RESEARCH REPORT

NO. 2011-RR3

ADAPTIVE CAPACITY OF HOUSEHOLDS, COMMUNITY ORGANIZATIONS AND INSTITUTIONS FOR EXTREME CLIMATE EVENTS IN THE PHILIPPINES

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The intensity of typhoons that enter the Philippine Area of Responsibility has been increasing over the last 50 years. It is therefore imperative to explore how to enhance the adaptive capacity and resilience of vulnerable communities. This study was conducted to analyze the adaptive capacity and adaptation strategies of households, local government units (LGUs) and community organizations (COs) during Typhoon Milenyo (Xangsane). It assessed the barriers that constrain their adoption of recommended adaptation options and recommend measures that could guide the stakeholders to overcome adaptation barriers and enhance resilience.

The data collected through interviews with LGU staff and CO members and survey of households in lowland and coastal communities of Tanauan City and San Juan, Batangas revealed that: a) households have not stepped-up their adaptation strategies to cope with the increasing risks associated with typhoons of increasing intensity; b) COs are willing to help but their participation in disaster risk management has not yet been institutionalized; and c) LGUs recognized that there are other adaptation possibilities that could make the communities less vulnerable to typhoon events. Greater awareness about the climate change phenomena and the need to enhance preparedness and adaptive capacity could help reduce disaster risk.

Published by the Economy and Environment Program for Southeast Asia (EEPSEA)
22 Cross Street, #02-55 South Bridge Court, Singapore 048421 (www.eepsea.org)
Tel: +65-6438-7877, Fax: +65-6438-4844, Email: eepsea@idrc.org.sg

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ISBN: 978-981-08-9694-2

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July 2011

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EEPSEA is supported by the International Development Research Centre (IDRC); the Swedish International Development Cooperation Agency (Sida); and the Canadian International Development Agency (CIDA).

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ACKNOWLEDGEMENTS

We acknowledge the research grant provided by EEPSEA-IDRC that enabled us to undertake this piece of research and the cooperation and assistance extended by the municipal officials of Tanauan City and San Juan, Batangas, barangay officials of Ambulong, Altura, Ticalan and Tipas and the respondent households who shared with us their knowledge and experiences during Typhoon Xangsane (Milenyo).

We also acknowledge the participation of the following research staff of the Institute of Agrarian and Rurban and Development Studies, College of Public Affairs: Ms. Aida O. Grande, Ms. Flordeliza A. Sanchez, Ms. Eldy Z. Martinez, Ms. Susan S. Guiaya and Ms. Sarah Lyn R. Peñalba; and the technical assistance of Dr. Nathaniel C. Bantayan on the use of the Global Positioning System in risk assessment.

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BDCC	Barangay Disaster Coordinating Council
CALABARZON	Cavite, Laguna, Batangas, Rizal, Quezon
CBMS	Community-based Monitoring System
CDCC	City Disaster Coordinating Council
CLUP	Comprehensive Land Use Plan
CSWDO	City Social Welfare and Development Office
CO	Community organizations
CPDC	City Planning and Development Coordinator
CRM	Climate risk management
DBM	Department of Budget and Management
DCC	Disaster Coordinating Councils
DILG	Department of Interior and Local Government
DMP	Disaster Management Plan
DRM	Disaster risk management
ERPAT	Empowerment and Reaffirmation Paternal Abilities Training
FGD	Focus group discussions
IEC	Information, education, and communication
IPCC	Intergovernmental Panel on Climate Change
KALIPI	*Kalipunan ng Liping Pilipina* (Filipino Women‘s League)
KC	Knights of Columbus
KII	Key informant interviews
LDCC	Local Disaster Coordinating Council
LGC	Local Government Code
LGU	Local government unit
MC	memorandum circular
MDCC	Municipal Disaster Coordinating Council
MSWDO	Municipal Social Welfare and Development Office
NDCC	National Disaster Coordinating Council
NIPAS	National Protected Areas System
OCD	Office of Civil Defense
PAGASA	Philippine Atmospheric, Geophysical, and Astronomical Services Administration

PAR	Philippine Area of Responsibility
PD	Presidential Decree
PDCC	Provincial Disaster Coordinating Council
PACD	Provincial Assistance for Community Development
RA	Republic Act
RC	Rotary Club
RDCC	Regional Disaster Coordinating Council
SAFDZ	Strategic Agriculture and Fisheries Development Zone
TFA	Ticalan Farmers‘ Association

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EXECUTIVE SUMMARY

Tropical cyclone is the most commonly occurring natural hazard in the Philippines causing billions of pesos worth in socio-economic losses and other forms of damages. Analysis of 59-year data on Philippine typhoons revealed that their intensity had been increasing, especially since the 1990s. It is therefore important for people, communities, and institutions to enhance their capacity to adapt to typhoon events and improve resilience to their probable risks.

This research work focused on local government units (LGUs), community organizations (COs), and households in the province of Batangas and their experience with Typhoon Milenyo (international name Xangsane) in September 2006. Using data from primary and secondary sources, key informant interviews, and focus group discussions (FGDs), the study assessed their adaptive capacity and how this capacity was translated to adaptation behavior as manifested in their specific responses to Typhoon Milenyo.

The LGUs' response to typhoon and flooding was essentially _relief, rescue, and rehabilitation' in nature. However, they recognized that there were other adaptation possibilities that could make the communities less vulnerable to typhoon events. This indicates some gaps between adaptation practices actually taken and practices recommended but were not done. One acknowledged gap in LGU response was better preparedness to typhoon event, showing the importance of establishing an early warning. This system would inform the public and decision makers about critical adaptation decision points such as what adaptation options are available and what adaptation strategies would be most appropriate. Other recommended strategies are medium to long-term in nature in order to mitigate or prevent damages from future typhoons. Constraints to adoption of more effective adaptation options pertain to weak enforcement of existing policies and standards (e.g., land use policy, building code), which are some of the underlying risk factors that could exacerbate vulnerability of the localities. Other barriers include unclear operational procedures; financial constraints, particularly for long-term and infrastructure development measures; and integration of climate risk management to local development plans.

While LGUs rate their adaptive capacity high, their programs and policies and human resource capability were apparently low. There may be a need to further enhance this capacity for more effective and sustainable adaptation strategies. Partnership with other sectors of society is crucial, thus the current limited role of community organizations should also be intensified.

The second part of the study analyzed the adaptive capacity of households and their experiences and adaptive behavior to deal with the impacts of Typhoon Milenyo. Primary data were generated from personal interviews of lowland and coastal households in two localities of Batangas.

Results of the analysis showed that, overall, lowland and coastal households had the same adaptive capacity index. However, their differences emerged when it came to specific indicators. Lowland households had the highest capacity index in terms of infrastructure, followed by technology, and lowest in terms of social capital. On the other hand, coastal households fared highest in social capital, followed by economic adaptive capacity, and lowest in skills and knowledge.

The damage brought by Typhoon Milenyo varied by sector. The cost of damage to houses was highest in the coastal areas, while agricultural production suffered the most in the lowland areas. Recovery period for majority of affected households was within one month, but agricultural households took a longer period to recover as the income they could have generated from their harvest was lost. During the typhoon, however, there was an increase in fish catch and sales of retail business.

Adaptation strategies of the households to deal with Typhoon Milenyo were mostly structural such as reinforcing their houses and household properties as well as behavioral such as securing food, water, and other household needs including boats and livestock. Some collective action took place in the community particularly after the typhoon as relief operations were mobilized.

Some households were not able to take some possible adaptation options because of financial reasons. Those who were not willing to adopt strategies recommended by experts such as moving to a safer place preferred to stay in their own homes. The awareness of households on climate change-related events has not been always translated to individual actions. The lack of action was not only because of the low adaptive capacity of households but also because of their attitude and perception over climate change-related problems and solutions.

The lessons learned from the Typhoon Milenyo experience showed the importance of disaster preparedness. Households expressed the need for financial assistance and hard infrastructure to deal with typhoon events. However, majority of the respondents "agree" to "strongly agree" that their experience with an extreme typhoon event such as Milenyo was a matter of fate over which they had little control.

The respondents pointed to the role of LGUs in minimizing risks and facilitating rehabilitation recovery, which involve early warning system, information campaign, and monitoring system. Community organizations could also enhance their role in providing assistance in funding, warning system, information dissemination, and rescue and relief operations.

Policymakers need to be aware of the barriers to action and analyze policy options accordingly. Relevant policy areas include communication and public education and institutional capacity building.

1.0 INTRODUCTION

1.1 Rationale

Tropical cyclone is the most commonly occurring natural hazard in the Philippines. A record high of 20 tropical cyclones pass through the Philippine Area of Responsibility (PAR) each year causing billions of pesos in damages. Analysis of 59-year data on tropical cyclones revealed that the intensity of typhoons is getting stronger, especially since the 1990s (PAGASA 2008). Records also show that about 70 percent of the disasters experienced in the Philippines are hydro-meteorological in nature (Hilario 2009). Tropical cyclones account for around 47 percent of the average annual rainfall in the country. It is therefore not surprising if flooding is usually associated with typhoon events. It is important for people, communities, and institutions to develop adaptive capacity to minimize risks, damages, and losses and to enhance resilience to typhoon events.

In 2006, nine of the 20 typhoons that entered the PAR landed/crossed the country. Of these, five were considered deadly including Typhoon Milenyo (international name Xangsane), which stayed in the PAR from September 25-29, 2006. Typhoon Milenyo, the worst typhoon to hit the Philippines in a decade, was classified as Category 4 with a maximum wind of 230 kph. It affected the highest number of municipalities (277) and caused the highest total cost of damages amounting to over PhP6.6 billion (US$0.1375 billion). Southern Luzon was among the hardest hit, particularly the provinces of Laguna, Cavite, and Batangas.

Local government institutions are mandated by law to be in the forefront of disaster risk management (DRM) and climate risk management (CRM). Response to climate-induced events, such as typhoons and the consequent floodings that these may cause, largely depend on the LGUs‘ technical and financial capability, available resources, institutional capacity, attitude, and behavior as well as economic and development preferences of LGU officials. However, responding to climate change events should not be the sole responsibility of the government. Community organizations (COs) can be effective partners of the LGU and the community. Likewise, it is important for individual households to fully understand the potential risks and undertake appropriate response strategies.

In this light, this research work focused on LGUs, COs, and households as they responded to typhoon-associated risks in the Philippines, particularly with Typhoon Milenyo in 2006. Sections 2 and 3 present the methodology and the profile of the study sites, respectively. Section 4 examines the adaptive capacity and adaptation strategies of

LGUs in dealing with typhoon-related risks. It also shows a gap analysis of the LGUs' adaptation behavior by examining their actual adaptation practices before, during, and after the event vis-à-vis recommended strategies. These are the actions, which with the benefit of hindsight, could have been taken and should be taken in the future under similar circumstances, to enhance adaptive capacity and resilience. Section 5 presents the adaptive capacity of households, the impacts of Typhoon Milenyo, adaptation behavior of households, and other adaptation possibilities and constraints**.** Section 6 discusses the role of COs in adaptation to Typhoon Milenyo, and Section 7 presents the institutional challenges and recommended courses of actions.

1.2 Objectives

The research was carried out with the following objectives:

1. assess the adaptive capacity of LGUs and COs using specific indicators, namely: institutions and governance; risk assessment, monitoring, and warning; knowledge, education, and information; climate change adaptation technology and infrastructure; and underlying risk factors;
2. identify the adaptation strategies of LGUs, COs, and households before, during, and after Typhoon Milenyo;
3. identify other possible adaptation options that LGUs could have taken, and analyze gaps between actual and recommended practices and the factors constraining adoption of recommended options; and
4. draw lessons from the Typhoon Milenyo experience and recommend measures that could guide the stakeholders to overcome adaptation barriers and enhance resilience.

2.0 METHODOLOGY

2.1 Study Sites Selection

The selection of study sites underwent several stages and a number of selection criteria. The basic concept of the selection process was to choose the site that is exposed to both physical and outcome risks and where adaptive capacity enhancement would be most meaningful. Based on these principles, the first stage involved the study of Philippine typhoon patterns. Northern Luzon and Bicol provinces are the regions that are most susceptible to typhoons, followed by Central Luzon and the CALABARZON region.

Then, using the National Disaster Coordinating Council (NDCC) data, the extent of typhoon damages were assessed to determine the vulnerable regions. This assessment revealed that the vulnerable region was Southern Luzon because it is relatively more developed and densely populated. In this region, Laguna, Batangas, and Cavite were the provinces that were the mostly affected by typhoons. The next step was to find out which of the municipalities in these provinces incurred major damages in their lowland and coastal ecosystems and kept a good enough record of typhoon-related damages. Only Batangas could provide more detailed information on the extent of damages down to the municipal level. Hence, Batangas province was chosen as the sample province.

Based on secondary data obtained from the Provincial Disaster Coordinating Council (PDCC), the top two municipalities of Batangas that suffered heavy damages from Typhoon Milenyo and where the two types of ecozones (i.e., coastal and lowland barangays) are located were San Juan and Tanauan City (Figure 1). This stage-wise selection process revealed that San Juan and Tanauan City were the most suitable study sites. Forty (40) of the 42 barangays of San Juan and 44 of the 48 barangays of Tanauan City suffered damages in agriculture, fisheries, public and private infrastructures, and livelihood sources when they were hit by Typhoon Milenyo. These municipalities also suffered heavy damages when they were hit by three typhoons in 2006 and one in 2008.

In these two municipalities, two lowland and two coastal barangays that suffered the heaviest losses during Typhoon Milenyo were chosen as the focal study sites. These were Barangays Tipas and Ticalan in San Juan and Barangays Altura Bata and Ambulong in Tanauan City.

Figure 1. Map of the Philippines showing Tanauan City and San Juan, Batangas

Sources of Photos: www.dadomontano.com; www.mapladia.com; www.dbmp.philrice.gov.ph and www.tanauancity.gov.ph

2.2 Data Collection and Analysis

This report covers municipal and community level data collected from LGUs in two municipalities and the COs operating in two coastal and two lowland barangays in the province of Batangas.

Qualitative and quantitative data used in this study were gathered from primary and secondary sources. For the institutional adaptive capacity analysis, primary data were collected through key informant interviews (KII) and focus group discussions (FGD) using pretested questionnaires and interview guides. These involved regional, provincial, municipal, and barangay officials; experts in agriculture, health, engineering; and officers of selected COs.

A total of 20 key informants were interviewed, and 11 FGDs were conducted with a total of 100 participants. These included barangay officials, members of local disaster coordinating councils, and some community residents who were affected by the typhoon (Table 1).

Key informants from the LGUs were asked to rate their adaptive capacity using indicators. To verify and qualify the ratings, follow-up questions on the detailed activities that LGUs undertook were asked. The key informants' perceived performance as revealed by the rating and their response to the follow-up questions were analyzed and compared with the existing literature on adaptive capacity and adaptation strategies. The technical, institutional, social, and economic contexts within which the LGU community and COs operate were considered in the analysis.

