化の程度に○）



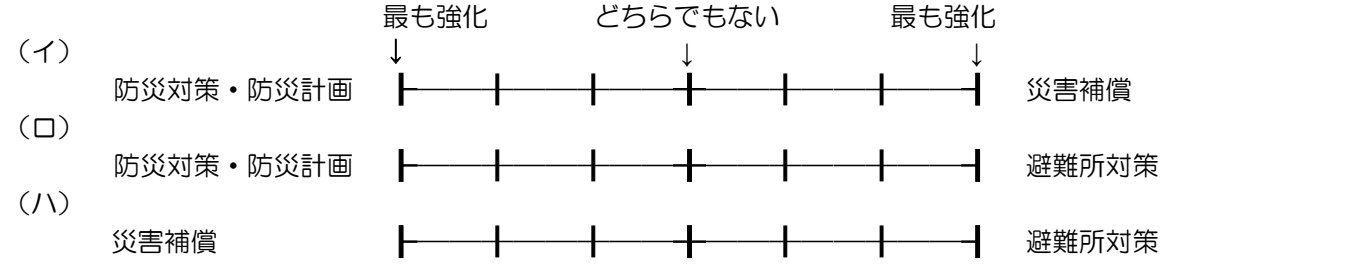
(2) 同じく、**「慢性疾患（糖尿病、高血圧症などの持病）の悪化」**に対処するためには、どうでしたか？



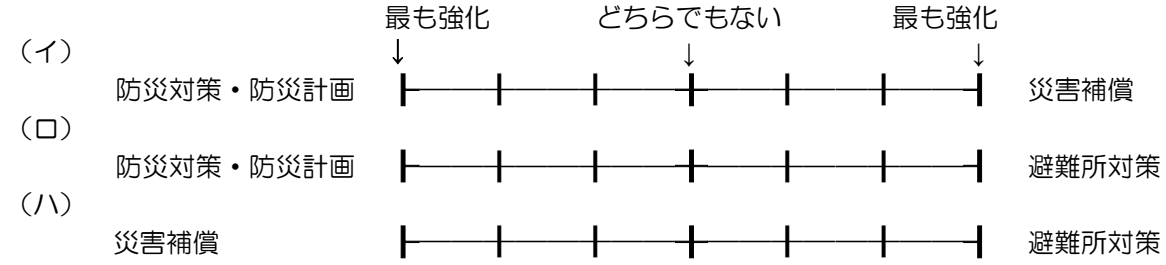
(3) 同じく、**「（小中学校など）休校期間が長かったこと」**に対処するためには、どうでしたか？



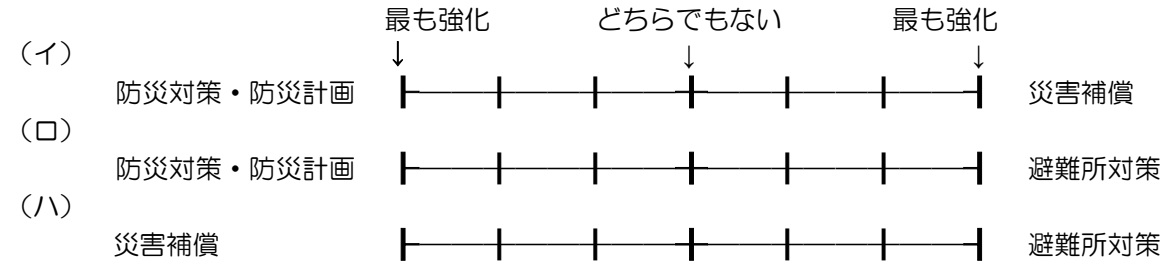
(4) 同じく、**「（小中学校など）休校した学校数が多かったこと」**に対処するためには、どうでしたか？



(5) 同じく、**「町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと」**に対処するためには、どうでしたか？

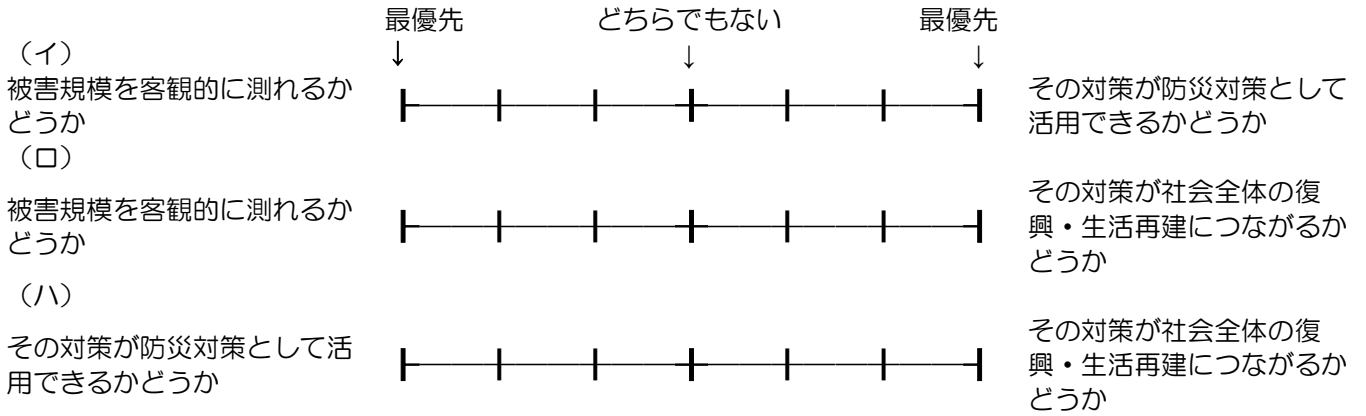


(6) 同じく、**「政策決定において地域の関与ができなかったこと」**に対処するためには、どうでしたか？



質問 5.　台風被害の対策を決める際に、行政が優先すべき決定基準についてお聞かせください。

(1) 台風被害の対策を決める際に、以下の決定基準は、どちらを、どのくらい優先すべきだと思いますか？（優先度の程度に○）



質問 6.　台風 12 号であなたの町が受けた被害の状況についてお聞かせください。

台風 12 号が去ってから 3 か月後の 12 月初旬ごろを思い出し、行政職員の視点からお答えください。

(1) 台風 12 号によって、あなたの町は、以下の被害を受けましたか？（1 つに○）

（イ） 精神的な苦痛（ストレスや心の病）

1. かなり受けた　2. ある程度受けた　3. どちらとも言えない　4. あまり受けなかった　5. 全く受けなかった

（ロ） 慢性疾患（糖尿病、高血圧症などの持病）の悪化

1. かなり受けた　2. ある程度受けた　3. どちらとも言えない　4. あまり受けなかった　5. 全く受けなかった

(2) 台風 12 号によって、あなたの町の小中学校などの学校は休校しましたか？（1 つに○）

（イ） 休校した期間

1. かなり長かった　2. 長かった　3. どちらとも言えない　4. 短かった　5. 休校しなかった

（ロ） 休校した学校数

1. かなり多かった　2. 多かった　3. どちらとも言えない　4. 少なかった　5. 全くなかった

(3) 台風 12 号によって、以下のことは多いと思いましたか？（1 つに○）

（イ） 町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと

1. かなり多かった　2. 多かった　3. どちらとも言えない　4. 少なかった　5. 全くなかった

（ロ） 政策決定において地域の関与ができなかったこと

1. かなり多かった　2. 多かった　3. どちらとも言えない　4. 少なかった　5. 全くなかった

（ハ） 町内の他の地区に転出（引越し）された方

1. かなり多かった　2. 多かった　3. どちらとも言えない　4. 少なかった　5. 全くなかった

（ニ） 町外に転出（引越し）された方

1. かなり多かった　2. 多かった　3. どちらとも言えない　4. 少なかった　5. 全くなかった

以下の台風１２号被害の原因・理由についてご意見等あれば、ご自由にお書きください。

「精神的な苦痛（ストレスや心の病）」について
（　　）

「慢性疾患（糖尿病、高血圧症などの持病）の悪化」について
（　　）

「（小中学校など）休校期間が長かったこと」について
（　　）

「（小中学校など）休校した学校数が多かったこと」について
（　　）

「町役場等の自治体が機能しない等の理由で、自治体と地域住民間の連携がなかったこと」について
（　　）

「政策決定において地域の関与ができなかったこと」について
（　　）

「町内の他の地区・町外に転出（引越し）されたこと」について
（　　）

その他、台風 12 号被害についてご意見等あれば、ご自由にお書きください。
（　　）

質問 7. あなた自身についてお聞きします。

(1) あなたの性別をお聞かせください。（1 つに○）

1. 男性　　2. 女性

(2) あなたの年齢をお聞かせください。

満（　　）歳

(3) あなたのご所属（担当課）をお聞かせください。

（　　）担当課

(4) 台風 12 号によって、あなたはどのような被害を受けましたか？　（あてはまるもの全てに○）

1. 金銭的被害（家屋、土地、所有物など）
（　　）
2. 非金銭的被害（健康・地域・自治体などの問題）
（　　）
3. その他
（　　）
4. 被害はない

アンケートへのご協力、誠にありがとうございました。

4. AHP results from questionnaire survey for households

Table 1 Pairwise comparison of criteria

Overall:

Ref.	Criteria	Weight	Rank
C-1	Measurability and verifiability	0.198	3
C-2	Relevance to DRR/CCA policy	0.340	2
C-3	Societal value	0.462	1
	CR	**0.001**	

1. Gender Group

		Male:		*Female:*	
Ref.	**Criteria**	**Weight**	**Rank**	**Weight**	**Rank**
C-1	Measurability and verifiability	0.199	3	0.186	3
C-2	Relevance to DRR/CCA policy	0.334	2	0.364	2
C-3	Societal value	0.467	1	0.450	1
	CR	**0.001**		**0.000**	

2. Age Group

		Youth:		*Middle-aged:*		*Elderly:*	
Ref.	**Criteria**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
C-1	Measurability and verifiability	0.132	3	0.169	3	0.224	3
C-2	Relevance to DRR/CCA policy	0.230	2	0.342	2	0.345	2
C-3	Societal value	0.638	1	0.489	1	0.432	1
	CR	**0.134**		**0.001**		**0.000**	

3. Income Group

		Low-income:		*Above-low-income:*	
Ref.	**Criteria**	**Weight**	**Rank**	**Weight**	**Rank**
C-1	Measurability and verifiability	0.227	3	0.190	3
C-2	Relevance to DRR/CCA policy	0.335	2	0.343	2
C-3	Societal value	0.439	1	0.467	1
	CR	**0.004**		**0.000**	

Table 2 Pairwise comparison of indicators in terms of each criterion

Overall:

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental diseases	0.184	2	0.180	3	0.176	3	0.179	**3**
I-2	Chronic diseases	0.154	4	0.168	4	0.168	4	0.165	4
I-3	Period of school discontinuation	0.153	5	0.132	5	0.139	5	0.139	5
I-4	Number of school discontinued	0.131	6	0.119	6	0.116	6	0.120	6
I-5	Less collaboration of local gov't	0.200	1	0.212	1	0.215	1	0.211	**1**
I-6	Less participation of community	0.178	3	0.189	2	0.187	2	0.186	**2**
	CR	**0.001**		**0.003**		**0.003**			

1.1 Gender Group: Male

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental diseases	0.179	3	0.178	3	0.169	3	0.174	**3**
I-2	Chronic diseases	0.154	4	0.169	4	0.165	4	0.164	4
I-3	Period of school discontinuation	0.148	5	0.128	5	0.137	5	0.136	5
I-4	Number of school discontinued	0.129	6	0.117	6	0.116	6	0.119	6
I-5	Less collaboration of local gov't	0.204	1	0.214	1	0.218	1	0.214	**1**
I-6	Less participation of community	0.185	2	0.194	2	0.194	2	0.192	**2**
	CR	**0.001**		**0.003**		**0.003**			

1.2 Gender Group: Female

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental diseases	0.189	2	0.184	3	0.202	2	0.193	**2**
I-2	Chronic diseases	0.154	5	0.158	4	0.164	4	0.160	4
I-3	Period of school discontinuation	0.164	3	0.139	5	0.132	5	0.141	5
I-4	Number of school discontinued	0.140	6	0.127	6	0.109	6	0.121	6
I-5	Less collaboration of local gov't	0.191	1	0.203	1	0.212	1	0.205	**1**
I-6	Less participation of community	0.161	4	0.190	2	0.180	3	0.180	**3**
	CR	**0.005**		**0.003**		**0.010**			

2.1 Age Group: Youth

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental diseases	0.363	1	0.202	2	0.225	2	0.238	**1**
I-2	Chronic diseases	0.163	2	0.165	3	0.151	4	0.156	4
I-3	Period of school discontinuation	0.140	3	0.144	5	0.113	6	0.124	5
I-4	Number of school discontinued	0.110	5	0.110	6	0.119	5	0.115	6
I-5	Less collaboration of local gov't	0.121	4	0.217	1	0.227	1	0.211	**2**
I-6	Less participation of community	0.103	6	0.162	4	0.165	3	0.156	**3**
	CR	**0.022**		**0.039**		**0.025**			

2.2 Age Group: Middle-aged

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental diseases	0.199	2	0.175	3	0.181	2	0.182	**2**
I-2	Chronic diseases	0.133	6	0.150	5	0.148	5	0.146	5
I-3	Period of school discontinuation	0.163	4	0.151	4	0.157	4	0.156	4
I-4	Number of school discontinued	0.135	5	0.128	6	0.126	6	0.128	6
I-5	Less collaboration of local gov't	0.205	1	0.216	1	0.217	1	0.215	**1**
I-6	Less participation of community	0.165	3	0.181	2	0.171	3	0.173	**3**
	CR	**0.003**		**0.007**		**0.008**			

2.3 Age Group: Elderly

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental diseases	0.156	4	0.179	4	0.165	4	0.168	4
I-2	Chronic diseases	0.169	3	0.181	3	0.179	3	0.177	**3**
I-3	Period of school discontinuation	0.141	5	0.114	5	0.125	5	0.125	5
I-4	Number of school discontinued	0.128	6	0.112	6	0.107	6	0.114	6
I-5	Less collaboration of local gov't	0.205	1	0.208	1	0.215	1	0.210	**1**
I-6	Less participation of community	0.200	2	0.206	2	0.209	2	0.206	**2**
	CR	**0.002**		**0.002**		**0.003**			

3.1 Income Group: Low-income

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental diseases	0.158	4	0.185	3	0.168	4	0.172	**3**
I-2	Chronic diseases	0.155	5	0.172	4	0.169	3	0.167	4
I-3	Period of school discontinuation	0.162	3	0.132	5	0.133	5	0.139	5
I-4	Number of school discontinued	0.138	6	0.130	6	0.130	6	0.132	6
I-5	Less collaboration of local gov't	0.196	1	0.192	1	0.200	1	0.196	**1**
I-6	Less participation of community	0.191	2	0.190	2	0.198	2	0.194	**2**
	CR	**0.006**		**0.002**		**0.001**			

3.2 Income Group: Above-low-income

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental diseases	0.188	2	0.177	3	0.176	3	0.179	**3**
I-2	Chronic diseases	0.154	4	0.164	4	0.163	4	0.162	4
I-3	Period of school discontinuation	0.147	5	0.128	5	0.139	5	0.137	5
I-4	Number of school discontinued	0.129	6	0.115	6	0.111	6	0.116	6
I-5	Less collaboration of local gov't	0.206	1	0.221	1	0.224	1	0.220	**1**
I-6	Less participation of community	0.176	3	0.194	2	0.187	2	0.188	**2**
	CR	**0.003**		**0.005**		**0.006**			

Table 3 Pairwise comparison of practices in terms of each indicator

Overall:

		I-1		I-2		I-3		I-4		I-5		I-6		Overall	
Ref.	**Practices**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
P-1	DRR policy and planning	0.287	3	0.286	3	0.344	2	0.365	2	0.365	2	0.363	1	0.335	**2**
P-2	Disaster compensation	0.300	2	0.297	2	0.263	3	0.256	3	0.253	3	0.277	3	0.275	**3**
P-3	Shelter policy	0.412	1	0.417	1	0.393	1	0.379	1	0.382	1	0.361	2	0.390	**1**
	CR	**0.010**		**0.005**		**0.003**		**0.003**		**0.008**		**0.009**			

1.1 Gender Group: Male

		I-1		I-2		I-3		I-4		I-5		I-6		Overall	
Ref.	**Practices**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
P-1	DRR policy and planning	0.285	3	0.279	3	0.340	2	0.363	2	0.354	2	0.367	1	0.331	2
P-2	Disaster compensation	0.299	2	0.296	2	0.261	3	0.261	3	0.251	3	0.271	3	0.273	3
P-3	Shelter policy	0.417	1	0.425	1	0.398	1	0.376	1	0.396	1	0.362	2	0.396	1
	CR	**0.011**		**0.004**		**0.002**		**0.002**		**0.005**		**0.009**			