Table 1. Number of key informants interviewed and FGD participants, 2009

Institution/Level	No. of Key Informants Interviewed	No. of FGD Participants
Regional office	3	-
Provincial office	-	9
Municipal office	14	21
Barangay officials	-	51
Community organization	3	19
Total	**20**	**100**

Secondary data and information were collected from local government and disaster coordinating council reports. These included: socio-demographic and economic profiles, bio-physical and geographic characteristics, impacts experienced from typhoon (e.g., areas and population affected, extent of damage, revenue loss, costs of mitigation, and adaptation activities); adaptation strategies and reasons for adoption; and policies, programs, and response actions adopted by concerned institutions.

Household data were collected through personal interview of households randomly chosen from the list provided by the barangays secretaries. The barangays were divided into several sitios or villages. The names of barangay residents were first grouped based on the location of their houses to ensure that all sitios would be represented. Using a table of random numbers, the sample respondents were drawn. A total of 100 respondents were drawn from each of the four barangays or a total of 200 respondents per municipality or 400 respondents in all the sites. The household data were analyzed using the SPSS program.

Comparison of adaptive capacity between the two types of ecosystem involved calculation of adaptive capacity index. The individual variables for each indicator were aggregated to a parameter value, and these indicators values were aggregated into an overall index of adaptive capacity. This study adopted the normalization procedure

applied for the Human Development Index (HDI) by the United Nations Development Program (UNDP) (cited in Swanson et al. 2007) as shown in the following equations:

$$Normalized\ value_{(Where\ higher\ is\ better)} = \frac{Value\ of\ the\ indicator\ to\ be\ normalized\ -\ Minimum\ value\ of\ all\ indicators}{Maximum\ value\ of\ all\ indicators\ -\ Minimum\ value\ of\ all\ indicators}$$

$$Normalized\ value_{(Where\ lower\ is\ better)} = 1 - \frac{Value\ of\ the\ indicator\ to\ be\ normalized\ -\ Minimum\ value\ of\ all\ indicators}{Maximum\ value\ of\ all\ indicators\ -\ Minimum\ value\ of\ all\ indicators}$$

Each variable within an adaptive capacity determinant (indicator) was considered to be of equal importance. Based on this assumed weighting, a single aggregated value for the indicator was calculated as the average of the normalized values of the different variables for each indicator. Each indicator was also considered to be of equal importance in calculating the overall adaptive capacity index for each area. Based on this assumed weighting, a single overall adaptive capacity index for each area was calculated as the average of the aggregated indicator values.

Analysis of the adaptive capacity index for the indicators was taken from a relative perspective, i.e., ranking. The ranking relative to each other was helpful in identifying which areas appeared to be fairing well with respect to adaptive capacity. The scores were between 0 and 1 with 1 signifying that an area had the highest value for this indicator compared to all other areas. A score of 0 signified that the area had the lowest indicator value compared to all other areas.

To determine vulnerability of the households, impacts of typhoons were estimated based on costs of damage to household properties, production activities, livelihood sources, and health and safety. Adaptation strategies of households to deal with the climate event were classified as behavioral, structural, technological, and financial. Other adaptation possibilities not taken by the households and the barriers to adoption of other options were identified. These were identified to analyze adaptation gaps and to determine possible interventions for the improvement of the households‘ adaptive capacity and resilience to typhoons.

2.3 Theoretical Framework

Adaptive capacity is the property of a system to adjust its characteristics or behavior in order to expand its coping range under existing climate variability or future climate conditions (Brooks and Adger 2005). It is also described as its ―. ability to design and implement effective adaptation strategies, or to react to evolving hazards and stresses so as to reduce the likelihood of the occurrence and/or the magnitude of harmful outcomes resulting from climate-related hazards.” The adaptation process requires the capacity to learn from previous experiences to cope with current climate, and to apply these lessons to cope with future climate, including surprises.” Adaptive capacity can be expressed as actions that can lead to a system‘s adaptation, enhance its coping capacity, and increase its coping range – thereby, reducing its vulnerability to climate hazards.

Adaptive capacity is influenced by certain key factors such as economic and natural resources, social networks, entitlements, institutions and governance, human resources, and technology (IPCC Working Group II, Fourth Assessment Report cited in

Adger et al. 2007). Stakeholder participation is also important in the development of local-level indicators of adaptive capacity because local people are generally the best equipped to identify factors that facilitate and constrain their own adaptation. At the household level, adaptive capacity indicators used in this study included infrastructure, economic, technology, social capital, and skills and knowledge. Households' endowments of these resources would bear on the impacts of climate hazards experienced by the households (Table 2).

Table 2. Indicators of households' adaptive capacity

Indicator	Indicator Variable	Rationale
Infrastructure	- House ownership - Degree of permanence - No. of storey	- Characteristics and location of infrastructure affect adaptive capacity, i.e., permanent construction materials enhance adaptive capacity. - Ownership of house and lot can enhance adaptive capacity.
Economic indicators	- Area and ownership of land (residential, farm) - Ownership of other assets (e.g., vehicle) - Household income and sources - Credit sources	- Greater economic resources increase adaptive capacity. - Lack of financial resources limits adaptation options. - Greater financial assets mean more ability to recover from material loss. - Diverse employment opportunities provide more options if climate affects particular type of occupation.
Technology	- Availability and accessibility of shelter - Household willingness to evacuate to shelter - Sources of information on climate-related events	- Lack of technology limits range of potential adaptation options. - Access to technology, e.g., shelter, information sources can enhance adaptive capacity. - Effective communications services guarantee faster response from within and without. - Greater access to information increases likelihood of timely and appropriate adaptation.
Social capital	- Membership in community organization - Sources and type of assistance available to households - Interaction in the community on climate-related and other issues	- Social/organization relations help reduce impacts of climate-related risks, and therefore increase adaptive capacity. - Community-based participation can enhance adaptive capacity. - Connections/networks facilitate information flow and may enhance community access to assistance.
Skills and knowledge	- Attendance in training in disaster preparedness - Knowledge gained and usefulness of training - Indigenous knowledge	- Training and skill development can enhance adaptive capacity. - Greater access to information increases likelihood of timely and appropriate adaptation.

Note: Adapted from Swanson et al. 2007

Adaptation does not occur instantaneously. There are two types of adaptation: proactive and reactive (Burton et al. 2006). A proactive approach aims to reduce exposure to future risks, for instance, by avoiding development on flood-prone lands. A purely reactive approach aims only to alleviate impacts once these have occurred, for instance, by providing emergency assistance to flood victims. As a general rule, adaptation decisions should prioritize proactive actions to reduce future risk. However,

because significant risks remain, reactive approaches to help vulnerable populations recover from unavoidable impacts should also be provided.

When a reactive response perpetuates or exacerbates exposure to climate risks, for instance, by assisting reconstruction in a flood-stricken area, it might be termed ―maladaptation". Maladaptation is an action or process that increases vulnerability to climate change-related hazards. Maladaptive actions and processes often include planned development policies and measures that deliver short-term gains or economic benefits but lead to exacerbated vulnerability in the medium to long-term (UNDP 2009).

The vulnerability or potential vulnerability of a system that is associated with anticipated hazards and future risk depends on its ability to institute appropriate long-term adaptation measures. However, instantaneous vulnerability to hazards that may occur in the immediate future is related to a system's existing short-term coping capacity rather than its ability to pursue long-term adaptation strategies (Brooks and Adger 2005).

In the literature, preparedness to address climate change impacts refers to a process of ensuring that an organization: 1) has complied with the preventive measures; 2) is in a state of readiness to contain the effects of a forecasted disastrous event to minimize loss of life, injury, and damage to properties; 3) can provide rescue, relief, rehabilitation, and other services in the aftermath of the disaster; and 4) has the capability and resources to continue to sustain its essential functions without being overwhelmed by the demand placed on them.

Some principles play an important role in defining emerging preparedness: 1) it is the responsibility of all; 2) it should be woven into the community and administrative context, and be undertaken at all administrative levels of both government and non-government organizations; 3) it should not be done in isolation but integrated in the management system; and 4) it should not concentrate only on disasters but integrate prevention and response strategies for any scale of emergency (UNHCR and NDCC 2003).

A person's behavior towards all environmental issues is a result of the interaction of several factors. Environmentally-relevant behavior at a given time is affected most directly by: a) a person's emotions (concern, anger, shame) about the conditions of the environment; b) the expected benefits and/or costs of specific actions; c) his/her perceived ability to take specific types of actions; and d) his/her habits with respect to various actions (Patchen 2006).

These variables are likely to be affected, in turn, by the person's appraisals of the situation (the seriousness of environmental problems, what others are doing, and the effectiveness of alternative actions). For example, a person who believes that climate change will bring flooding to his/her coastal city is likely to be fearful about this prospect, and therefore, will act accordingly (Patchen 2006).

Global awareness of climate change has constantly increased, but this has not been translated to individual actions largely because people are confused over climate change causes and solutions. This ―green gap" in public attitudes partly stems from how climate science is communicated and how our minds' (mis)understand climate dynamics. The multi-stakeholder nature of adaptation to climate change implies that the solution

rests not on a single actor but is a concern of all affected sectors. An added challenge to environmental behavior modification is how a person perceives the problem (Liverani 2009).

It has also been shown that understanding a problem does not always lead to action. Knowledge is mediated through value systems shaped by psychological, cultural, and economic factors that determine whether we act or not. People are particularly good at acting upon threats that present themselves as unexpected, dramatic and immediate, rather than problems which emerge and develop slowly and gradually (Liverani 2009). In other words, people act upon threats that can be linked to a human face—that show obvious links to human health and that challenge our moral framework involving human action to a recent personal experience. The slow-changing quality of climate change, as well as the delayed, intangible, and statistical nature of its risks, simply do not –move people".

Behavioral economics shows that features of human decision making under uncertainty tend to constrain man's instinct to adapt. Man generally favors the status quo and agree only to make small incremental adjustments to it, and strongly discount future events to assign higher priorities to spatially and temporally closer problems. For instance, the public tends to be mobilized by –visible" environmental problems (urban air pollution) and not by less visible ones (groundwater pollution).

According to Liverani (2009), knowledge about climate change is not always expected to lead to action for several reasons: 1) people prioritize between a set of needs, and 2) people assess both the market and non-market implications of their decisions. Further, he said that the very act of _interpreting' or _mediating' adaptation needs is costly. To make rational decisions, individuals and communities facing adaptation choices incur transaction costs collecting and interpreting new and additional information. For a household having to decide whether to keep rebuilding on a flood-prone area, these costs can be real and substantial. The same can be said for a local authority official in charge of designing and enforcing building codes in low-lying coastal areas.

Policymakers need to be aware of these barriers to action and treat policy options accordingly. Three policy areas are relevant here: communications, institutional measures, and social norms. Well designed climate communication campaigns that address individuals as members of a local community—and not powerless members of an unmanageably large group—can empower them to act (Liverani 2009).

Institutional measures. Beyond communication, a key question for climate policy is to design interventions that take into account psychological and social constraints to positive action. The design of effective adaptation interventions should include institutional measures reducing the transaction costs for individuals in making decisions while enhancing the ownership of the information available. This would require adaptation strategies to be informed by the communities' own perceptions of risk, vulnerability, and capacity. The institutionalization of participatory self-assessments for national and local disaster preparedness, adaptation planning, and mitigation targets can be useful in this (Liverani 2009).

Social norms. Social norms are established patterns of behavior that most people approve of—or the yardstick individuals use - to assess the appropriateness of their own behavior. As they shape human action, social norms can achieve socially desirable outcomes, generally at a fairly low cost. The basic idea is that individuals want to act in a socially acceptable way. We tend to follow the lead of others, particularly when the others are numerous and appear similar to them (Liverani 2009).

Social norms have a particularly strong impact on recipients under conditions of uncertainty. Rather than look for clues about how to behave when unsure about conduct and outcomes, people rely on what others do. Evidence from different environmental contexts shows that social norm-based appeals for pro-environmental behavior are superior to traditional persuasive appeals. The use of social norms has traditionally been neglected in public policy in favor of more standard measures, such as regulation, taxation, and pricing (Liverani 2009).

3.0 PROFILE OF STUDY SITES, IMPACTS AND LOSSES

3.1 Profile of Study Sites

3.1.1 San Juan, Batangas

The municipality of San Juan is located in the southern tip of Batangas province. It has a total land area of 27,340 ha, the second biggest municipality in the province of Batangas (Table 3). The town‘s population in 2007 was 87,276 and the total number of household was 20,314. Aside from farming, fishing was also a major industry in the municipality, with 16 coastal barangays depending on the industry for livelihood. The major crops planted were rice, corn, coconut, banana, mango, and various kinds of vegetables. The study barangays in San Juan are Barangay Ticalan (located along the coast of Tayabas Bay) and Barangay Tipas, a lowland barangay, traversed by a big river system. In 2007, Barangay Ticalan had a total land area of 459 ha and a population of 1,773. Barangay Tipas is smaller, covering 197.87 ha, but it had a bigger population of 2,867.

Table 3. Profile of the study areas

Item	San Juan			Tanauan City		
	Total for San Juan	Bgy. Ticalan	Bgy. Tipas	Total for Tanauan	Ambulong	Altura Bata
Ecosystem	Coastal Lowland Upland	Lowland	Coastal (along Tayabas Bay, with river, creek	Coastal Lowland Upland	Lowland (generally flat)	Coastal (along Taal lake)
Land area (ha)	27,340	459	197.878	10,716	220	216
Physical feature	Low flat land to rolling to mountain-ous	Coastal (along Tayabas Bay, with river, creek	Lowland	Gently sloping	Coastal (along Taal lake)	Lowland (generally flat)
No. of barangays/ ~~–si~~tio/puroks"	42 bgys	7 sitios	7 sitios	48 bgys	7 puroks	4 puroks
Total population (2007 census)	87,276	1,773	2,867	142,537	5,461	1, 203
Total number of households	20,314	383	542	21,912	1,135	239
Public means of transportation	Tricycle, jeepney, and bus	Tricycle, jeepney, and bus	Tricycle and jeepney	Jeepney, tricycle, and van	Jeepney and tricycle	Jeepney, tricycle, and van
Main source of income	Farming and fishing	Farming	Farming and fishing	Farming and fishing	Farming	Fishing

Sources of data: Annual Report of San Juan; Comprehensive Land Use of Tanauan City; Bgy. Socio-Economic Profile and Development Plan of Ambulong and Altura Bata; Tanauan City.

3.1.2 Tanauan City, Batangas

Tanauan City is strategically located near major growth centers such as Metro Manila and Batangas City, which have influenced its urbanization. It has a total land area of 10,716 ha with 48 barangays. A total of 142,537 residents and 21,912 households were living in the city as of 2007. The major sources of livelihood were farming and fishing, while others were industrial and commercial activities.

The study barangays in Tanauan City were Barangay Altura and Barangay Ambulong. Barangay Altura is a lowland barangay that is traversed by a big river and is located at the foot of Tagaytay Highlands. It has a total land area of 216 ha and a total population of 1,203 in 239 households. Ambulong is a coastal barangay located along the coast of Taal Lake. It is almost the same in size as Barangay Altura with 220 ha, but it was more densely populated in 2007 with 5,461 people.

3.2 Impacts of Typhoon Milenyo in the Study Areas

Typhoon Milenyo in 2006 brought an estimated damage of PhP6.6 billion (US$0.1375 billion) in the Philippines (NDCC n.d.). Batangas province was one of the provinces severely hit by Milenyo, affecting 34 municipalities and over 4,700

households. Agriculture was the most severely affected representing 90 percent of the estimated total damage of PhP0.485 billion.

3.2.1 Vulnerable areas and sectors

The lowland and coastal ecozones in the two LGUs are said to be the most vulnerable to typhoons. Lowland barangays located along river systems and urban centers are exposed to flooding associated with typhoon and heavy rainfall. Agricultural lands in upland and rainfed areas are also sensitive to climate variability and its associated water and temperature stress. Vulnerable areas are farmlands and settlement sites located in areas traversed by rivers and coastal barangays located along the shores of San Juan River and Taal Lake in Tanauan City. These areas are quite sizeable considering the big river systems that traverse San Juan and Tanauan City.

The geophysical condition of the two municipalities expose them to hydro-meteorological-related hazards. Several river systems traverse the inland barangays, while the coastal barangays located along the shores of San Juan and Taal Lake in Tanauan City are exposed to heavy windstorm and storm surges.

During Typhoon Milenyo, some lowland areas in San Juan and Tanauan City were flooded. Coastal barangays were exposed to windstorm. Strong winds damaged several houses, fishing boats, and fish pens in San Juan strong winds.

The farmers, fisherfolks, and residents of low lying areas are considered as the most vulnerable sectors in both municipalities because their livelihood sources are very dependent and sensitive to climatological factors, particularly flooding.

3.2.2 Losses incurred

More than 90 percent of all barangays in both municipalities suffered damages from Typhoon Milenyo. Almost the same number of families was affected, the number of persons affected in San Juan is slightly higher. The number of partially damaged houses was almost the same but the number of totally damaged houses was higher in Tanauan City. Unfortunately, one person died in San Juan (Table 4). Classes in San Juan were suspended for two days, and it took 1 to 14 days to restore electric power services in various parts of the town.

Table 4. Losses/damages incurred because of Typhoon Milenyo, San Juan and Tanauan City, Batangas, 2006

Item	San Juan	Tanauan City
No. of barangays affected	40	44
No. of families affected	2,038	2,956
No. of persons affected	10,635	12,174
No. of dead persons	1	-
No. of injured persons	-	2
No. of houses partially damaged	1,874	1,791
No. of houses totally damaged	164	289
No. of days classes were suspended	2 days	-
No. days electric power was disrupted	1-14 days	-

Source: Batangas PDCC

There is a wide difference in terms of total value of losses reported by the two LGUs (Table 5). The total value of losses incurred by San Juan is more than two times higher than that of Tanauan City. Agriculture suffered the most in both sites, particularly for rice, corn, fruits, and vegetable areas. Livestock accounted for the greatest value of losses in San Juan (USD250,000) while crop losses ranked first (USD228,274) in Tanauan City. Damage to infrastructure was reported only in San Juan.

Table 5. Estimated cost of damage brought by Typhoon Milenyo, 2006

Item	Cost of Damage			
	San Juan		Tanauan City	
	PhP	USD	PhP	USD
Crops	10,402,957	216,728	10,957,178	228,274
Livestock	12,000,000	250,000	420,000	8,750
Infrastructure	3,000,000	62,500	-	-
Total	**25,402,957**	**529,228**	**11,377,178**	**237,024**

Source: PDCC
Note: Exchange rate: US$1 = PhP48

In terms of land area and value of losses, banana was the most adversely affected by Typhoon Milenyo in San Juan (Table 6). A total of 804.5 ha of banana plantation was affected. About 30 percent of the expected yield with the total expected value of about PhP4.827 million (US$0.1006M) was lost.

Losses to coconut farmers was relatively low at PhP253, 200 (US$5,275), but the long-term impact of the typhoon was quite significant. Coconut flowers and young fruits are very sensitive and easily destroyed by strong winds, so it is not uncommon for the recovery period to last for two to three years. In San Juan, coconut trees have not yet fully recovered since Typhoon Milenyo that hit the area three years ago.

Huge losses were also incurred by many mango growers. However, recovery period for mango is relatively shorter than coconut and other fruit trees because mango flowering can be chemically-induced.

Based on total value of losses and the necessary recovery period, the impact on vegetable farmers in both San Juan and Tanauan City appears small. But since vegetable farming is a supplementary livelihood source for the small farmers in both municipalities, its poverty impact was quite significant.

Typhoon Milenyo also threatened the food security base of San Juan. About 148 ha of rice lands operated by about 100 farmers were affected. Fortunately, some of the rice plants were able to recover and only 30 percent of the expected yield with an expected value of about PhP606, 370 (US$12,633) was lost.

In Tanauan City, orchard growers and corn farmers suffered the highest value of losses from the typhoon. A total of 271 vegetable and 66 corn farmers reported total damages of about PhP796,500 (US$16,594) and PhP481,518 (US$10,032), respectively. The socio-economic implications to corn farmers are enormous because they plant only one crop per year on rainfed farms. Vegetable farming is a supplementary income source. Hence, corn farmers have to wait for the next rainy season to be able to resume their farming operations.

Table 6. Estimated value of crop losses because of Typhoon Milenyo, San Juan and Tanauan City, Batangas 2006

Crop	San Juan				Tanauan City			
	No. of affected farmers	Area planted	% yield loss/ha	Value	No. of affected farmers	Area planted	% yield loss/ha	Value
Rice	--	148	30	606,370 (US$12,633)	23	23.5	20	64,187 (US$1,337)
Coconut	--	21	--	253,200 (US$5,275)	--	--	--	--
Rambutan	--	--	--	--	38	14	80	560,000 (US$11,667)
Mango	--	5.25	100	105,000 (US$2,188)	98	42.5	80	748,000 (US$15,583)
Tamarind	--	20	30	129,000 (US$2,687)	--	--	--	--
Lanzones	--	--	--	--	17	60.5	80	2.42M (US$0.0504 million)
Assorted vegetables	--	43	80	387,000 (US$8,062)	271	88.5	60	796,500 (US$16,594)
Others (Corn, banana, chico, calamansi, avocado, jack fruit, and papaya)	--	830	10-30	4.859 million (US$0.1013 million)	199	102	60-100	818,718 (US$17,057)

Notes: 100% of all planted areas were affected but with chances of recovery except the mango areas.
Exchange rate: US$1 = PhP48
Source: PDCC, Batangas

4.0 ADAPTIVE CAPACITY AND ADAPTATION STRATEGIES OF LOCAL CRM INSTITUTIONS

4.1 Adaptive Capacity of Local Institutions

The indicators used to assess adaptive capacity of LGUs were the following: a) institutions and governance; b) risk assessment, monitoring, and warning; c) knowledge, education, and information; d) climate change adaptation technology and infrastructure; and e) underlying risk factors.

The local government officials involved in DRM were asked to assess the LGUs' adaptive capacity to climate change impacts. The staff of the Provincial Assistance for Community Development (PACD) were also asked to rate the adaptive capacity of the LGUs in the study municipalities. Not surprisingly, the municipal officials ranked themselves high (i.e., 4 or 5) in many aspects, not because they wanted to simply project a good image but because they perceived themselves to have high adaptive capacity based on their appreciation of appropriate response actions. On the other hand, the PACD staff who have greater exposure to DRM protocols generally gave the two LGUs lower adaptive capacity rating.

4.1.1 Institutions and governance

The institutions' governance capability was assessed using several indicators, namely: frameworks and structures, programs and policies, financial capability and human resource capability.

San Juan's rating of its capacity indicator of institutions and governance was relatively higher than that of Tanauan City. Key informants of San Juan rated their adaptive capacity from 4 to 5, while those in Tanauan City rated theirs from 3 to 4. San Juan respondents recognized that they have some limitations in frameworks and structures; effectiveness of organizations in performing their tasks, programs and policies; and human resources. However, they believed that they have adequate financial capability as well as satisfactory, sustainable, and effective resource generation measures in place.

On the other hand, key informants in Tanauan believed that their frameworks and structures, financial capability, and human resource capability were satisfactory, although with some limitations (rating= 4). They recognized that while they might have some CRM programs and policies, they needed to improve their responsiveness. The PACD staff also recognized that the CRM frameworks and structures in the two municipalities were quite effective, but they still have serious limitations in terms of programs and policies, financial capability, and human resource capability (Figure 2).

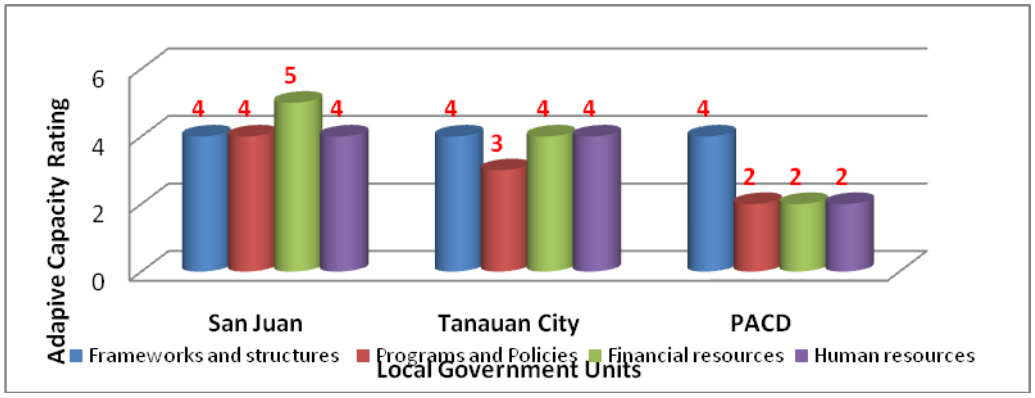

Figure 2. Adaptive capacity rating of LGUs in terms of institutions and governance

4.1.1.1 Frameworks and structures for disaster risk management

The Philippines has a set of well established disaster risk management procedures and structures, which involve all levels of government and all relevant government agencies. Disaster risk management is said to be a priority concern of the LGUs, which gave them a general perception that they have effective frameworks and structures. However, some conceptual and operational issues have to be clarified before these LGUs can effectively respond to climate change-related events.

The key informants in San Juan and Tanauan City rated themselves high in frameworks and structures for disaster risk management (Figure 3). They have an organization within the LGU that effectively discharged DRM functions and responded to CRM concerns. These organizations called the local disaster coordinating councils (LDCCs) used a DRM manual issued by the Office of Civil Defense (OCD) as a guide in responding to all types of disasters.

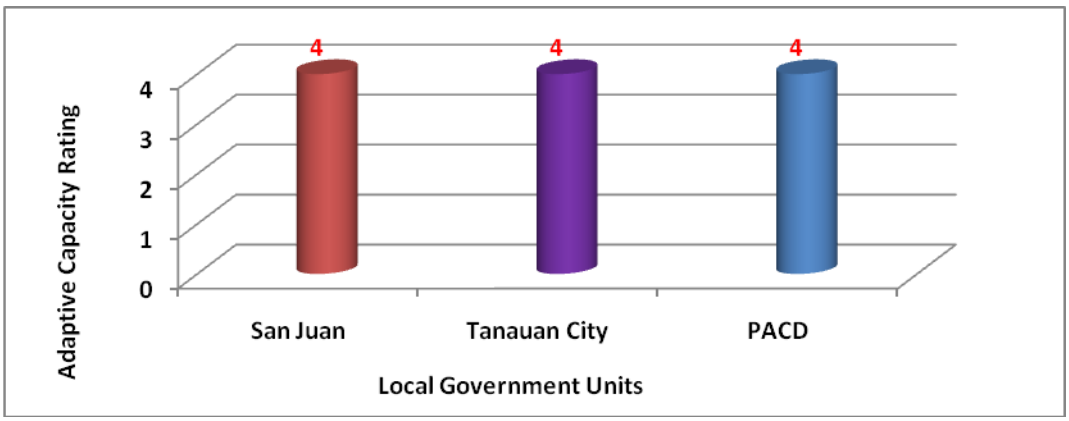

Figure 3. Adaptive capacity rating of LGUs‘ frameworks and structures

The fundamental basis for DRM in the Philippines is outlined in Presidential Decree (PD) 1566 (1978), which aims to ―strengthen the Philippines‘ disaster control capability" and establish the National Program on Community Disaster Preparedness. PD 1566 mandated the creation of disaster coordinating councils at all government levels (national, regional, provincial, municipal/city, and barangay). The National Disaster Coordinating Council (NDCC) is chaired by the Secretary of National Defense, while the OCD Administrator serves as its Executive Officer. Eighteen major government departments represented by the department secretaries, are

designated as NDCC members, and they perform functions related to their mandates and sectoral concerns.

The salient features of PD No. 1566 are as follows:

1. Promotion of self-reliance and mutual assistance among local officials and their constituents
2. Emphasis on disaster preparedness
3. Organization of the national, regional, provincial, municipal/city, and barangay DCCs
4. Mobilization of all government agencies and delegation of disaster response leadership through local government authorities
5. Conduct of periodic drills and exercises by concerned agencies/DCCs
6. Authorization of LGUs to program funds for disaster preparedness activities
7. Preparation and updating of a National Disaster and Calamities Preparedness Plan
8. Documentation of disaster preparedness plans at all government levels

In compliance with PD 1566, both San Juan and Tanauan City have organized their respective LDCCs. The Municipal/City Mayor serves as the LDCC Chair assisted by the Chief of Police assigned in the Municipality/City as his deputy. The chief of the municipal/city social welfare department is deputized as City Disaster Coordinating Council (CDCC) Coordinator and his/her office is used as the operations center during disasters. All organic municipal officials, as well as all national officials working at the municipal level are members of the local DCCs.

The disaster operation center in both San Juan and Tanauan City was housed under the local Social Welfare and Development Office (SWDO). The local SWD officer was deputized as LDCC Coordinator and assisted by the other LGU departments. This organizational structure indicates that the LGU‘s response action is primarily reactive and oriented for relief and rescue rather than proactive and oriented for preparedness. Some of the LGU staff, including the barangay coordinating councils, have attended a training related to disaster management.

All the personnel who worked on DRM activities were full-time staff members of the various LGU departments, but they were seconded to the LDCC to perform DRM functions in times of calamities. The Tanauan City SWDO has suggested the creation of a disaster operations center as a separate unit and the appointment of a full-time DRM officer. However, the local legislative body has not yet acted on this recommendation.