1.2 Gender Group: Female

		I-1		I-2		I-3		I-4		I-5		I-6		Overall	
Ref.	**Practices**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
P-1	DRR policy and planning	0.296	2	0.306	3	0.347	2	0.348	2	0.374	1	0.348	1	0.336	2
P-2	Disaster compensation	0.277	3	0.313	2	0.255	3	0.231	3	0.276	3	0.305	3	0.279	3
P-3	Shelter policy	0.428	1	0.381	1	0.399	1	0.422	1	0.350	2	0.347	2	0.385	1
	CR	**0.022**		**0.010**		**0.017**		**0.011**		**0.056**		**0.010**			

2.1 Age Group: Youth

			I-1		I-2		I-3		I-4		I-5		I-6		Overall	
Ref.	**Practices**		**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
P-1	DRR policy and planning		0.168	3	0.382	1	0.433	1	0.507	1	0.383	2	0.463	1	0.365	2
P-2	Disaster compensation		0.344	2	0.265	3	0.203	3	0.227	3	0.206	3	0.247	3	0.256	3
P-3	Shelter policy		0.488	1	0.353	2	0.364	2	0.266	2	0.411	1	0.290	2	0.379	1
		CR	**0.009**		**0.004**		**0.048**		**0.035**		**0.015**		**0.024**			

2.2 Age Group: Middle-aged

			I-1		I-2		I-3		I-4		I-5		I-6		Overall	
Ref.	**Practices**		**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
P-1	DRR policy and planning		0.283	3	0.267	3	0.395	1	0.435	1	0.397	1	0.377	1	0.358	2
P-2	Disaster compensation		0.292	2	0.323	2	0.261	3	0.270	3	0.246	3	0.279	3	0.277	3
P-3	Shelter policy		0.425	1	0.410	1	0.345	2	0.295	2	0.357	2	0.344	2	0.365	1
		CR	**0.020**		**0.005**		**0.002**		**0.003**		**0.019**		**0.013**			

2.3 Age Group: Elderly

			I-1		I-2		I-3		I-4		I-5		I-6		Overall	
Ref.	**Practices**		**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
P-1	DRR policy and planning		0.301	2	0.288	2	0.298	2	0.296	2	0.329	2	0.346	2	0.313	2
P-2	Disaster compensation		0.291	3	0.286	3	0.262	3	0.240	3	0.265	3	0.279	3	0.273	3
P-3	Shelter policy		0.408	1	0.425	1	0.440	1	0.464	1	0.406	1	0.376	1	0.414	1
		CR	**0.009**		**0.006**		**0.002**		**0.002**		**0.005**		**0.012**			

3.1 Income Group: Low-income

		I-1		I-2		I-3		I-4		I-5		I-6		Overall	
Ref.	**Practices**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
P-1	DRR policy and planning	0.272	3	0.310	2	0.308	2	0.304	2	0.324	2	0.358	2	0.315	2
P-2	Disaster compensation	0.283	2	0.292	3	0.252	3	0.230	3	0.263	3	0.264	3	0.266	3
P-3	Shelter policy	0.445	1	0.398	1	0.440	1	0.466	1	0.413	1	0.377	1	0.420	1
	CR	**0.009**		**0.001**		**0.002**		**0.001**		**0.018**		**0.007**			

3.2 Income Group: Above-low-income

		I-1		I-2		I-3		I-4		I-5		I-6		Overall	
Ref.	**Practices**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
P-1	DRR policy and planning	0.294	2	0.280	3	0.363	2	0.391	1	0.379	1	0.368	1	0.345	2
P-2	Disaster compensation	0.291	3	0.292	2	0.255	3	0.253	3	0.248	3	0.276	3	0.270	3
P-3	Shelter policy	0.415	1	0.427	1	0.383	1	0.356	2	0.373	2	0.356	2	0.385	1
	CR	**0.015**		**0.008**		**0.002**		**0.006**		**0.006**		**0.013**			

5. AHP results from questionnaire survey for local government

Table 1 Pairwise comparison of criteria

Ref.	Criteria	Weight	Rank
C-1	Measurability and verifiability	0.229	**3**
C-2	Relevance to DRR/CCA policy	0.366	**2**
C-3	Societal value	0.406	**1**
	CR	**0.000**	

Table 2 Pairwise comparison of indicators in terms of each criterion

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental diseases	0.292	1	0.240	1	0.262	1	0.261	**1**
I-2	Chronic diseases	0.144	5	0.192	2	0.181	3	0.176	**3**
I-3	Period of school discontinuation	0.149	2	0.138	5	0.131	5	0.137	5
I-4	Number of school discontinued	0.118	6	0.102	6	0.098	6	0.104	6
I-5	Less collaboration of local gov't	0.147	4	0.186	3	0.187	2	0.177	**2**
I-6	Less participation of community	0.149	3	0.142	4	0.142	4	0.144	4
	CR	**0.009**		**0.007**		**0.008**			

Table 3 Pairwise comparison of practices in terms of each indicator

		I-1		I-2		I-3		I-4		I-5		I-6		Overall	
Ref.	**Practices**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
P-1	DRR policy and planning	0.400	1	0.287	2	0.493	1	0.466	1	0.547	1	0.582	1	0.452	**1**
P-2	Disaster compensation	0.226	3	0.268	3	0.176	3	0.177	3	0.159	3	0.145	3	0.198	**3**
P-3	Shelter policy	0.374	2	0.445	1	0.331	2	0.357	2	0.295	2	0.274	2	0.350	**2**
	CR	**0.003**		**0.000**		**0.001**		**0.001**		**0.000**		**0.001**			

Appendix II: Bangladesh

1. Discussion sheet for community consultation

Q 1. Prioritization of Areas of NELD:

Please choose three most important areas of NELD (in other words, areas that were lost or damaged by 2009 Cyclone Aila in 2009 but were not / have not been well addressed, although these are important for you to put your life back) and rank them from 1 to 3, in each phase. "1" means the most important area, "2" means second most important area, and "3" means third most important area. You should not give same rank to more than one area.

NOTE: Emergency response phase is "between the date when the disaster happened to a couple of days"; Response & relief phase is "between a couple of days to a couple of months"; and "recovery phase is more than a couple of months (Let's say 'three months after the disaster happened'".

	Areas	**Rank**			
		Emergency response phase	Response & relief phase	Recovery phase	Overall phase (period is not considered)
1	Human life & Health				
2	Water & Sanitation				
3	Education				
4	Displacement & Migration				
5	Territory				
6	Social capital				
7	Culture, Heritage & Indigenous knowledge				
8	Governance (i.e., local governance on municipalities)				
9	Biodiversity & Ecosystem service				

Q 2. Prioritization of Criteria:

Please choose three most important criteria for including or prioritizing specific NELD indicators (in other words, criteria for addressing NELD or choosing risk reduction practices) in the recovery phase and rank them from 1 to 3. "1" means the most important criteria, "2" means second most important criteria, and "3" means third most important criteria. You should not give same rank to more than one criteria.

	Criteria	Rank
1	Societal value	
2	Long-term societal well-being	
3	Cost of measuring the indicator	
4	Relevance to DRR/CCA policy & planning	
5	Measurability & Verifiability	
6	Familiarity	
7	Exclusivity	
8	Appropriateness to the problem	
9	Data availability	
10	Social & cultural inclusivity	

Q 3. Prioritization of NELD indicators:

Please focus on three most important areas of "the recovery phase" identified in the above section of 'Q 1. Prioritization of Areas of NELD', choose three most important indicators for assessing NELD in the each area (in other words, most relevant causes why the area was lost and damaged) in the recovery phase, and rank them from 1 to 3. "1" means the most important indicator, "2" means second most important indicator, and "3" means third most important indicator. You should not give same rank to more than one indicator.