The social/organizational network of an LGU also indicates how it links with other possible partners in addressing climate change. LDCC is composed of 10 task units, which include: 1) communication and warning; 2) transportation; 3) evacuation; 4) rescue and engineering; 5) health; 6) fire; 7) police; 8) relief; 9) rehabilitation; and 10) public information. Other social and civic organizations, non-government organizations, and the private sector also assisted the LDCCs in times of disaster. The LDCC has supervisory power over the BDCC and reported to the PDCC about the nature and extent of typhoon damages within their political jurisdiction.

Effectiveness of Organizations

The key informants generally believed that the LDCCs were effective in performing their tasks. They rated the LDCCs high (4) although these still had limitations in capacities and resources. Accordingly, the councils had enough funds to provide relief to affected population and to inform the public about the impending typhoon. The LDCC were able to mobilize all the LGU personnel to respond to emergencies, set up evacuation centers, and stock up relief goods for the evacuees.

In San Juan, the factors that enhanced the LDCCs' effectiveness were adequate funds; skilled manpower; full administrative support from the LGU; and good coordination between teams/units. In Tanauan City, adequate funds enhanced the LDCCs' effectiveness, while the PACD staff considered good community cooperation and coordination between teams/units as enhancing factors, which facilitated disaster information dissemination, timely evacuation, and minimal casualties and damage to properties.

The factors that constrained the effectiveness of San Juan's DCC was the lack of equipment for risk monitoring and relief operations. Key informants from Tanauan City, on the other hand, pointed to the lack of coordination between the tasks units as their major constraint. In Tanauan, key informants from PACD likewise considered lack of funds and inadequate preparedness against strong typhoons like Milenyo as the LGUs' major constraints.

4.1.1.2 Programs and policies

Key informants from Tanauan City rated their programs and policies low (3) because adaptation to climate change-related event has not yet been incorporated in their overall planning. For instance, some of the institutional changes recommended by the deputized DRM officer regarding the creation of a distinct DRM office with full-time staff and budget to prepare DRM plans have not yet been approved by the local legislature. They also believed that much should still be done in formulating and implementing appropriate DRM programs, such as the relocation of people living in river banks and the enforcement of a building code.

Key respondents from San Juan gave a relatively higher rating (4), indicating that adaptation programs have already been integrated in their development plan. However, this perception was countered by the key informants from the PACD who believed that integration was quite limited in both LGUs (Figure 4).

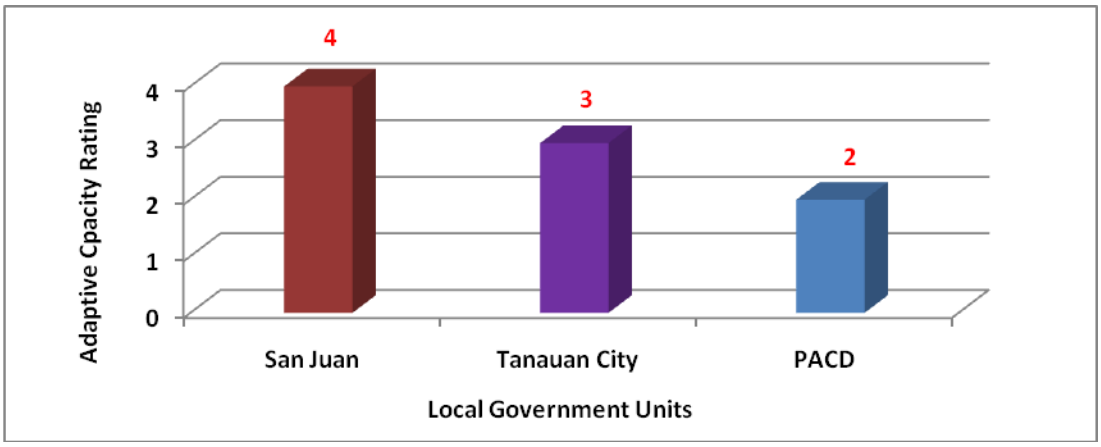

Figure 4. Adaptive capacity rating of LGUs' in terms programs and policies

Republic Act (RA) No. 7160 of 1991, also known as the Local Government Code, is one of the legal bases of the LGUs in utilizing funds related to natural calamities such as typhoon. This code stipulates that the LGUs shall set aside 5 percent of the estimated revenue from regular sources as annual lump sum appropriation for unforeseen expenditures resulting from calamities in areas declared by the President in a state of calamity. This implies that Calamity Fund release can be authorized only if the President has declared an area/city/municipality under calamity based on certain criteria, one of which is the extent of damage. The authority to declare the "state of calamity" was transferred from the President to the local legislature by virtue of RA 8185 of 1996, which in effect empowered the LGU to act or respond immediately. Thus, resource mobilization, particularly those that will require budget disbursement, was facilitated.

On March 20, 2003, joint Department of Budget and Management (DBM)-DILG Memorandum Circular No. 2003-1 was issued allowing the use of local "calamity fund" for disaster preparedness and other pre-disaster activities provided that the *Sanggunian* shall declare an imminent danger of calamity. This implies that the calamity fund could be used not only after a climate disaster event but also for pre-disaster or 'preparedness' activities such as training and information, education, and communication (IEC) campaigns. However, LGUs were hesitant to use the Calamity Fund for disaster preparedness for fear that they may be charged with technical malversation. Some state auditors believed that disaster preparedness was not identified in RA 7160 and that another law had to be passed revising the specific provisions of RA 7160 because an executive order could not repeal a law.

LGUs have crafted a Disaster Management Plan (DMP), also in compliance with PD 1566 that was consistent with the Batangas Provincial Disaster Preparedness and Mitigation Manual. The manual contains the duties and responsibilities of the DCC members, the principles and guidelines for disaster management approaches, and the procedures for contingency planning.

The LGUs also have prepared the Comprehensive Land Use Plan (CLUP) that should guide local development planning and take CRM into consideration. Further, the LGUs have crafted the Building Code to regulate the construction of infrastructure, houses, and buildings and to ensure building safety and standards. This code had to be strictly enforced, particularly in flood-prone areas to mitigate potential losses and damages.

Other DRM programs concerned IEC in order to raise the awareness and improve the response capability not only of the LDCC members but also of the community.

Recognizing the urgency to lay down CRM procedures, the Department of Interior and Local Government (DILG) issued memorandum circulars to raise climate change awareness and enhance the CRM capability of LGUs.

4.1.1.3 Financial resources

The key informants rated their LGU's financial capability as high. San Juan respondents believed that satisfactory, sustainable, and effective measures were already in place to ensure their financial capability for DRM. San Juan was able to meet its financial requirements in 2006 even though four typhoons hit the municipality. Tanauan City respondents had a slightly lower rating (4) because they

perceived some limitations in capacities and resources (Figure 5). For instance, they encountered some financial problems in responding to Typhoon Milenyo. Key informants from the PACD also rated Tanauan City's financial capability as low (2).

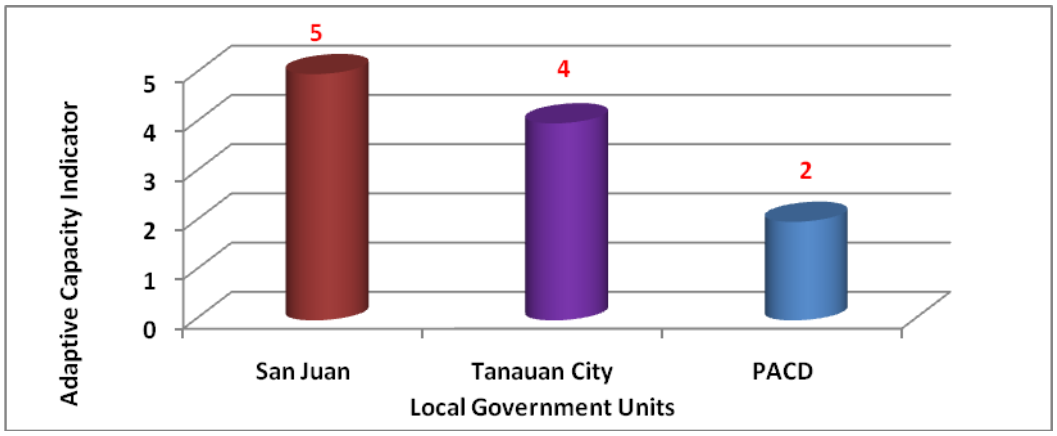

Figure 5. Adaptive capacity rating of LGUs' in terms of financial resources

Institutional measures have been set up to enable the LGUs to access additional calamity fund from internal and external sources. When the LGUs' Calamity Funds have been used up, the local legislative body had the authority to allocate supplemental budget. The LGU could also request the provincial and national governments for additional financial assistance to augment their own Calamity Fund.

4.1.1.4 Human resources

The PACD supports LGUs in the enhancement of human resource capability. Both San Juan and Tanauan City key informants rated their LGUs high (4) in this aspect (Figure 6). Each of the LGUs had 10 task units, each of which was composed of three personnel who could be mobilized to perform DRM activities. In addition, the BDCC with its full complement of barangay councilors and police, were also mobilized to disseminate information and help in evacuation and relief operations.

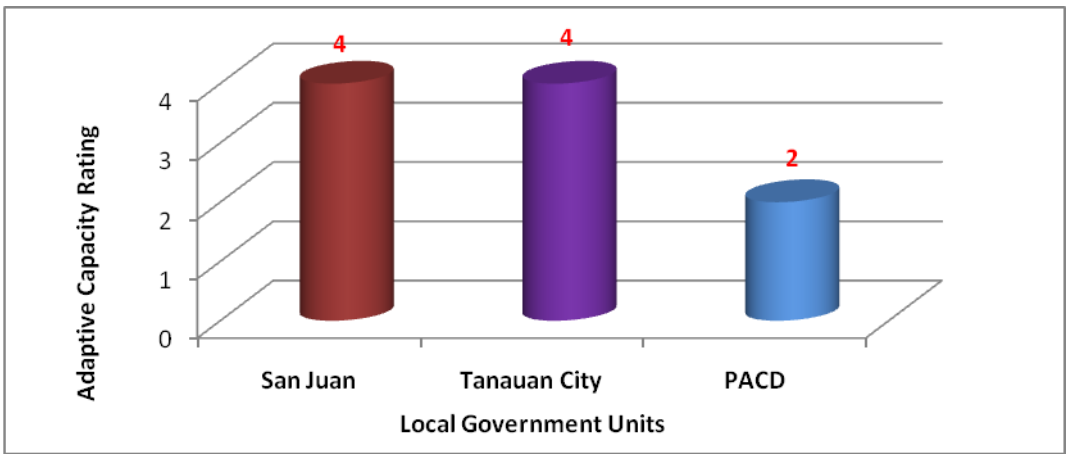

Figure 6. Adaptive capacity rating in terms of human resource capability

However, the level of awareness and technical skills of the LDCC members and that of the community were quite low. Of the 64 LDCC members, only 10 or 15.6 percent have attended DRM seminars. Six San Juan DCC staff attended a three-day

seminar on disaster management conducted in Malaysia and a climate change awareness-raising seminar conducted by UPLB (Figure 7). On the other hand, two Tanauan City DCC and two PACD staff attended a disaster preparedness training conducted by NDCC, RDCC ,and PDCC. Tanauan City SWDO, in turn, conducted DRM seminars on disaster preparedness and management and disaster response action for barangay officials and volunteers as well as the general public.

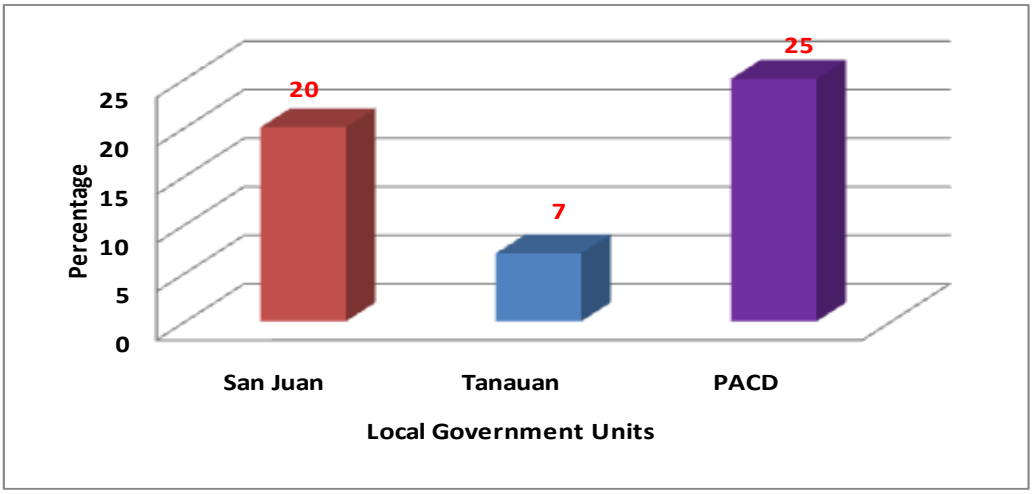

Figure 7. Proportion of LDCC staff who have attended a DRM seminar

4.1.2 Risk assessment, monitoring, and warning

Key informants again differed in rating their capability in risk assessment, monitoring, and warning (Figure 8). They rated San Juan relatively higher (4) than Tanauan City (3), while key informants from PACD maintained the low rating (2) of the LGUs. Not one of the LGU had a hazard map or a localized risk monitoring system to determine vulnerable areas and the necessary adaptation strategies and adaptive capacity that should be enhanced.

The LGU of San Juan claimed to have effective early warning systems in place and to have carried out climate change-related risk assessments. Their only limitation, according to the key informants was that they still needed to enhance their risk management systems to regularly monitor hazards and risks. These claims, however, were not supported by documentary evidence. The LGU had no hazard map, and its early warning system consisted of typhoon warnings using information from the mass media.

On the other hand, the LGU of Tanauan City reported serious constraints in all the three components of this adaptive capacity indicator. The key informants were aware of the vulnerable areas and sectors in their municipality, but based merely on past experiences. Further, these information were collected only as supporting documents for auditing calamity fund disbursement and not systematically documented and stored. Report on the sectors affected and value of losses/damages caused by Typhoon Milenyo, for example, were stored in the LGUs‘ store room and were not easily retrievable.

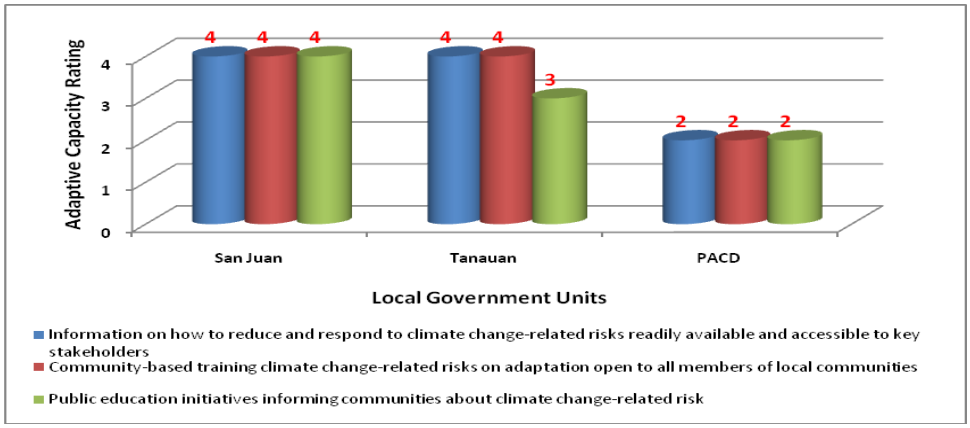

Figure 8. Risk assessment, monitoring, and warning capability of LGUs

The LGUs also had limited access to climatological and hydrometeorological data and information. For instance, while the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA) has a synoptic station in Tanauan City, weather observations (atmospheric pressure, wind direction and speed, air temperature, humidity, clouds, precipitation) were transmitted to the central office in Manila for analysis and interpretation. These observations were not directly available to the LGU. Hence, it was still the central office that announced and issued weather forecast bulletins.

PAGASA also issued flood warning signals and information as well as flood bulletins to various government agencies. However, the agency monitored flood in only four major river systems that feed into major multi-purpose dams and water storage facilities. The river systems in the study areas were not among those monitored by PAGASA.

The LGUs monitored the progress of the Typhoon Milenyo by listening to the radio, by watching television, and by getting information from the PDCC. They then warned the population at risk through a public address system. They literally warned people about the possible threats of the typhoon and the need to take precautionary measures, particularly going to evacuation centers. Warning system and monitoring were done using off-road vehicles to reach the different barangays. As part of their risk monitoring activity, the LDCCs held monthly meetings and communicated regularly with the BDCCs.

The local government of San Juan claimed that it keeps a database on climate-related impacts and a list of indigent/vulnerable families. These families included farmers, senior citizens, fisherfolks, and children who were vulnerable because of their geographic location and poverty. In Tanauan City, the vulnerable sectors included children, the elderly, and people living in river banks.

Both municipalities reported having a database system that contained information on crop losses and damages, areas affected, population affected, casualties, and houses damaged. However, these information were not systematically stored and easily retrievable. For instance, records of Typhoon Milenyo were already stored in stockrooms, and the office concerned (e.g., social welfare department) did not keep its own copy of such records.

Technically, risk assessment would require information on the vulnerable areas and sectors based on a scientific vulnerability assessment. Moreover, monitoring

should not only focus on intensity of typhoon based on national forecast but on the potential impact of the event on the locality. Risk assessment could be done by measuring and monitoring the amount of rainfall that the locality has received and the consequent flooding from this rainfall. Further, monitoring should extend beyond the number of people that are affected by the typhoon. More importantly, other factors that should be monitored such as the decision points, i.e. when to start evacuation because of possible flooding; what is the expected flood level; and how this information can be communicated to all concerned. These information could become available only if an early warning system had been established.

The warning signal should be understood by the community. The warning should be based on a long-term study of the impacts of typhoons, the areas exposed or sensitive to typhoons and flooding, and the adaptive capacity of the effected sectors.

However, there were no localized information on critical hydro-meteorological variables such as rainfall and flooding. Moreover, the LDCC could not accurately predict which areas would be severely affected by the typhoon. Because of the lack of localized information, many past predictions of typhoon impacts did not materialize. As a consequence, the community residents have doubted the reliability of national forecast and evacuation warnings by LGU officials. As a consequence, in recent years, the people would wait for visual signs of danger (e.g., flood waters rising) before they would respond to evacuation warnings.

The LDCCs in both LGUs have not actually conducted any training on adaptation to climate change-related events but on disaster risk management for BDCC and other LDCC members. While this training was open to all members of local communities, including the most vulnerable groups, very few of them actually attended such training.

4.1.3 Knowledge, education, and information system

San Juan again got a relatively higher rating than Tanauan City in knowledge, education, and information system. Both municipalities claimed that they had information on how to reduce and respond to climate change-related risks that were readily available and accessible to key stakeholders. They had community-based training on climate change-related risks and adaptation open to all members of the local communities but with limitations in capacities and resources (Figure 9).

San Juan had the same rating in public education initiatives or the sharing of information about climate change-related risks to communities. Tanauan City, which had not done much on this aspect, rated itself relatively low. The PACD staff gave both LGUs a consistently low rating on this indicator.

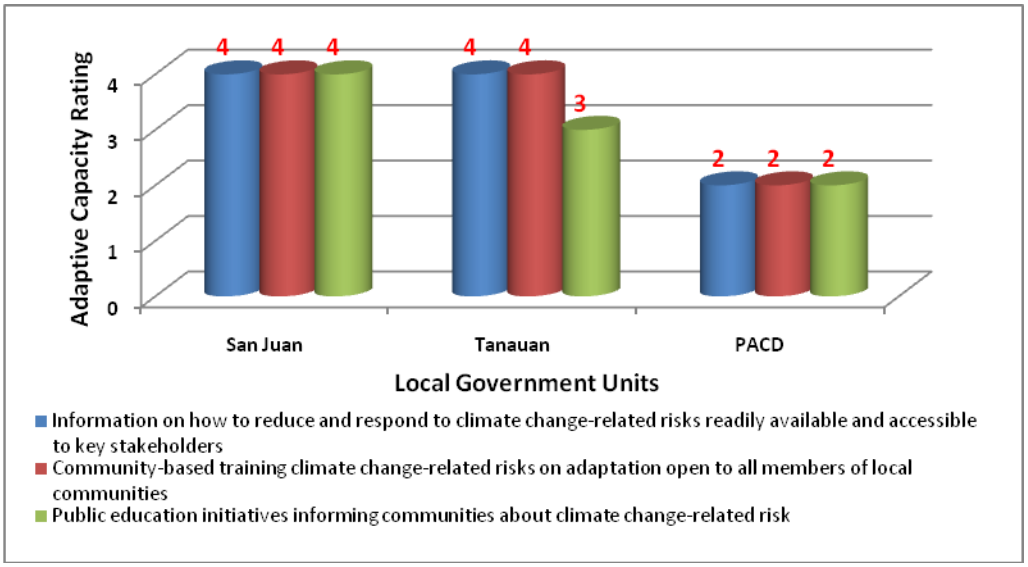

Figure 9. Knowledge, education, and information programs of LGUs

Information on climate change-related risks and how to both reduce and respond to them at the national level were readily available and accessible to key stakeholders including government officials, general public, private sector, and local leaders in affected communities. The information on typhoon intensity and general direction were provided by PAGASA and broadcasted in national television and radio stations regularly. Typhoon bulletins were issued by PAGASA four times a day during typhoon events. LGU officials and the general public sourced their information about the typhoon from these media, although the LDCC also got regular updates from the PDCC and RDCC.

Other than the attempt of San Juan's SWDO to conduct a DRM information lecture to elementary students and to hold an art contest on DRM, there was no public education initiative to inform communities about the risks, exposure reduction, protection, and response to climate change-related disasters.

The progress of the typhoon, including the extent of affected areas and population, were monitored by the LDCC through constant communication with the PDCC and the BDCC. Reports of damages were transmitted from the BDCC to the LDCC and PDCC, which in turn, transmitted the report to the RDCC and NDCC.

As mentioned above, the LDCCs and the communities relied on national media for information on typhoons. The LDCCs then mobilized the PNP and the barangay police to disseminate such information to the villagers. The information commonly transmitted referred to the typhoon intensity and the need for those living in flood-prone areas to take precautionary measures and evacuate to safer grounds. However, people usually doubted the accuracy of such warnings because oftentimes, the national level forecast had little relevance to local conditions. LGUs have to prepare a localized early warning system that would reflect local physical impacts (e.g., flooding) of climatic events that are national in scope.

Tanauan City conducted information dissemination on disaster and contingency planning. However, the lecture materials were quite limited in scope and were not very informative. These barely described disaster preparedness, and the illustrations focused on landslide, which was less frequent than a typhoon or flooding. Attendance of community residents to seminars was low and the effectiveness of the

seminars has not been evaluated. Some BDCC members and BDCC chairs have not yet attended such seminar/training. The seminar/training on disaster risk management has been stopped in San Juan after only one session.

Knowledge and information are critical decision-making inputs. Accurate, concrete, and adequate information are essential for policymakers and affected individuals for them to make timely and appropriate decisions. In CRM, decisions are based not only on the current situation but on time-series data that indicate the extent of a typhoon‘s impact with its windstorm and rainfall. Also important are information on the areas and sectors that may be affected and the possible adaptation options for such a typhoon‘s intensity.

4.1.4 Climate change adaptation technology and infrastructure

Technologies for disaster risk management are related to risk monitoring and warning, communication, and transportation. Risk monitoring and warning technology refers to rain gauge, flood indicator, and information dissemination instruments. Communication devices include landline phone and fax, mobile phone, two-way radio, and internet. LGUs have fire trucks, a dump truck, and service vehicle for information dissemination, evacuation, and rescue and relief operations. Moreover, LGUs have generators to provide electricity to the LGU offices and other service-oriented areas such as the public market as well as equipment (e.g., grader) for clearing operations.

This finding indicates that San Juan and Tanauan City were not yet conscious of the technology and infrastructure requirement to address typhoon-induced impacts. Both LGUs did not have a rain gauge or a flood indicator device, and they did not consider these instruments as priorities. There was a PAGASA synoptic station in one of the barangays in Tanauan City, but there was no instituted mechanism by which data generated by the station could be used by the LGU. Both LGUs believed that they were not vulnerable to climate change-induced events even if flooding and windstorms have caused severe damages to their people and livelihood.

Technology would have been useful in risk assessment, monitoring, and warning. However, the LDCC‘s recognition of their technology needs depended on their appreciation of the risks and necessary adaptation measures. Lack of additional technological requirements to enhance LGUs‘ adaptive capacity reflected their low level of appreciation for technology.

4.1.5 Underlying risk factors

On average, the three groups of key informants agreed that addressing the underlying risk factors must be significantly improved. However, their opinion varied considerably as to the status of their LGU‘s efforts along this line. For instance, San Juan LGU was reportedly effective in their protection of critical public facilities against major hazards, in their adaptation to climate change, and in planning land use. On the other hand, the LGU of Tanauan City rated itself relatively high (4) on various social aspects, low (3) in environmental concerns, and very low (2) in its capability to enforce the building code (Table 7).

Table 7. Rating of the LGU's capability to address underlying risk factors

Indicator	Rating			
	San Juan	Tanauan City	PACD	Average
Local policies support environmental and natural resource management.	3	3	3	**3**
LGU supports communities to adapt to climate change.	3	4	3	**3.33**
LGU strengthens food security in vulnerable communities.	3	4	3	**3.33**
Social protection is available to vulnerable groups.	3	4	3	**3.33**
LGU provides economic protection against unsafe livelihoods.	3	4	3	**3.33**
Land use planning incorporates adaptation to climate change.	4	3	2	**3**
Urban planning includes issues of informal settling in vulnerable areas.	3	3	3	**3**
Overall planning addresses climate change adaptation.	4	3	4	**3.67**
Building codes and standards are applicable to informal settlers.	3	2	3	**2.67**
LGU has the capacity to implement building codes and standards.	3	2	4	**3**
There is protection of critical public facilities against major hazard threats.	5	4	3	**4**
LGU initiates public-private partnerships in climate change adaptation.	3	4	2	**3**

The LGUs' concerns to reduce climate change-related risks may be expressed through other local initiatives, such as the protection of environment and natural resources; socio-economic measures to improve the communities' social and economic resilience; and public-private partnership. In the study areas, these were addressed in the CLUP; in the local Building Code in order to ensure safety of infrastructure; and in the Solid Waste Management Program to abate the problem of flooding.

To address the squatters' problem, Tanauan City also designated areas for socialized housing where river bank residents could be relocated. Through seed distribution program, food stock, and livelihood training programs, food security was also been addressed. Tanauan City also had a crop insurance system with the farmers, which was executed through a Memorandum of Agreement between the LGU and the farmer. As discussed earlier, the LGUs were able to harness the participation of the private and business sectors in climate-event related activities.

Despite the LGUs' mitigation and adaptation efforts, however, development in surrounding municipalities and provinces may exacerbate climate change impact on the study barangays. For instance, the settlement development in Tagaytay Highlands has allegedly caused increased surface run-off and flooding that adversely affected the lowland barangays of Tanauan City, including the barangays covered by the study.

4.2 Adaptation Strategies of Local Institutions Pre, During and Post-Typhoon Milenyo

4.2.1 Adaptation strategies done by Local Government Units for Typhoon Milenyo

The adaptation strategies of the two LGUs before and during the typhoon were basically the same because they carried out activities in accordance with the DRM manual and the established protocol.

The strategies are classified as structural, technological, financial, behavioral, and institutional (Table 8). Expectedly, most strategies before, during, and after Typhoon Milenyo were institutional as the LGUs mobilized the resources needed and spearheaded the activities undertaken.

Pre-disaster activities of the LDCC included the following:

1. emergency LDCC meeting to assess the level of preparedness of various LDCC committees to meet any emergency situation and assist the public;
2. preparedness of ensuring medical and food supplies, evacuation centers, and rescue equipment;
3. informing people about the impending event and warning them to evacuate to safer places; and
4. ensuring that all LDCC members were at the DOC to monitor the progress of the event and to provide the necessary assistance

During the events, LDCC members were required to report to the DOC and respond to any emergency. However, there was very little they could do beyond monitoring the progress of Typhoon Milenyo because of the strong winds. Rescue of residents in flooded areas was made possible during the lull but had to suspend operations when strong winds hit again.

The post-Typhoon Milenyo activities of the LDCCs were focused on the rehabilitation of damaged public infrastructures and provision of assistance to facilitate the recovery of affected community residents. LDCC tasks units inspected affected areas and estimated damages and monitored the incidence of diseases and casualties (injuries and death) in the communities and hospitals. Because of the extent of damage in San Juan, the local legislature declared the municipality in a state of calamity. Post-disaster activities were mainly relief operations for displaced residents and rehabilitation of damaged properties.