1. Human life & Health:

	Indicators	Rank
1	People died	
2	People injured	
3	People suffered infectious diseases	
4	People suffered chronic diseases	
5	People suffered mental diseases	

6	People suffered contagious diseases	
7	People suffered communicable diseases	
8	People became disabled	
9	People suffered malnutrition	
10	People suffered psycho-social disorders	
11	People suffered reproductive ill health	

2. Water & Sanitation:

	Indicators	**Rank**
1	Inaccessible to sanitation	
2	Inaccessible to quality water	
3	People suffered waterborne diseases	

3. Education

	Indicators	**Rank**
1	Many schools discontinued	
2	Children dropped out school	
3	Children temporary discontinued school	
4	Low passing out rate	
5	Children not going to school	
6	Long days of school discontinuation	

4. Displacement & Migration

	Indicators	**Rank**
1	People displaced	
2	Long duration of displacement	
3	People seasonally migrated	
4	People (permanently) migrated	
5	Women headed families	
6	Deserted family	

5. Territory

	Indicators	**Rank**
1	Less place identity to the area felt by people	
2	Less place dependence on the area felt by people	

6. Social capital

	Indicators	Rank
1	Decrease participation to social/religious activities	
2	Less acceptance of community leaders	
3	Social hostilities	
4	Disability to build consensus	
5	Decrease cooperatives/membership in societies	
6	Decrease common spaces for social activities	
7	Decrease social/religious activities	

7. Culture, Heritage & Indigenous knowledge

	Indicators	Rank
1	Less cultural identity to cultural heritage sites felt by people	
2	Less cultural dependence on cultural heritage sites felt by people	
3	Cultural heritage damaged	
4	Unavailability of indigenous knowledge	
5	Unavailability of people with indigenous knowledge	
6	Stressed change in occupation	
7	Crimes (change in culture)	

8. Governance (i.e., local governance on municipalities)

	Indicators	Rank
1	Less collaboration	
2	Organizational conflicts	
3	Disability to facilitate external coordination	
4	Less accountability	
5	Less transparency	
6	Decrease participation of community in decision-making	
7	Low % of affected community receiving support and service	

9. Biodiversity & Ecosystem service

	Indicators	Rank
1	Decrease species abundance	
2	Decrease species diversity	
3	Decrease area of green cover	
4	Decrease amount of water available	
5	Decrease keystone species abundance	

Q 4. Prioritization of Practices for addressing NELD:

Please rank the following risk reduction practices for addressing NELD in the recovery phase from 1 to 5. "1" means the most important practice, and "5" means least important practice. You should not give same rank to more than one practice.

	Practices	Rank
1	Insurance	
2	Disaster compensation	
3	Preparedness planning	
4	Cyclone shelters	
5	Land-use policy	

2. Questionnaire survey sheets for households

Household Survey

Prioritization on NELD from Cyclone Aila in 2009: Koyra upazila, Khulna district

Respondent profile

Please check the appropriate box (and specify as necessary).

1. **Gender of Respondent (head of household):** 1 ☐ Male, 2 ☐ Female
2. **Age of Respondent (head of household):** _____years old
3. **Occupation:** 1 ☐ Farmer, 2 ☐ Fishermen, 3 ☐ Small businesses, 4 ☐ Daily labourer, 5 ☐ Salaried employment,
   6 ☐ Remittance, 7 ☐ Unemployed, 8 ☐ Van puller, 9 ☐ Motor cycle driver,
   10 ☐ Other (Specify):_____
4. **Marriage status:** 1 ☐ Married, 2 ☐ Not married
5. **Education level:** 1 ☐ Illiterate (no schooling), 2 ☐ Primary (1-5 years of schooling), 3 ☐ Secondary (6-10 years of schooling), 4 ☐ High school (10-12 years of schooling), 5 ☐ University/college (more than 12 years of schooling)
6. **Number of family members (including you):** _____persons
7. **Do you have children and/or grandchildren you live with?** 1 ☐ Yes, 2 ☐ No
8. **Structure of household:** 1 ☐ Live alone, 2 ☐ Husband-wife (no child), 3 ☐ Parents & child,
   4 ☐ Three generation (parents, child & grandchild), 5 ☐ Single-parent, 6 ☐ Other (Specify): _____
9. **Monthly household income:** _____BDT (Bangladeshi Taka: BDT)
10. **Poverty line (Threshold: 1,226.21 BDT as monthly per capita income):**
    1 ☐ Above poverty line, 2 ☐ Below poverty line
11. **Housing condition:**
    1 ☐ Katcha durable / Tin (both wall and roof are made of tin (corrugated iron sheet)),
    2 ☐ Katcha non-durable (wall are made of straw or non-durable materials and roof are made of tin),
    3 ☐ Jhupri / katcha (muddy/ straw made/polythene) temporary,
    4 ☐ Semi pucca (Brick wall and tin roof),
    5 ☐ Pucca (Brick wall and concrete roof),6 ☐ Other (Specify): _____
12. **Land ownership:** 1 ☐ Agricultural land, 2 ☐ Homestead (not include rented house),
    3 ☐ Other (Specify): _____
13. **Type of economic loss from Cyclone Aila in 2009:** 1 ☐ House/homestead, 2 ☐ Property, 3 ☐ Agricultural land,
    4 ☐ Crop yield, 5 ☐ Livestock, 6 ☐ Merchandise, 7 ☐ Salary/business income,
    8 ☐ Others (Specify): _____
14. **Amount of economic loss:** 1 ☐ House/homestead_____BDT, 2 ☐ Crop yield_____BDT,
    3 ☐ Others_____BDT.
    Total loss _____BDT
15. **Do you understand the difference between economic and non-economic losses?** 1 ☐ Yes, 2 ☐ No
16. **Which losses from Cyclone Aila in 2009 did you think more significant to you?**
    1 ☐ Economic losses (e.g., damaged houses, livestock and agriculture), 2 ☐ Non-economic losses (e.g., increase in psycho-social disorders and malnutrition, inaccessibility to sanitation, loss of children' education opportunity),
    3 ☐ Both, 4 ☐ Don't know
17. **Which risk reduction practices were available to you before Cyclone Aila happened in 2009?**
    1 ☐ Disaster insurance, 2 ☐ Disaster compensation, 3 ☐ Preparedness planning, 4 ☐ Cyclone shelters,
    5 ☐ Land-use policy, 6 ☐ Early warning, 7 ☐ Other (Specify): _____
18. **Which risk reduction practices have become available to you since Cyclone Aila happened in 2009?**
    1 ☐ Disaster insurance, 2 ☐ Disaster compensation, 3 ☐ Preparedness planning, 4 ☐ Cyclone shelters,
    5 ☐ Land-use policy, 6 ☐ Early warning, 7 ☐ Other (Specify): _____
19. **Which risk reduction practices do you think provide you resilience against cyclones?**
    1 ☐ Disaster insurance, 2 ☐ Disaster compensation, 3 ☐ Preparedness planning, 4 ☐ Cyclone shelters,
    5 ☐ Land-use policy, 6 ☐ Early warning, 7 ☐ Other (Specify): _____

AHP Questionnaire

Intensity of importance

We will compare the criteria, indicators and practices on non-economic loss and damage (NELD) (i.e., losses of human health, water & sanitation and education, caused by Cyclone Aila in 2009), using the Saaty's scale of fundamental judgement, a 1-9 scale. The meaning of the numbers is given in table below:

Intensity of importance	Definition	Explanation
1	Equal importance of both options	Two options contribute equally to the objective
3	Moderate importance of one option	Judgment slightly favors one option over another
5	Strong importance for one option	Judgment strongly favors one option over another
7	Very strong importance for one option	One option is favored very strongly over another
9	Extreme importance for one option	Judgment favoring one option is of the highest possible order of affirmation

Q1. Pair-wise comparison of criteria

Which criteria do you think should be more important for addressing NELD from Cyclone Aila in 2009 and other recent cyclones (in other words, for choosing practices for addressing NELD) in the recovery phase? Please compare criteria below with each other and mark the appropriate scale number.

Relevance to DRR/CCA policy	9 7 5 3 1 3 5 7 9	Long-term societal well-being
Relevance to DRR/CCA policy	9 7 5 3 1 3 5 7 9	Societal value
Long-term societal well-being	9 7 5 3 1 3 5 7 9	Societal value

Relevance to DRR/CCA policy means 'whether or not the practice chosen is relevant to DRR/CCA policy'.
Long-term societal well-being means 'whether or not the practice chosen leads to individual recovery'.
Societal value means 'whether or not the practice chosen leads to the recovery for whole the society'.

Example:

If you think 'Long-term societal well-being' is more strongly important than 'Relevance to DRR/CCA policy & planning', please mark the appropriate scale number, as below:

Relevance to DRR/CCA policy	9 7 5 3 1 3 **5** 7 9	Long-term societal well-being

Q2. Pairwise comparison of indicators by each criteria

Now, we will compare each indicator in the recovery phase (let's say 'three months after the disaster happened') by keeping single criteria in view each time.

Q2-1. Pairwise comparison of indicators by the criteria of 'Relevance to DRR/CCA policy & planning'

Which NELD from Cyclone Aila in 2009 do you think should be addressed in DRR/CCA policy & planning in the recovery phase? Please compare the indicators below with each other and mark the appropriate scale number.