Table 8. Adaptation strategies done by LGUs for Typhoon Milenyo, 2006

Time	Adaptation Strategies
Pre-Typhoon Milenyo	- Set up/checked evacuation centers - Checked if the Rural Health Units were ready - Prepared rescue equipment - Inventoried resources such as transport for relief operations - Inventoried medicine and emergency supplies - Stockpiled basic necessities - Mobilized City/BDCC - Monitored progress of typhoons from PAGASA and media - Conducted Disaster Operation Seminar - Announced warning signals - Made an initial report on standing crop and livestock - Held meeting of health unit and social welfare staff - Prepared report forms - Advised field men to warn farmers
During Typhoon Milenyo	- Stood by and monitored weather situation and conditions in the community - DCCs inspected and monitored flood-prone areas - Evacuated residents affected by flood - Submitted reports to higher authorities, e.g., PDCC
Post-Typhoon Milenyo	- Evaluated situation in evacuation centers - Repaired public physical facilities - Conducted clearing activities - Provided construction materials (such as galvanized iron sheets) for house repair - Provided fishing nets to fisherfolks - Implemented Self-employment Assistance Program - Provided financial assistance - Assessed crop damages and paid crop insurance - Distributed pails (donated by the Regional Social Welfare and Development office) - Distributed relief goods - Provided livelihood assistance - Inspected affected areas and estimated damages - Monitored incidence of diseases, injured people, sanitation situation in the community, hospitals - Local council declared the area under a state of calamity

Both LGUs provided financial assistance of PhP2,000 (US$41) to PhP5,000 (US$104) in the form of building materials to those whose houses were damaged by the typhoon, depending on the extent of damage. Starter seeds were also provided to farmers whose crops were damaged. Additional help from other groups and individuals were also distributed by the offices concerned to the different sectors. For instance, the congressman from San Juan donated PhP12,000 (US$250) worth of seeds and PhP200,000 (US$4,166) in cash for affected families.

In Tanauan City, the LGU implemented a Self-employment Assistance Program. Ten families with sari-sari stores (small variety stores) were loaned PhP5,000 (US$104) each, to be paid within one year. A total of 50 families were also given financial assistance amounting to PhP1,000 (US$20) per family. Overall, the LGU spent about PhP800,000 (US$16,666) for the various relief, rescue, and rehabilitation activities in connection with Typhoon Milenyo.

The LGUs were able to resume normal functions within one week after Typhoon Milenyo. This was because the availability of calamity fund enabled the LGUs to procure necessary rehabilitation materials, provide financial support, and allocate funds for rehabilitation. The systems and procedures for restoring damaged

facilities and utility services were in place. Further, the community residents already knew how to seek support for relief and rehabilitation from the LGU. The evacuees in Tanauan City stayed in the schools, which were converted to evacuation centers for only one day; classes resumed after the typhoon signal was lowered. Electric power and water supply were also restored immediately after the typhoon. However, the recovery period for the affected families varied considerably depending on the extent of the typhoon's impact and their level of resilience.

4.2.2 Adaptation strategies that the LGUs planned to do/recommended

As mandated in PD 1566, LGUs are to prepare a DRM program that outlines the LDCCs activities before, during, and after a disaster. These adaptation strategies practiced by the LGUs should follow the "Preparedness – Prevention – Mitigation" pattern as illustrated in Figure 10. This is in accordance with the DRM manual and the established protocol. This also explains why the adaptation strategies of the LGUs before and during the typhoon are basically the same.

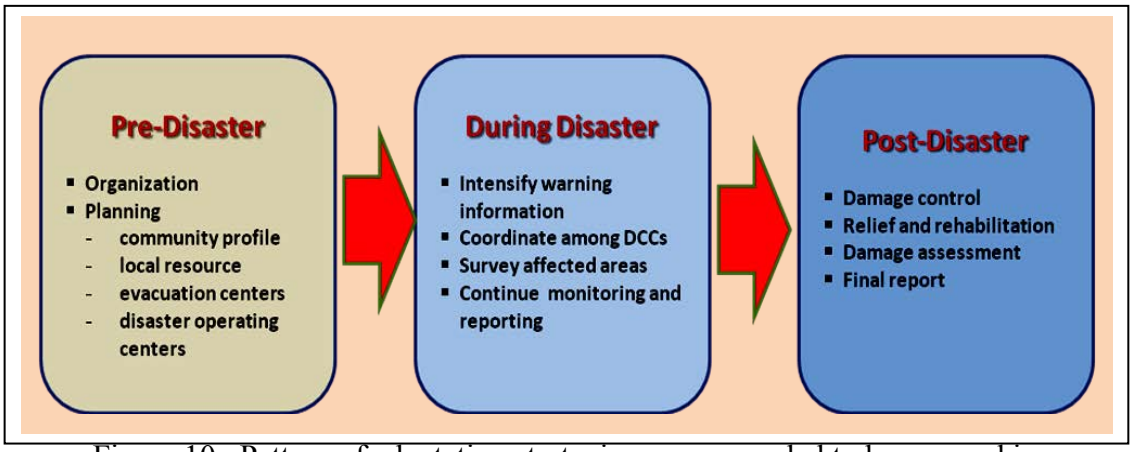

Figure 10. Pattern of adaptation strategies recommended to be pursued in the study sites

Source: Batangas PDCC

A. Pre-disaster

The pattern above indicates that LDCCs are required to determine the vulnerable sectors and identify possible adaptation options based on the community profile that will be generated. Also, based on these data, accessible evacuation centers are to be identified. Preparedness also refers to the LDCC's readiness to respond to an emergency situation.

The municipalities/communities are expected to maintain a stock of rice, instant noodles, canned fish, and other relief goods for emergencies. These goods are to be distributed to those staying in evacuation centers during the typhoon and sometimes even immediately after the typhoon.

B. During Disasters

1. activate disaster operation center
2. ensure that the disaster operation center is manned for 24 hours
3. monitor typhoon warning signals issued by PAGASA
4. sound the warning bell to alarm residents about the weather situation

5. alert the various committees to report to the disaster operation center
6. advise the public of what the LDCC is doing and where to get assistance
7. provide transportation facilities to the evacuees
8. keep all communication lines open and inform authorities of the local situation
9. receive reports and coordinate the works of the different committees
10. survey the affected areas and report to the LDCC chair
11. provide emergency relief and medical assistance
12. regularly update the LDCC chair and the PDCC about the situation in affected areas
13. make sure that all committees are provided necessary support and are doing their tasks and that all victims and donation are properly documented.

C. Post- disaster

1. undertake damage control
2. monitor the incidence of diseases and casualties (injured and dead)
3. locate missing persons
4. undertake relief and rehabilitation services
5. assess and estimate damages
6. perform continuous monitoring and reporting
7. prepare final report after operations

The LGUs were confident that they undertook the appropriate responses, particularly because these actions were in accordance with the DRM Manual. Hence, they would follow the same procedures and undertake the same activities for similar events in the future. However, they were hoping for improvements such as additional manpower, a full-time DRM office, and additional equipment so as not to over burden the LGU staff during and after an extreme typhoon event.

4.2.3 Gaps and weaknesses in the LGUs' adaptation to Typhoon Milenyo

With their long years of dealing with typhoon and flooding and of applying DRM protocols, the LGU key informants felt confident that their current adaptive capacity and adaptation strategies were adequate and effective to address climate-related incidents. Viewed in the context of CRM and the preparedness principles that should guide their disaster preparedness and planning, these are some gaps and weaknesses in the LGUs' response to Typhoon Milenyo:

1. Stakeholders' misperception about climate change phenomena and the associated climate risk.

   Stakeholders have to understand that climate change is unequivocal and that typhoons with increasing intensity will be a recurring event. Hence, preparedness should be proactive and long-term in nature.

2. Stakeholders‘ misconception about the principles of adaptation and response to climate change, which have implications on the nature and scope of their response.

   According to Burton et al. (2006), climate change adaptation should be long-term. It should be pro-active to avoid the recurrence of disaster and to prevent climate risk from turning into a disaster. The ultimate goal of an effective adaptation strategy is to help populations at risk to enhance and develop a higher level of resilience.

3. Misconception about some of the crucial elements of disaster preparedness such as risk assessment and early warning system.

   An effective risk management strategy should have a sound scientific basis and should provide policy and decision makers with concrete decision criteria. An early warning system should inform and empower people to make independent decisions based on warning signals that are easily understood. Likewise, an adequate basis for making policy decisions on the best and most effective adaptation strategy should be available to policymakers. These information are not currently available in the study areas.

4. Adaptation strategies are not based on scientific evidence.

   Accurate information on vulnerable areas and the extent of vulnerability of the various sectors of society are needed in preparing appropriate adaptation strategies. However, these were not available in the study LGUs. The LGUs did not have a rain gauge that would measure rainfall or a flood warning signal that would alert the public to take necessary actions. According to the Contingency Planning for Emergencies Manual for LGUs (2003), the collection, analysis, and dissemination of information on vulnerability is the springboard to all emergency preparedness, mitigation, and readiness. Simple measures and procedures that are doable by the locals are very important, and these do not have to involve a state-of-the-art computer system.

5. LGUs do not generate local level data that would indicate threats to local residents.

   The information disseminated to the public and monitored by the LDCC is based on national PAGASA typhoon warning signals, which can be accessed from radio and television networks. Critical local level information on, say, potential flooding, is not available.

6. All the local government officials involved in LDCC work are seconded staff who work full-time in other departments.

   The LDCC is activated when there are typhoon warnings, and the implementation of the DRM activities depend largely on the initiatives of the designated disaster coordinator. During normal times, the disaster coordinator works full-time on his regular assignment and nobody takes charge of regularly pursuing activities for disaster preparedness.

7. There is no monitoring and evaluation (M&E) to assess the effectiveness of adaptation strategies.

   M&E is an essential component of a DRM system to ensure that effective response strategies are sustained and that necessary corrective measures are

instituted. San Juan and Tanauan City still do not have M&E systems. The DRM approaches are generally rescue and relief. Further, these approaches need revision and a long-term M&E plan must still be prepared.

8. Community and resource mobilization systems are not institutionalized.

   One of the principles of disaster preparedness is that preparedness is a responsibility of all sectors, not of the government alone. The government provides the response framework to guide the stakeholders and to coordinate community action. Moreover, the government creates the enabling environment to motivate and mobilize concerned sectors (i.e., private business, NGOs, and LCOs).

   In the study community, LCOs volunteered in relief and rescue operations and expressed their willingness to help in similar future events. There was no formal link between the LDCC, LCOs, and the private sectors. The LGUs should recognize these potential partners and establish systematic protocols and networks based on a thorough assessment of resource needs and capability. Different groups have different capabilities for relief and rescue, program planning, and implementation that can be mobilized in various activities for climate change adaptation.

9. LGUs, communities, and LCOs have misperceived level of adaptive capacity.

   The LGUs, communities, and LCOs did not have a clear idea about their deficiencies (e.g., technology such as rain gauge and flood level measuring device). The misperception may stem from their lack of comprehension and misconception about climate risk and appropriate climate risk management mechanisms.

10. LGUs had poor compliance with DRM planning protocols.

    The Contingency Planning for Emergencies Manual for LGUs (2003), which should guide LGUs in disaster preparedness, outlines the essential elements of disaster preparedness. Among these elements were vulnerability map, monitoring and evaluation system, public awareness and community participation, and organizational and human resource development. Both LGUs have not complied with these requirements. If the LGUs would be judged based on their compliance with PD 1566 (1978) and the manual, then their level of disaster preparedness and adaptive capacity would be considered very low.

11. Appropriate information materials were lacking.

5.0 ADAPTIVE CAPACITY AND ADAPTATION STRATEGIES OF HOUSEHOLDS

5.1 Adaptive Capacity of Households

The respondents interviewed in the household survey were mainly the head (53%) of households (Table 9) and their spouses (39%) or relatives. Majority of the respondents (67%) were female with an average age of 47 years. The youngest respondent was 18 and the oldest was 93 years old. The households have been living in the area for around 24 years.

Table 9. Demographic characteristics of sample household survey respondents

Item	Lowland		Coastal		Total	
	N	%	N	%	N	%
Total no. of respondents	200		200		400	
Category of respondent						
Head of household	103	51.50	110	55.00	213	53.25
Spouse of HH head	86	43.00	72	36.00	158	39.50
Relative of HH head	11	5.50	18	9.00	29	7.25
Gender						
Male	56	28.00	74	37.00	130	32.50
Female	144	72.00	126	63.00	270	67.50
Average Age (years)	48.05		46.50		47.28	
Age distribution						
18-35	44	22.00	44	22.00	88	22.00
36-60	115	57.50	123	61.50	238	59.50
61 and above	41	20.50	33	16.50	74	18.50
Average number of years living in the area	25.11		23.88		24.50	

5.1.1 Household's adaptive capacity index

Based on the overall household adaptive capacity index (HACI), lowland and coastal households were of equal standing (i.e., 0.48). However, they differed in specific indicators. For instance, lowland households had the highest capacity index in infrastructure (0.64), followed by technology, and lowest in social capital (0.35). On the other hand, coastal households fared highest in social capital (0.68), followed by economic adaptive capacity, and lowest in skills and knowledge (Table 10).

Table 10. Household adaptive capacity index in lowland and coastal areas

Indicator	Lowland		Coastal	
	HACI	Rank	HACI	Rank
Infrastructure	0.6407	1	0.3659	4
Economic	0.3793	4	0.5450	2
Technology	0.5238	2	0.4690	3
Social capital	0.3542	5	0.6866	1
Skills and knowledge	0.5111	3	0.3444	5
Average	0.4818	-	0.4822	-

5.1.2 Infrastructure indicators

Over 90 percent of the households in both lowland and coastal areas owned their houses, which usually built with semi-permanent to permanent materials (e.g., concrete, wood) (Figure 11). However, only 25 percent had two-storey or one-storey houses with elevated ground floors. Over 90 percent had electricity connections, and they sourced their drinking water from pipe water and tube wells or hand pumps.

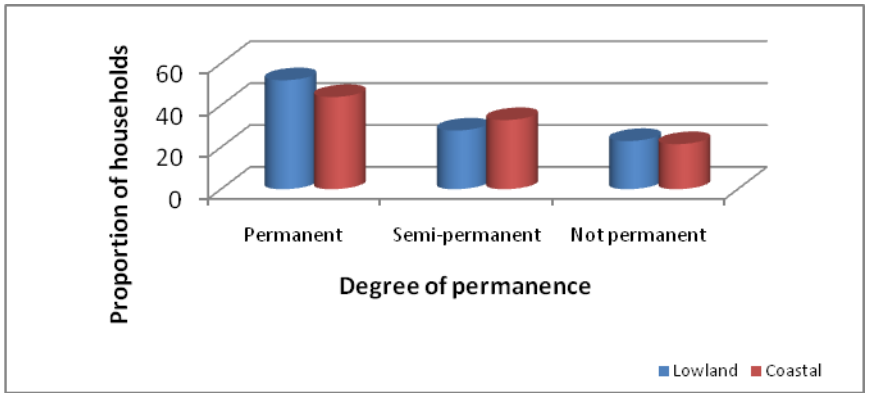

Figure 11. Percentage distribution of households by degree of permanence of house

5.1.3 Economic indicators

Economic indicators of adaptive capacity of households included landholdings, other properties such as vehicles, and income.

Landholdings

Households' landholdings included residential lots and farmlands. An average residential lot was almost 400 sq m (Table 11). Residential lots of lowland households were larger than those of coastal households. Around 55% of the respondents in the lowlands owned the land where their houses were built with an average size of 347 sq m. In the coastal area, around 46 percent owned their residential lot in coastal barangays with an average size of 412 sq m. Over 45 percent of the households in the coastal barangays occupied lots provided free by relatives or in-laws or they were informal settlers.

Irrigated lands, planted mainly to rice, had an average size of 21,705 sq m and were larger in lowland barangays than in coastal barangays. Less than 1 percent of households owned irrigated farm lands, while 2 percent were under tenancy arrangement.

Around 12 percent of the households cultivated non-irrigated lands planted to vegetables and fruit crops. These non-irrigated farms had an average size of over 14,000 sq m in the lowland barangays and over 6,000 sq m in coastal barangays. Only around 5 percent of the households owned the non-irrigated farms they were cultivating and another 5 percent had their farmlands lent for free by relatives and under tenancy arrangement.

Other household assets included vehicles and boats. Over 11 percent of the households owned one unit of motorcycle on average, while 7 percent owned a car or truck.

Table 11. Landholdings of sample lowland and coastal households

Item	Lowland		Coastal		Total	
	Average area (sq m)	% of HH	Average area (sq m)	% of HH	Average area (sq m)	% of HH
Total no. of respondents	200		200		400	
Residential lot	457		336		396	
Owned	347	55.50	412	46.00	376	50.75
Rented	90	1.00	45	2.00	60	1.50
Provided free	654	40.00	306	45.50	469	42.75
Mortgage	200	0.50	0	0	200	0.25
Tenant	133	1.00	114	5.00	117	3.00
Squatter	80	2.50	110	2.00	93	2.25
Farm land (irrigated)	30,000		18,595		21,705	
Owned	60,000	0.50	760	0.50	30,380	0.50
Lent by relative for free	0	0	10,000	0.50	10,000	0.25
Tenanted	15,000	1.00	23,000	3.00	21,000	2.00
Farm land (non-irrigated)	14,135		6,555		10,587	
Owned	2,720	5.00	2,916	6.50	2,831	5.75
Rented	70,000	0.50	10,000	0.50	40,000	0.50
Lent by relative for free	19,010	3.50	1,933	1.50	13,887	2.50
Mortgage	10,000	0.50	7,500	1.00	8,333	0.75
Tenanted	18,851	3.00	25,166	1.50	20,956	2.25

Sources of income, food consumption, and credit needs

The sample households had an average household size of 5.19 members. But around 83 percent of the households had an average of only one family member who was working. The dependency ratio was high as over 60 percent of the households had members below 15 years of age and over 28 percent had members above 60 years old.

The major sources of income of the households were self-employment (e.g., small retail store, food vending) (36%) and waged labor (e.g., factory worker) (above 30% of households). Around 14 percent of households were engaged in agriculture and over 8 percent in fishing.

Average household income per year was PhP118,102 or US$2,567 with households in the lowland barangays having higher income than households along coastal zones. The income poverty threshold level for Batangas province was PhP16,836 (US$366) per capita per year (nscb.gov.ph). With an average family size of five, the household income poverty threshold was PhP84,180 (US$1,830). Although the average income of total sample households was higher than the poverty threshold level, the percentage distribution of households by income revealed that over 52 percent were below the threshold level. Based on ecozone, there were more sample households (55%) in the coastal areas that were considered poor than in the lowland areas (50%) (Figure 12).

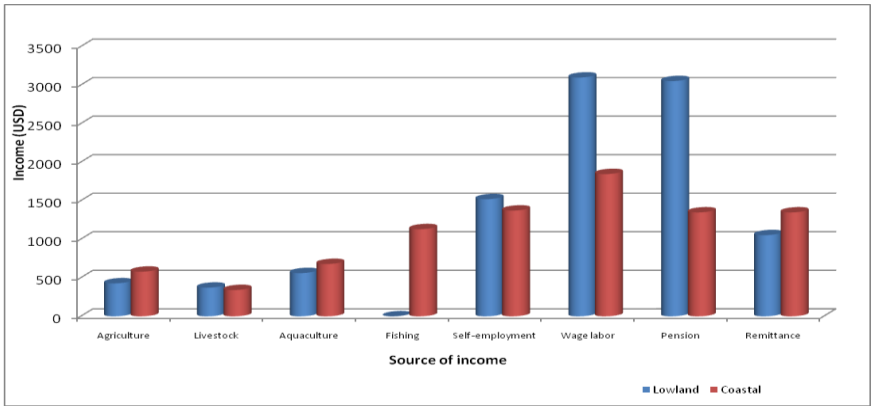

Figure 12. Average household income per year by source, by ecozone

With a few sample farming households, it is understandable that majority (80%) of the households were not producing the food they consumed. Around 16% of the respondents produced less than 50 percent of their food.

Over 80 percent of the respondents claimed that they could borrow money when needed. The most common credit source for both lowland (60.5%) and coastal (69.5%) households were their relatives or friends. About 18 percent of the lowland and 19 percent of the coastal households also sourced their credit from a formal financial institution.

5.1.4 Technology indicators

Technology indicators of adaptive capacity of households included first, availability and accessibility of shelter where they could evacuate in case of severe disasters, and second, means of communication by which the households could receive information or news.

Accessibility to shelter

In the study barangays, the government established shelters or evacuation centers in the public elementary school and in the barangay hall. The sample households in lowland barangays were closer (0.63 km) to the barangay hall than the coastal households (1.07 km) (Table 12). Aside from such government facilities, other types of shelter included relatives‘ and neighbors‘ houses. In the coastal areas, more of the respondents (31%) evacuated to neighbors‘ and relatives‘ houses than in government shelters (11.25%). In the lowland areas, however, the government centers were the preferred shelter by many respondents (30%) because the evacuees only had to walk to these shelters from their houses. About 80 percent of the respondents in both ecozones had easy access to the evacuation centers (Figure 13). However, only an average of 37 percent of the respondents evacuated. Majority of them, 65 percent in the lowland and 60 percent in the coastal areas, decided not to evacuate because they believed that their houses were strong and safe enough.

Table 12. Access of lowland and coastal households to shelter during severe disasters

Item	Proportion/Ecozone	
	Lowland	Coastal
Total no. of respondents	200	200
Average distance (km) of house from barangay hall	0.63	1.07
Evacuated	35.00	40.00
Type of shelter		
Government building	30.00	11.25
Neighbors'/relatives' house	21.50	31.00
Others (religious buildings, rice mill, old piggery)	3.00	4.50
Means of transportation		
Walking	94.29	95.00
Transport vehicle (e.g. , tricycle, jeep, truck)	5.71	5.00
Did not evacuate	65.00	60.00
Reason for not evacuating		
Own house is safe	93.08	87.50
No safer places to go/cannot access safer places	4.50	7.50

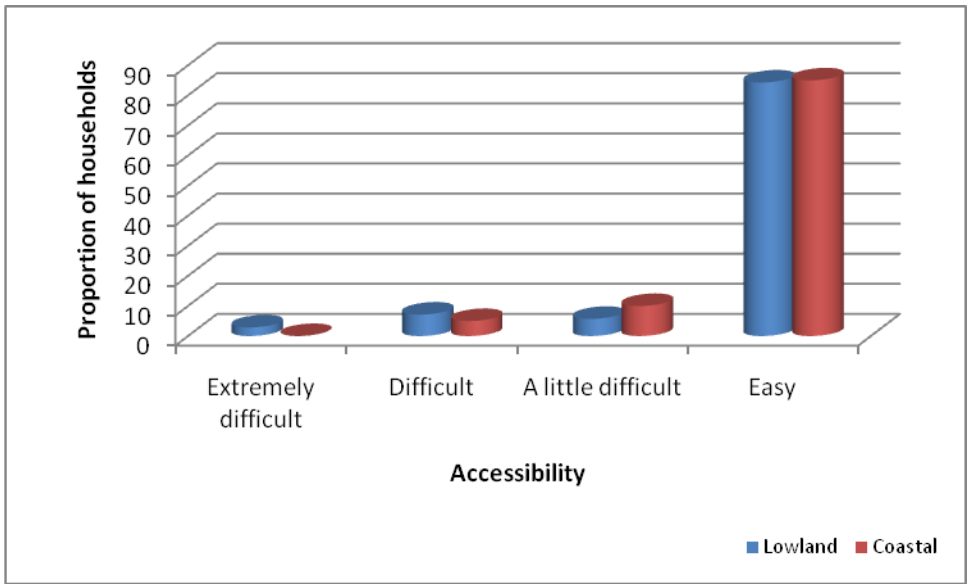

Figure 13. Percentage of households reporting on accessibility of evacuation center/safer place, by ecozone

Sources of information

As for medium through which the respondents received information or news, television (90%) was the most popular, followed by radio (35%). Only a few respondents (10%) cited local government officials as their source of information.

5.1.5 Social capital indicators

Social relations of households and interaction of residents in the neighborhood or within the community was an indication of the households' adaptive capacity.

Membership in community organization

Majority (69%) of the respondents have not joined any community organization. The rest were members of women's or men's organization; veterans', farmers', or fisherfolk association; cooperative/microfinance; and health-related,

religious, and civic organizations. Around 87 percent of the households who were members of organizations actively participated in the organizations‘ activities.

Sources of help

Majority (72%) of respondents turned to other individuals or institutions for help in financial or other problems. Relatives/neighbors were the most commonly approached people for financial assistance (79.66%). A few ran to LGUs for financial support (15). shelter (4), building materials (2), and medical items (1), while many ran to relatives or neighbors for food and clothing (38).

Interaction in the community

Around 39 percent of the respondents had no knowledge of how often the villages met to discuss common issues concerning their community. Around 20 percent claimed that they met once or twice a year.

On issues related to climate change or related disasters, 34 percent claimed that the community members did not interact, while 26 percent of the respondents reported that there were some interactions.

5.1.6 Skills and knowledge indicators

The respondents in both barangays had generally low level of education. About 45 percent of the lowland and 47 percent of the coastal respondents were able to finish 7 to 10 years of schooling while 37 percent (lowland) and 35 percent (coastal) were able to complete not more than 6 years. Less than 20 percent of the respondents reached college level (Figure 14).

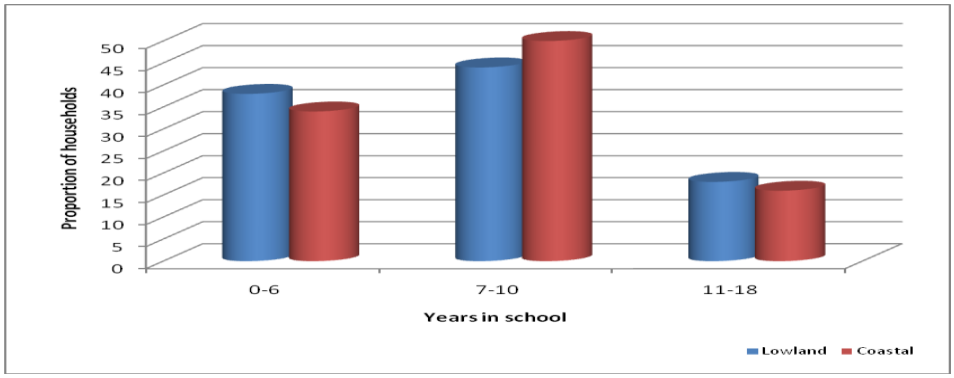

Figure 14. Educational attainment of household respondents

Training

Only 8 percent of the respondents have attended training on disaster preparedness, but majority (65%) thought that such training should be provided. They heard about the training from municipal and barangay officials, colleagues at work, relatives and friends, and other local organizations. The three most important points they learned from the training related to being alert, storing food and other needs, and assisting in evacuation.

Indigenous knowledge

Over 17 percent of the household respondents had existing indigenous knowledge and practices in their area related to the incidence of natural disasters. Their observations in the environment, such as the behavior of animals, birds, insects, and plants warned them of weather anomalies or disturbances.

5.2 Typhoon Milenyo and its impacts on households

Around 68 percent of the households claimed that typhoon/flooding occurred every year and a little over 50 percent recalled that Typhoon Milenyo in 2006 caused flooding (Table 13). Within the yard of lowland households, flood water was 1.145 m high, while in coastal households, flood reached around 0.7 m high. With many households having a one-storey house, flood water went inside their houses. The flood level was higher in lowland households than in coastal households. Typhoon Milenyo brought strong winds but not that much rainfall to cause overflows from rivers and severe flooding in the coastal area. Flooding in the lowland areas was associated with water coming from uplands aggravated by clogged waterways.

Table 13. Flood risks experienced by households

Item	Respondents/Ecozone			
	Lowland		Coastal	
	N	%	N	%
Total no. of respondents	200		200	
Frequency of typhoon/ flooding				
Yearly	141	71.00	132	66.00
Every five years	10	5.00	16	8.00
Every ten years	4	2.00	1	0.50
Rarely	45	23.00	51	26.00
Typhoon Milenyo caused flooding	124	62.00	79	40.00
Average height of flood				
Within the yard (m)	1.145		0.737	
Number reporting	124	62.00	79	40.00
Inside the house (m)	1.046		0.695	
Number reporting	91	46.00	59	30.00

Among the lowland households, 47 percent experienced little damage while 31 percent had severe damage. In the coastal areas, fewer households (26%) had severe damage.

5.2.1 Damages/losses experienced by households

Typhoon Milenyo destroyed household properties that included the house, appliances, vehicles, and other amenities such as electricity, water supply, and communication lines. It likewise damaged household production such as in agriculture, fishing, and business; and foregone income from waged labor of household members. Moreover, the safety of household members was jeopardized because of injury and illnesses caused by the typhoon.

The average amount of losses caused by typhoon Milenyo was over PhP11,000 (US$230), which was approximately 10% of the average annual household income. On average, the coastal households suffered higher amount of losses from Typhoon Milenyo.

More than half of the respondents reported damages to their houses as their house structures were either semi-permanent or not permanent. For coastal households, damage to their house incurred the highest cost (PhP15,000 or US$328) among the various damages. For lowland households, the damage in agriculture,

practically wiping out their expected earnings, incurred the highest cost for the respondents (Figure 15).

Agricultural households in the coastal areas also lost about 27 percent of their income. Meanwhile, losses in income from businesses and employment were relatively lower accounting for 3 percent (coastal households) to 7 percent (lowland) of their income. Foregone income from wage labor accounted for around 2 percent in both lowland and coastal households.

As for danger brought to household members, one lowland household reported that one member got injured, costing the household PhP50,000 (around US$1000) for hospitalization. A few households (over 1%) also had to spend on medicine for illnesses such as asthma and fever caused by exposure to the typhoon.