People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	People suffered malnutrition
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Inaccessible to sanitation
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
People suffered malnutrition	9 7 5 3 1 3 5 7 9	Inaccessible to sanitation
People suffered malnutrition	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases
People suffered malnutrition	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered malnutrition	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases
Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	Many schools discontinued
Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	Children temporary discontinued school

People suffered waterborne diseases	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered waterborne diseases	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
Many schools discontinued	9 7 5 3 1 3 5 7 9	Children temporary discontinued school

Inaccessibility to sanitation facilities can include 'toilets, sewerages (i.e., safe drinking water), etc.'.

Q2-2. Pairwise comparison of indicators by the criteria of 'Long-term societal well-being'

Which NELD from Cyclone Aila in 2009 do you think should be addressed for putting your life back in the recovery phase? Please compare the indicators below with each other and mark the appropriate scale number.

People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	People suffered malnutrition
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Inaccessible to sanitation
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
People suffered malnutrition	9 7 5 3 1 3 5 7 9	Inaccessible to sanitation
People suffered malnutrition	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases
People suffered malnutrition	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered malnutrition	9 7 5 3 1 3 5 7 9	Children temporary discontinued school

Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases
Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	Many schools discontinued
Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
People suffered waterborne diseases	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered waterborne diseases	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
Many schools discontinued	9 7 5 3 1 3 5 7 9	Children temporary discontinued school

Inaccessibility to sanitation facilities can include 'toilets, sewerages (i.e., safe drinking water), etc.'.

Q2-3. Pairwise comparison of indicators by the criteria of 'Societal value'

Which NELD from Cyclone Aila in 2009 do you think should be addressed to recover whole the society in the recovery phase? Please compare the indicators below with each other and mark the appropriate scale number.

People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	People suffered malnutrition
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Inaccessible to sanitation
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
People suffered malnutrition	9 7 5 3 1 3 5 7 9	Inaccessible to sanitation
People suffered malnutrition	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases

People suffered malnutrition	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered malnutrition	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases
Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	Many schools discontinued
Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
People suffered waterborne diseases	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered waterborne diseases	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
Many schools discontinued	9 7 5 3 1 3 5 7 9	Children temporary discontinued school

Inaccessibility to sanitation facilities can include 'toilets, sewerages (i.e., safe drinking water), etc.'.

Q3. Pairwise comparison of practices by indicators

Q3-1. Pairwise comparison of practices by the indicator of 'People suffered psycho-social disorders'

To address 'People suffered psycho-social disorders' by Cyclone Aila in 2009, which practice do you think should be enhanced in the recovery phase? Please compare the practices below with each other and mark the appropriate scale number.

Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Cyclone shelters
Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Disaster compensation
Cyclone shelters	9 7 5 3 1 3 5 7 9	Disaster compensation

Q3-2. Pairwise comparison of practices by the indicator of 'People suffered malnutrition'

To address 'People suffered malnutrition' by Cyclone Aila in 2009, which practice do you think should be enhanced in the recovery phase? Please compare the practices below with each other and mark the appropriate scale number.

Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Cyclone shelters
Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Disaster compensation
Cyclone shelters	9 7 5 3 1 3 5 7 9	Disaster compensation

Q3-3. Pairwise comparison of practices by the indicator of 'Inaccessible to sanitation'

To address 'Inaccessible to sanitation' by Cyclone Aila in 2009, which practice do you think should be enhanced in the recovery phase? Please compare the practices below with each other and mark the appropriate scale number.

Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Cyclone shelters
Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Disaster compensation
Cyclone shelters	9 7 5 3 1 3 5 7 9	Disaster compensation

Q3-4. Pairwise comparison of practices by the indicator of 'People suffered waterborne diseases'

To address 'People suffered waterborne diseases' by Cyclone Aila in 2009, which practice do you think should be enhanced in the recovery phase? Please compare the practices below with each other and mark the appropriate scale number.

Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Cyclone shelters
Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Disaster compensation
Cyclone shelters	9 7 5 3 1 3 5 7 9	Disaster compensation

Q3-5. Pairwise comparison of practices by the indicator of 'Many schools discontinued'

To address 'Many schools discontinued' by Cyclone Aila in 2009, which practice do you think should be enhanced in the recovery phase? Please compare the practices below with each other and mark the appropriate scale number.

Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Cyclone shelters
Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Disaster compensation
Cyclone shelters	9 7 5 3 1 3 5 7 9	Disaster compensation

Q3-6. Pairwise comparison of practices by the indicator of 'Children temporary discontinued school'

To address 'Children temporary discontinued school' by Cyclone Aila in 2009, which practice do you think should be enhanced in the recovery phase? Please compare the practices below with each other and mark the appropriate scale number.

Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Cyclone shelters
Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Disaster compensation
Cyclone shelters	9 7 5 3 1 3 5 7 9	Disaster compensation

Q4. Impact of each indicator

Lastly, we will measure impact intensity of each indicator as well as ask the related information to quantify the indicator.

Q4-1. 'Psycho-social disorders'

Were you and/or your family affected by 'psycho-social disorders' caused by Cyclone Aila in 2009?

1. Very high	2. High	3. Moderate	4. Low	5. No impact

The numbers of family members affected	_____	persons
Months to stay in hospital	_____	months
Monthly medical fee at hospital	_____	BDT
Monthly transportation cost to hospital	_____	BDT
Months not go to work during the disease time	_____	months
The numbers of affected family members whose salary/income were affected due to the disease	_____	persons
Monthly salary/income during the disease time	_____	BDT
Monthly salary/income during usual time	_____	BDT
The example of psycho-social disorders	_____	
The reason of psycho-social disorders	_____	

Note: The months, fees and salary/income are based on average value per affected family member.

Q4-2. ‘Malnutrition’

Were you and/or your family affected by ‘malnutrition’ caused by Cyclone Aila in 2009?

1. Very high	2. High	3. Moderate	4. Low	5. No impact
The numbers of family members affected			_____ persons	
Months to stay in hospital			_____ months	
Monthly medical fee at hospital			_____ BDT	
Monthly transportation cost to hospital			_____ BDT	
Months not go to work during the disease time			_____ months	
The numbers of affected family members whose salary/income were affected due to the disease			_____ persons	
Monthly salary/income during the disease time			_____ BDT	
The example of malnutrition			_____	
The reason of malnutrition			_____	

Note: The months, fees and salary/income are based on average value per affected family member.

Q4-3. ‘Inaccessible to sanitation’

Were you and/or your family inaccessible to sanitation due to Cyclone Aila in 2009?

1. Very high	2. High	3. Moderate	4. Low	5. No impact
The numbers of family members affected			_____ persons	
Cost of broken infrastructures (sewerages, pipelines, toilets, etc.)			_____ BDT	
Cost until sanitation is recovered (mobile toilets, payment to public toilets, other alternatives, etc.)			_____ BDT	
Repair cost			_____ BDT	
Average months until sanitation is recovered			_____ months	
The example of broken sanitation			_____	
The reason of inaccessibility to sanitation			_____	

Q4-4. ‘Waterborne diseases’

Were you and/or your family affected by ‘waterborne diseases’ caused by Cyclone Aila in 2009?

1. Very high	2. High	3. Moderate	4. Low	5. No impact
The numbers of family members affected			_____ persons	
Months to stay in hospital			_____ months	
Monthly medical fee at hospital			_____ BDT	
Monthly transportation cost to hospital			_____ BDT	
Months not go to work during the disease time			_____ months	
The numbers of affected family members whose salary/income were affected due to the disease			_____ persons	
Monthly salary/income during the disease time			_____ BDT	
The example of waterborne diseases			_____	
The reason of waterborne diseases			_____	

Note: The months, fees and salary/income are based on average value per affected family member.

Q4-5. ‘Numbers of schools discontinued’

How many school around you and/or your family discontinued due to Cyclone Aila in 2009?

1. Very many	2. Many	3. Moderate	4. A few	5. None
Types of school discontinued		1. Primary	2. Secondary	3. High school
The numbers of schools discontinued			_____ schools	
Months of school discontinuation			_____ months	
The reason of school discontinuation			_____	

Q4-6. ‘Children temporary discontinued school’

Did your child (or children) temporary discontinue school due to Cyclone Aila in 2009?

1. Very long	2. long	3. Moderate	4. Short	5. None
The numbers of your children discontinued		_____ persons		
Types of school your children discontinued		1. Primary	2. Secondary	3. High school
Months that your children discontinued school		_____ months		
Monthly tuition fee to pay for school		_____ BDT		
The reason that your children discontinued school		_____		

Note: The months and fees are based on average value per affected child.

----------Thank You very much!----------

3. Questionnaire survey sheets for local government

Survey to Local Government Officer

Prioritization on NELD from Cyclone Aila in 2009: Koyra upazila, Khulna district

Respondent profile

Please check the appropriate box (and specify as necessary).

20. **Gender of Respondent:** 1 ☐ Male, 2 ☐ Female
21. **Age of Respondent:** _____years old
22. **Name of Union:** _____
23. **Name of Department:** _____
24. **Name of Position:** _____
25. **Years of employment:** _____
26. **Had you been employed by the above Union when Cyclone Aila happened in 2009?** 1 ☐ Yes, 2 ☐ No

27. **Do you understand the difference between economic and non-economic losses?** 1 ☐ Yes, 2 ☐ No
28. **Which losses from Cyclone Aila in 2009 did you think more significant to your union?**
    1 ☐ Economic losses (e.g., damaged houses, livestock and agriculture), 2 ☐ Non-economic losses (e.g., increase in psycho-social disorders and malnutrition, inaccessibility to sanitation, loss of children' education opportunity), 3 ☐ Both, 4 ☐ Don't know
29. **Which risk reduction practices were available to your union before Cyclone Aila happened in 2009?**
    1 ☐ Disaster insurance, 2 ☐ Disaster compensation, 3 ☐ Preparedness planning, 4 ☐ Cyclone shelters, 5 ☐ Land-use policy, 6 ☐ Early warning, 7 ☐ Other (Specify): _____
30. **Which risk reduction practices have become available to your union since Cyclone Aila happened in 2009?**
    1 ☐ Disaster insurance, 2 ☐ Disaster compensation, 3 ☐ Preparedness planning, 4 ☐ Cyclone shelters, 5 ☐ Land-use policy, 6 ☐ Early warning, 7 ☐ Other (Specify): _____
31. **Which risk reduction practices do you think provide your union resilience against cyclones?**
    1 ☐ Disaster insurance, 2 ☐ Disaster compensation, 3 ☐ Preparedness planning, 4 ☐ Cyclone shelters, 5 ☐ Land-use policy, 6 ☐ Early warning, 7 ☐ Other (Specify): _____

AHP Questionnaire

Intensity of importance

We will compare the criteria, indicators and practices on non-economic loss and damage (NELD) (i.e., losses of human health, water & sanitation and education, caused by Cyclone Aila in 2009), using the Saaty's scale of fundamental judgement, a 1-9 scale. The meaning of the numbers is given in table below:

Intensity of importance	Definition	Explanation
1	Equal importance of both options	Two options contribute equally to the objective
3	Moderate importance of one option	Judgment slightly favors one option over another
5	Strong importance for one option	Judgment strongly favors one option over another
7	Very strong importance for one option	One option is favored very strongly over another
9	Extreme importance for one option	Judgment favoring one option is of the highest possible order of affirmation

Q1. Pair-wise comparison of criteria

Which criteria do you think should be more important for addressing NELD from Cyclone Aila in 2009 and other recent cyclones (in other words, for choosing practices for addressing the NELD) in the recovery phase? Please compare criteria below with each other and mark the appropriate scale number.

Relevance to DRR/CCA policy	9 7 5 3 1 3 5 7 9	Long-term societal well-being
Relevance to DRR/CCA policy	9 7 5 3 1 3 5 7 9	Societal value
Long-term societal well-being	9 7 5 3 1 3 5 7 9	Societal value

Relevance to DRR/CCA policy means 'whether or not the practice chosen is relevant to DRR/CCA policy'.
Long-term societal well-being means 'whether or not the practice chosen leads to individual recovery of local people'.
Societal value means 'whether or not the practice chosen leads to the recovery for whole the society'.

Example:

If you think 'Long-term societal well-being' is more <u>strongly important</u> than 'Relevance to DRR/CCA policy & planning', please mark the appropriate scale number, as below:

Relevance to DRR/CCA policy	9 7 5 3 1 3 **5** 7 9	Long-term societal well-being

Q2. Pairwise comparison of indicators by each criteria

Now, we will compare each indicator in the recovery phase (let's say 'three months after the disaster happened') by keeping single criteria in view each time.

Q2-1. Pairwise comparison of indicators by the criteria of 'Relevance to DRR/CCA policy & planning'

Which NELD from Cyclone Aila in 2009 do you think should be addressed in DRR/CCA policy & planning in the recovery phase? Please compare the indicators below with each other and mark the appropriate scale number.

People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	People suffered malnutrition
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Inaccessible to sanitation
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
People suffered malnutrition	9 7 5 3 1 3 5 7 9	Inaccessible to sanitation
People suffered malnutrition	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases
People suffered malnutrition	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered malnutrition	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases
Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	Many schools discontinued
Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	Children temporary discontinued school

People suffered waterborne diseases	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered waterborne diseases	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
Many schools discontinued	9 7 5 3 1 3 5 7 9	Children temporary discontinued school

Inaccessibility to sanitation facilities can include 'toilets, sewerages (i.e., safe drinking water), etc.'.

Q2-2. Pairwise comparison of indicators by the criteria of 'Long-term societal well-being'

Which NELD from Cyclone Aila in 2009 do you think should be addressed for putting individual livelihood of local people back in the recovery phase? Please compare the indicators below with each other and mark the appropriate scale number.

People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	People suffered malnutrition
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Inaccessible to sanitation
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
People suffered malnutrition	9 7 5 3 1 3 5 7 9	Inaccessible to sanitation
People suffered malnutrition	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases
People suffered malnutrition	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered malnutrition	9 7 5 3 1 3 5 7 9	Children temporary discontinued school

Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases
Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	Many schools discontinued
Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
People suffered waterborne diseases	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered waterborne diseases	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
Many schools discontinued	9 7 5 3 1 3 5 7 9	Children temporary discontinued school

Inaccessibility to sanitation facilities can include 'toilets, sewerages (i.e., safe drinking water), etc.'.

Q2-3. Pairwise comparison of indicators by the criteria of 'Societal value'

Which NELD from Cyclone Aila in 2009 do you think should be addressed to recover whole the society in the recovery phase? Please compare the indicators below with each other and mark the appropriate scale number.

People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	People suffered malnutrition
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Inaccessible to sanitation
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered psycho-social disorders	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
People suffered malnutrition	9 7 5 3 1 3 5 7 9	Inaccessible to sanitation
People suffered malnutrition	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases

People suffered malnutrition	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered malnutrition	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	People suffered waterborne diseases
Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	Many schools discontinued
Inaccessible to sanitation	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
People suffered waterborne diseases	9 7 5 3 1 3 5 7 9	Many schools discontinued
People suffered waterborne diseases	9 7 5 3 1 3 5 7 9	Children temporary discontinued school
Many schools discontinued	9 7 5 3 1 3 5 7 9	Children temporary discontinued school

Inaccessibility to sanitation facilities can include 'toilets, sewerages (i.e., safe drinking water), etc.'.

Q3. Pairwise comparison of practices by indicators

Q3-1. Pairwise comparison of practices by the indicator of 'People suffered psycho-social disorders'

To address 'People suffered psycho-social disorders' by Cyclone Aila in 2009, which practice do you think should be enhanced in the recovery phase? Please compare the practices below with each other and mark the appropriate scale number.

Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Cyclone shelters
Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Disaster compensation
Cyclone shelters	9 7 5 3 1 3 5 7 9	Disaster compensation

Q3-2. Pairwise comparison of practices by the indicator of 'People suffered malnutrition'

To address 'People suffered malnutrition' by Cyclone Aila in 2009, which practice do you think should be enhanced in the recovery phase? Please compare the practices below with each other and mark the appropriate scale number.

Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Cyclone shelters
Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Disaster compensation
Cyclone shelters	9 7 5 3 1 3 5 7 9	Disaster compensation

Q3-3. Pairwise comparison of practices by the indicator of 'Inaccessible to sanitation'

To address 'Inaccessible to sanitation' by Cyclone Aila in 2009, which practice do you think should be enhanced in the recovery phase? Please compare the practices below with each other and mark the appropriate scale number.

Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Cyclone shelters
Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Disaster compensation
Cyclone shelters	9 7 5 3 1 3 5 7 9	Disaster compensation

Q3-4. Pairwise comparison of practices by the indicator of 'People suffered waterborne diseases'

To address 'People suffered waterborne diseases' by Cyclone Aila in 2009, which practice do you think should be enhanced in the recovery phase? Please compare the practices below with each other and mark the appropriate scale number.

Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Cyclone shelters
Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Disaster compensation
Cyclone shelters	9 7 5 3 1 3 5 7 9	Disaster compensation

Q3-5. Pairwise comparison of practices by the indicator of 'Many schools discontinued'

To address 'Many schools discontinued' by Cyclone Aila in 2009, which practice do you think should be enhanced in the recovery phase? Please compare the practices below with each other and mark the appropriate scale number.

Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Cyclone shelters
Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Disaster compensation
Cyclone shelters	9 7 5 3 1 3 5 7 9	Disaster compensation

Q3-6. Pairwise comparison of practices by the indicator of 'Children temporary discontinued school'

To address 'Children temporary discontinued school' by Cyclone Aila in 2009, which practice do you think should be enhanced in the recovery phase? Please compare the practices below with each other and mark the appropriate scale number.

Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Cyclone shelters
Disaster preparedness planning	9 7 5 3 1 3 5 7 9	Disaster compensation
Cyclone shelters	9 7 5 3 1 3 5 7 9	Disaster compensation

Q4. Impact of each indicator

Lastly, we will measure impact intensity of each indicator.

Q4-1. 'Psycho-social disorders'

Were your union affected by 'psycho-social disorders' caused by Cyclone Aila in 2009?

1. Very high	2. High	3. Moderate	4. Low	5. No impact
The example of psycho-social disorders				
The reason of psycho-social disorders				

Q4-2. 'Malnutrition'

Were your union affected by 'malnutrition' caused by Cyclone Aila in 2009?

1. Very high	2. High	3. Moderate	4. Low	5. No impact
The example of malnutrition				
The reason of malnutrition				

Q4-3. ‘Inaccessible to sanitation’

Were your union inaccessible to sanitation due to Cyclone Aila in 2009?

1. Very high	2. High	3. Moderate	4. Low	5. No impact
The example of broken sanitation				
The reason of inaccessibility to sanitation				

Q4-4. ‘Waterborne diseases’

Were your union affected by ‘waterborne diseases’ caused by Cyclone Aila in 2009?

1. Very high	2. High	3. Moderate	4. Low	5. No impact
The example of waterborne diseases				
The reason of waterborne diseases				

Q4-5. ‘Numbers of schools discontinued’

How many schools of your union discontinued due to Cyclone Aila in 2009?

1. Very many	2. Many	3. Moderate	4. A few	5. None
Types of school discontinued		1. Primary	2. Secondary	3. High school
The reason of school discontinuation				

Q4-6. ‘Children temporary discontinued school’

Did children of your union temporary discontinue school due to Cyclone Aila in 2009?

1. Very long	2. long	3. Moderate	4. Short	5. None
The reason that your children discontinued school				

----------Thank You very much!----------

4. AHP results from questionnaire survey for households

Table 1 Pairwise comparison of criteria

Overall:

Ref.	Criteria	Weight	Rank
C-1	Relevance to DRR/CCA	0.255	3
C-2	Societal well-being	0.319	2
C-3	Societal value	0.426	1
	CR	**0.000**	

1. Gender Group

		Male:		*Female:*	
Ref.	**Criteria**	**Weight**	**Rank**	**Weight**	**Rank**
C-1	Relevance to DRR/CCA	0.263	3	0.224	3
C-2	Societal well-being	0.302	2	0.394	1
C-3	Societal value	0.436	1	0.381	2
	CR	**0.001**		**0.010**	

2. Age Group

		Youth:		*Middle-aged:*		*Elderly:*	
Ref.	**Criteria**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
C-1	Relevance to DRR/CCA	0.251	3	0.273	3	0.210	3
C-2	Societal well-being	0.350	2	0.300	2	0.326	2
C-3	Societal value	0.399	1	0.428	1	0.464	1
	CR	**0.001**		**0.000**		**0.015**	

3. Income Group

		Low-income:		*Above-low-income:*	
Ref.	**Criteria**	**Weight**	**Rank**	**Weight**	**Rank**
C-1	Relevance to DRR/CCA	0.221	3	0.274	3
C-2	Societal well-being	0.359	2	0.298	2
C-3	Societal value	0.419	1	0.427	1
	CR	**0.000**		**0.000**	

Table 2 Pairwise comparison of indicators in terms of each criterion

Overall:

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental disease	0.132	4	0.133	3	0.127	4	0.130	**3**
I-2	Malnutrition	0.098	6	0.109	5	0.105	5	0.104	6
I-3	Inaccessible sanitation	0.276	1	0.285	1	0.292	1	0.286	**1**
I-4	Waterborne diseases	0.249	2	0.245	2	0.243	2	0.245	**2**
I-5	Schools discontinued	0.135	3	0.122	4	0.129	3	0.129	4
I-6	Children discontinued	0.109	5	0.106	6	0.104	6	0.106	5
	CR	**0.024**		**0.012**		**0.012**			

1.1 Gender Group: Male

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental disease	0.129	4	0.130	3	0.125	4	0.128	**3**
I-2	Malnutrition	0.099	6	0.106	5	0.105	5	0.104	6
I-3	Inaccessible sanitation	0.281	1	0.298	1	0.294	1	0.291	**1**
I-4	Waterborne diseases	0.247	2	0.243	2	0.242	2	0.244	**2**
I-5	Schools discontinued	0.136	3	0.118	4	0.129	3	0.127	4
I-6	Children discontinued	0.108	5	0.104	6	0.104	6	0.105	5
	CR	**0.021**		**0.014**		**0.012**			

1.2 Gender Group: Female

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental disease	0.146	3	0.145	3	0.135	3	0.142	**3**
I-2	Malnutrition	0.093	6	0.117	5	0.104	5	0.107	6
I-3	Inaccessible sanitation	0.257	1	0.236	2	0.283	1	0.259	**1**
I-4	Waterborne diseases	0.255	2	0.251	1	0.245	2	0.249	**2**
I-5	Schools discontinued	0.133	4	0.140	4	0.130	4	0.135	4
I-6	Children discontinued	0.115	5	0.112	6	0.102	6	0.109	5

2.1 Age Group: Youth

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental disease	0.124	4	0.138	3	0.129	3	0.131	**3**
I-2	Malnutrition	0.097	6	0.117	4	0.101	6	0.105	6
I-3	Inaccessible sanitation	0.259	2	0.273	1	0.282	1	0.273	**1**
I-4	Waterborne diseases	0.274	1	0.255	2	0.258	2	0.261	**2**
I-5	Schools discontinued	0.131	3	0.112	5	0.124	4	0.122	4
I-6	Children discontinued	0.115	5	0.105	6	0.106	5	0.108	5
	CR	**0.027**		**0.017**		**0.019**			

2.2 Age Group: Middle-aged

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental disease	0.134	4	0.128	4	0.127	4	0.129	4
I-2	Malnutrition	0.101	6	0.108	6	0.107	5	0.106	6
I-3	Inaccessible sanitation	0.283	1	0.285	1	0.301	1	0.291	**1**
I-4	Waterborne diseases	0.233	2	0.236	2	0.230	2	0.232	**2**
I-5	Schools discontinued	0.140	3	0.133	3	0.129	3	0.133	**3**
I-6	Children discontinued	0.110	5	0.110	5	0.106	6	0.108	5
	CR	**0.025**		**0.012**		**0.014**			

2.3 Age Group: Elderly

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental disease	0.143	3	0.142	3	0.124	4	0.134	**3**
I-2	Malnutrition	0.091	6	0.096	5	0.106	5	0.100	5
I-3	Inaccessible sanitation	0.283	1	0.306	1	0.278	1	0.288	**1**
I-4	Waterborne diseases	0.259	2	0.255	2	0.260	2	0.258	**2**
I-5	Schools discontinued	0.128	4	0.108	4	0.139	3	0.127	4
I-6	Children discontinued	0.097	5	0.093	6	0.093	6	0.094	6
	CR	**0.032**		**0.021**		**0.007**			

3.1 Income Group: Low-income

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental disease	0.124	4	0.138	3	0.125	3	0.130	**3**
I-2	Malnutrition	0.109	5	0.121	4	0.116	5	0.117	5
I-3	Inaccessible sanitation	0.286	1	0.291	1	0.314	1	0.300	**1**
I-4	Waterborne diseases	0.252	2	0.247	2	0.223	2	0.238	**2**
I-5	Schools discontinued	0.130	3	0.106	5	0.122	4	0.118	4
I-6	Children discontinued	0.099	6	0.097	6	0.100	6	0.099	6
	CR	**0.033**		**0.013**		**0.017**			

3.2 Income Group: Above-low-income

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental disease	0.137	4	0.131	4	0.128	4	0.131	4
I-2	Malnutrition	0.093	6	0.102	6	0.100	6	0.099	6
I-3	Inaccessible sanitation	0.271	1	0.281	1	0.280	1	0.278	**1**
I-4	Waterborne diseases	0.247	2	0.243	2	0.253	2	0.249	**2**
I-5	Schools discontinued	0.138	3	0.131	3	0.133	3	0.134	**3**
I-6	Children discontinued	0.115	5	0.111	5	0.106	5	0.110	5
	CR	**0.020**		**0.012**		**0.011**			

Table 3 Pairwise comparison of practices in terms of each indicator

Overall:

		I-1		I-2		I-3		I-4		I-5		I-6		Overall	
Ref.	**Practices**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
P-1	Preparedness planning	0.491	1	0.533	1	0.514	1	0.543	1	0.502	1	0.492	1	0.516	**1**
P-2	Cyclone shelters	0.277	2	0.194	3	0.187	3	0.215	3	0.250	2	0.199	3	0.216	**3**
P-3	Compensation	0.232	3	0.272	2	0.299	2	0.242	2	0.248	3	0.308	2	0.268	**2**
	CR	**0.008**		**0.016**		**0.003**		**0.003**		**0.001**		**0.001**			

1.1 Gender Group: Male

		I-1		I-2		I-3		I-4		I-5		I-6		Overall	
Ref.	**Practices**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
P-1	Preparedness planning	0.515	1	0.549	1	0.536	1	0.546	1	0.508	1	0.492	1	0.529	1
P-2	Cyclone shelters	0.263	2	0.182	3	0.176	3	0.206	3	0.238	3	0.191	3	0.205	3
P-3	Compensation	0.221	3	0.269	2	0.288	2	0.249	2	0.253	2	0.317	2	0.267	2
	CR	**0.006**		**0.012**		**0.002**		**0.003**		**0.002**		**0.002**			

1.2 Gender Group: Female

		I-1		I-2		I-3		I-4		I-5		I-6		Overall	
Ref.	**Practices**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
P-1	Preparedness planning	0.393	1	0.463	1	0.425	1	0.530	1	0.472	1	0.490	1	0.464	1
P-2	Cyclone shelters	0.335	2	0.253	3	0.237	3	0.257	2	0.302	2	0.237	3	0.267	3
P-3	Compensation	0.272	3	0.284	2	0.338	2	0.213	3	0.225	3	0.273	2	0.269	2
	CR	**0.016**		**0.035**		**0.008**		**0.002**		**0.001**		**0.000**			

2.1 Age Group: Youth

			I-1		I-2		I-3		I-4		I-5		I-6		Overall	
Ref.	**Practices**		**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
P-1	Preparedness planning		0.551	1	0.533	1	0.569	1	0.568	1	0.531	1	0.551	1	0.556	1
P-2	Cyclone shelters		0.253	2	0.180	3	0.158	3	0.198	3	0.248	2	0.177	3	0.196	3
P-3	Compensation		0.196	3	0.287	2	0.273	2	0.234	2	0.221	3	0.272	2	0.248	2
		CR	**0.005**		**0.007**		**0.000**		**0.006**		**0.000**		**0.000**			

2.2 Age Group: Middle-aged

			I-1		I-2		I-3		I-4		I-5		I-6		Overall	
Ref.	**Practices**		**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
P-1	Preparedness planning		0.471	1	0.538	1	0.499	1	0.525	1	0.481	1	0.477	1	0.501	1
P-2	Cyclone shelters		0.285	2	0.202	3	0.200	3	0.227	3	0.259	3	0.197	3	0.225	3
P-3	Compensation		0.243	3	0.260	2	0.302	2	0.248	2	0.260	2	0.325	2	0.274	2
		CR	**0.009**		**0.021**		**0.006**		**0.003**		**0.004**		**0.003**			

2.3 Age Group: Elderly

			I-1		I-2		I-3		I-4		I-5		I-6		Overall	
Ref.	**Practices**		**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
P-1	Preparedness planning		0.448	1	0.515	1	0.465	1	0.557	1	0.517	1	0.433	1	0.495	1
P-2	Cyclone shelters		0.293	2	0.197	3	0.202	3	0.208	3	0.224	3	0.252	3	0.223	3
P-3	Compensation		0.259	3	0.289	2	0.333	2	0.235	2	0.259	2	0.315	2	0.282	2
		CR	**0.012**		**0.020**		**0.002**		**0.001**		**0.000**		**0.001**			

3.1 Income Group: Low-income

		I-1		I-2		I-3		I-4		I-5		I-6		Overall	
Ref.	**Practices**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
P-1	Preparedness planning	0.440	1	0.522	1	0.460	1	0.499	1	0.486	1	0.499	1	0.481	1
P-2	Cyclone shelters	0.301	2	0.187	3	0.194	3	0.223	3	0.251	3	0.189	3	0.220	3
P-3	Compensation	0.259	3	0.291	2	0.346	2	0.278	2	0.263	2	0.312	2	0.299	2
	CR	**0.002**		**0.015**		**0.000**		**0.000**		**0.000**		**0.000**			

3.2 Income Group: Above-low-income

		I-1		I-2		I-3		I-4		I-5		I-6		Overall	
Ref.	**Practices**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
P-1	Preparedness planning	0.518	1	0.538	1	0.542	1	0.565	1	0.510	1	0.489	1	0.534	1
P-2	Cyclone shelters	0.265	2	0.198	3	0.183	3	0.211	3	0.250	2	0.205	3	0.213	3
P-3	Compensation	0.218	3	0.263	2	0.275	2	0.224	2	0.240	3	0.306	2	0.252	2
	CR	**0.013**		**0.016**		**0.007**		**0.006**		**0.003**		**0.002**			

5. AHP results from questionnaire survey for local government

Table 1 Pairwise comparison of criteria

Ref.	Criteria	Weight	Rank
C-1	Relevance to DRR/CCA	0.399	**1**
C-2	Societal well-being	0.204	**3**
C-3	Societal value	0.397	**2**
	CR	**0.024**	

Table 2 Pairwise comparison of indicators in terms of each criterion

		C-1		C-2		C-3		Overall	
Ref.	**Indicators**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**
I-1	Mental disease	0.116	5	0.149	3	0.132	5	0.129	5
I-2	Malnutrition	0.084	6	0.094	6	0.092	6	0.089	6
I-3	Inaccessible sanitation	0.200	2	0.250	1	0.249	1	0.230	**2**
I-4	Waterborne diseases	0.249	1	0.248	2	0.238	2	0.244	**1**
I-5	Schools discontinued	0.195	3	0.134	4	0.156	3	0.167	**3**
I-6	Children discontinued	0.158	4	0.125	5	0.133	4	0.141	4
	CR	**0.020**		**0.033**		**0.011**			

Table 3 Pairwise comparison of practices in terms of each indicator

Ref.	Practices	I-1		I-2		I-3		I-4		I-5		I-6		Overall	
		Weight	Rank	Weight	Rank	Weight	Rank	Weight	Rank	Weight	Rank	Weight	Rank	Weight	Rank
P-1	Preparedness planning	0.567	1	0.572	1	0.636	1	0.630	1	0.618	1	0.546	1	0.604	**1**
P-2	Cyclone shelters	0.188	3	0.106	3	0.148	3	0.152	3	0.194	2	0.125	3	0.155	**3**
P-3	Compensation	0.245	2	0.322	2	0.217	2	0.218	2	0.188	3	0.329	2	0.241	**2**
	CR	**0.001**		**0.002**		**0.031**		**0.001**		**0.002**		**0.015**			

Appendix III: List of Publications

Chiba, Y., Mori, N. and Shimizu, N. (2017), "Strengthening the Integration of Climate Risks in the Banking Sector", IGES Policy Brief Number 38, Institute for Global Environmental Strategies (IGES), Kanagawa, May.

Chiba, Y. and Prabhakar, S. V. R. K. (2017), "Priority Practices for Addressing Non-economic Loss and Damage caused by Typhoons in Japan : Case Study of Nachikatsuura Town", IGES Research Report, Institute for Global Environmental Strategies (IGES), Kanagawa, 22 May.

Chiba, Y., Shaw, R. and Banba, M. (2017), "Japan's Experiences of Catastrophic Mountain Disasters in Wakayama", in Banba, M. and Shaw, R. (Eds), *Land Use Management in Disaster Risk Reduction,* Springer Japan, Tokyo, pp. 215-235.

Chiba, Y., Shaw, R. and Prabhakar, S. (2017), "Climate change-related non-economic loss and damage in Bangladesh and Japan", *International Journal of Climate Change Strategies and Management,* Vol. 9 No. 2, pp. 166-183.

Non-economic loss and damage in the context of climate change:
Comparative analysis of Wakayama (Japan) and Khulna (Bangladesh)

Yohei CHIBA