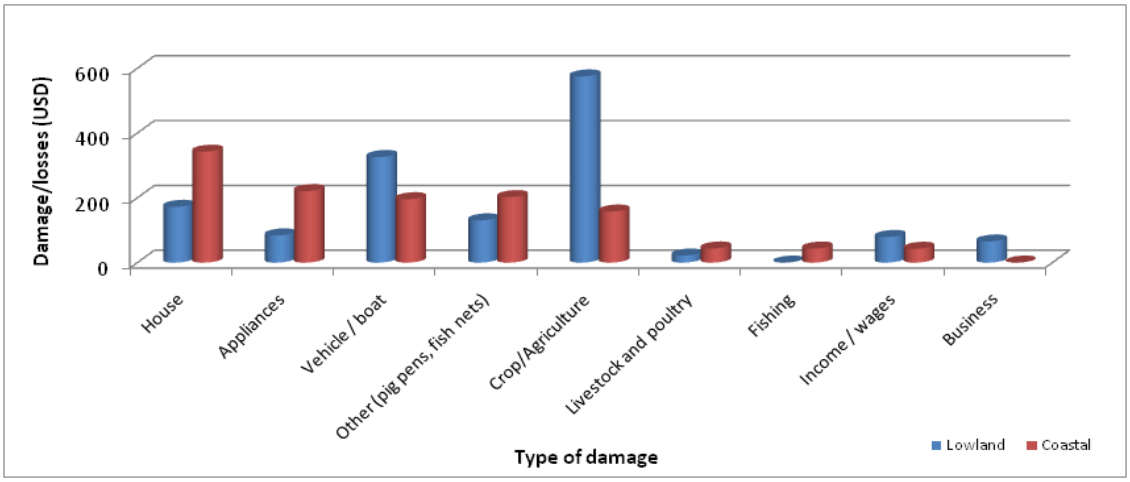

Figure 15. Cost of damage brought by Typhoon Milenyo, 2006

5.2.2 Benefits derived from Typhoon Milenyo

There were also some benefits derived from Typhoon Milenyo as reported by a few (7%) household respondents. More coastal households (11%) than lowland households had gains such as higher fish catch as fish were released from damaged fish pens. Retail stores also increased their sales for supplying the immediate needs of the residents. Lowland households gained from collecting fruits that fell from trees.

5.2.3 Recovery period

Households that relied on agriculture, livestock, and aquaculture as source of income took a longer (around one year) time to recover from losses/damages caused by Typhoon Milenyo (Figure 16). They have not yet repaid their loans, which they invested in their production. Other households with income from non-farm and employment recovered one to two months after the typhoon.

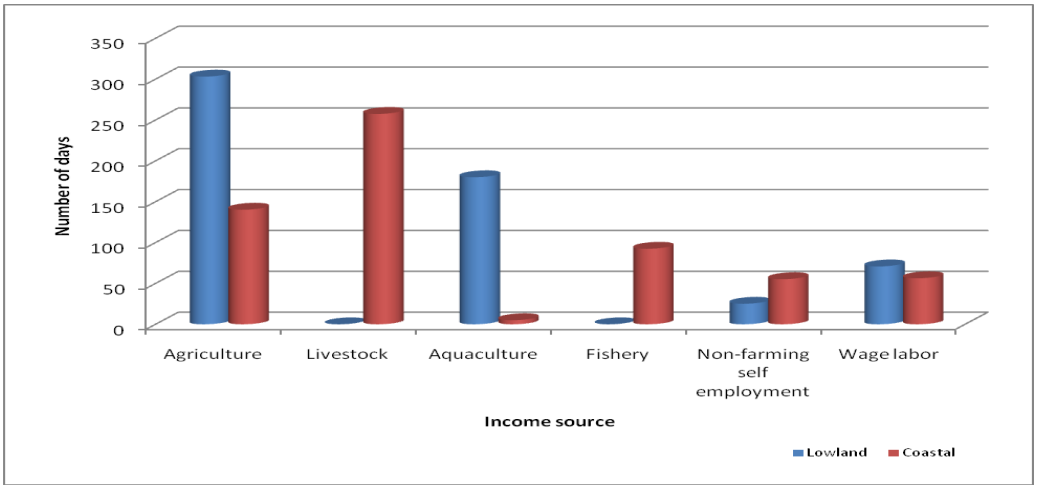

Figure 16. Households' recovery period from losses per income source because of Typhoon Milenyo

Between 2006 (when Typhoon Milenyo occurred) and 2008, all households had an increase in income from all sources except fishing that remained the same. Livestock registered a 37 percent increase on average, while agriculture posted 28% increase in income (Figure 17).

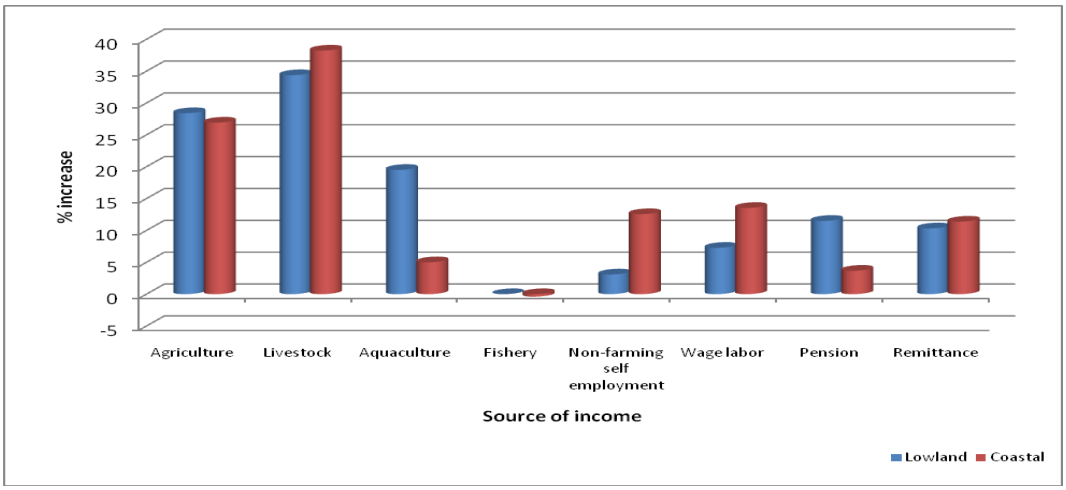

Figure 17. Percent change in household income from 2006 (year of Typhoon Milenyo)

5.3 Adaptation Behavior of Households

5.3.1 Warning received by households

Almost all respondents (98%) received a warning before Typhoon Milenyo hit their areas. The information came mostly (90%) from broadcast media such as television and radio (Table 14). A higher percentage (24%) of lowland households than coastal households (3%) got warning from the LGU. Neighbors were also a source of warning information of the respondents (7%). Around 98% of the respondents understood the message that they received 13 hours (on average) before the typhoon hit their area. This is actually the lead time for storm warning signal no. 4 (above 185 kph wind speed) in the Philippines. Majority of the respondents were able to act within two hours, an average length of time to cope with the event.

Table 14. Warning or advice received by lowland and coastal households before Typhoon Milenyo

Item	Respondents/Ecozone			
	Lowland		Coastal	
	N	%	N	%
Total no. of respondents	200		200	
Received warning	196	98.00	197	98.50
Source of warning information				
Local government unit	48	24.00	12	6.00
Media (television, radio)	178	89.00	184	92.00
Neighbor/Relative	19	9.50	20	10.00
Understood the message	195	97.50	198	99.00
Average number of hours warning received before typhoon Milenyo hit the area	13.19		14.34	
No. reporting	194	97.00	196	98.00
Average number of hours it took the household to act /cope with Typhoon Milenyo	3.28		2.16	
Number reporting	194	97.00	196	98.00

5.3.2 Adaptation strategies to deal with Typhoon Milenyo

Adaptation strategies adopted by households could be classified as behavioral, structural, and financial (Table 15).

Households practiced various behavioral adaptation measures. Majority (62%) put priority in ensuring basic necessities of the households such as food, water, and other household needs before the occurrence of Typhoon Milenyo. Around 7 percent looked after the safety of their family by moving to a safer place before the typhoon or by just staying at home during the typhoon. Moreover, around 40 percent protected their household properties by securing their boats; putting their livestock and household items in safer place; and wrapping their clothes in plastic bags and placing these inside a small drum as protection from wetness.

In terms of structural measures, more than 50 percent of the households secured their houses by securing these with ropes and putting concrete slabs on the roof for protection against the wind before the typhoon. After the typhoon, one of the first things they did was to repair or reinforce their houses. This is understandable because majority of the respondents owned their houses.

Only a few households practiced technological strategies such as planting trees along the river. A few households borrowed money or sold household assets as financial strategies.

Table 15. Adaptation strategies adopted by lowland and coastal households to deal with Typhoon Milenyo

Adaptation Strategy	Respondents/Ecozone			
	Lowland		Coastal	
	N	%	N	%
Behavioral				
Moved family members to safe place	60	30.00	56	28.00
Stayed in shelters and waited for the disaster to stop	136	68.00	154	77.00
Secured belongings (ships, boats, livestock, household items)	94	47.00	77	38.50
Monitored typhoon warning signal	44	22.00	43	21.50
Stored food and water	121	60.50	130	65.00
Helped neighbors	12	6.00	5	2.50
Sought government assistance	20	10.00	10	5.00
Sought support from relatives	10	5.00	7	3.50
Structural				
Reinforced house	97	48.50	136	68.00
Repaired house and furniture	102	51.00	120	60.00
Repaired dykes/ponds	16	8.00	3	1.50
Technological				
Cut the trees around the house to prevent damage from falling branches	14	7.00	20	10.00
Financial				
Coped with financial shortage (withdrawing from savings, selling stocks, borrowing money)	1	0.50	5	2.50
Sold assets: gold, motorbike, land, livestock; sold means of production: seeds, cattles, machines	4	2.00	0	0.00

The most popular reason of the respondents for their adaptation practice was that it was the most common strategy and everyone was doing it. Other reasons included the low cost of the adaptation practice and the recommendation of neighbors or experts for the strategy.

Among the strategies adopted, what were the most effective? A total of 36 percent of the households cited storing of food, water, and basic household needs and staying at home during the typhoon. Around 11 percent listed securing the boat, livestock, and household items in safer places and regularly updating of warning information as effective.

Structural measure such as reinforcing the house before the typhoon was rated not effective by 10 to 14 percent of households. This is understandable as damage to houses was the worst experienced by the households.

5.3.3 Collective adaptation

Majority of the respondents in both lowland (68%) and coastal (59%) households claimed that there was no collective action in their area to respond to Typhoon Milenyo because of the lack of cooperation or unity among the community members. Around 10 percent said that they did not know how to act collectively in dealing with the typhoon.

Around 40 percent of the household respondents reported that somebody (the respondent, spouse, sibling, or in-law) in the family participated in collective actions to deal with Typhoon Milenyo. For example, the family member spent around 0.5 man-days in helping to disseminate early warning information (before the typhoon)

(Table 16). During the typhoon, family members spent almost one man-day in assisting in the evacuation and rescue operations and in performing other activities such as providing shelter. Among coastal household respondents, more time, e.g., 5 man-days were spent for activities after the typhoon, such as in mobilizing assistance in distributing goods; and 2 man-days in repairing electrical facilities. Only one coastal household donated cash (PhP200 or US$4) after the typhoon.

Table 16. Average time (man-days) spent by family members who participated in collective action to deal with Typhoon Milenyo

Mode of collective action	Lowland		Coastal	
	Man-days	% of HH	Man-days	% of HH
Total no. of respondents	200		200	
No. of respondents with household members who participated	84	42.00	81	40.50
Before Milenyo				
Warned community members	0.45	19.05	0.57	12.34
Helped people to reinforce and harvest crop	0.20		0.08	
Number reporting	4	4.76	5	6.17
Other activities (coordinated at barangay level to provide evacuation equipment, moved livestock to safer places)	0.27	8.33	1.13	7.88
During Milenyo				
Assisted in evacuation, relief, and rescue operation	0.64	26.19	0.90	20.99
Monitored the situation	0.72	10.71	0.90	7.41
After Milenyo				
Helped assess social condition	0.47	10.71	1.92	3.70
Helped repair damaged dwellings	0.71	30.95	0.67	33.33
Extended credit to other community members	0.00	0.00	0.13	1.23
Helped in relief goods distribution	0.84	19.04	3.25	12.34
Other activities (repaired damaged electrical facilities in the barangay, helped put back household items, provided shelter, helped neighbors organize and clean up)	0.75	7.14	1.25	6.07

5.3.4 Assistance from external sources

Majority of the respondents (58%) did not receive assistance from external sources particularly after the typhoon (Table 17). From those who received assistance, 82 percent received relief goods and 19 percent received financial assistance from the LGUs. Relatives or friends also provided financial support to 22 percent and relief goods and shelter to 10 percent of the respondents.

Table 17. Percentage distribution of households who received assistance from external sources

Item	Lowland		Coastal		Total	
	N	%	N	%	N	%
Total no. of respondents	200		200		400	
Did your HH receive assistance						
No	126	63	108	54	234	58.5
Yes	74	37	92	46	166	41.5
Timing of Assistance						
Before	0	0	2	1	2	0.5
During	4	2	2	1	6	1.5
After	77	38.5	101	50.5	178	44.5

5.4 Other Adaptation Possibilities for Households and Constraints to Adoption

5.4.1 Adaptation options identified by households

The households were aware of the behavioral, structural, and technological adaptation options, but they were not able to do these with Typhoon Milenyo because of some constraints. Around 26 percent said that they should have reinforced the house before the typhoon (Tables 18). During the typhoon, a few households said that they should have moved the family members and household items to a safer place. Some said that they should have repaired household damages after the typhoon.

Table 18. Other adaptation options identified by respondents but were not undertaken by lowland and coastal households

Adaptation options	Lowland		Coastal	
	N	%	N	%
Behavioral				
Buy and store food, drinking water, and other necessities	19	9.50	13	6.50
Move household items to a safe place	9	5.50	11	5.50
Gather harvestable crops/harvest earlier	4	1.50	2	0.50
Evacuate to a safer place	6	3.00	8	4.00
Structural				
Reinforce/improve house	57	28.50	50	25.00
Technological				
Cut/trim trees near the house	6	3.00	6	3.00

The households were not able to do these activities because of financial constraints. Others did not act early because they did not expect the coming typhoon to be that strong. The respondents realized that they should always be prepared, save for emergency situation, and monitor the typhoon forecast.

5.4.2 Adaptation options identified by experts

Majority of the respondents agreed to attend trainings on climate change adaptation (75%) and to participate in community-organized activities (67%). However, 59% were not willing to move to a safer place permanently (Table 19).

Table 19. Other adaptation options identified by experts and willingness of households to adopt

Adaptation Option/Willingness to Adopt	Lowland		Coastal	
	N	%	N	%
Total no. of respondents	200		200	
Move voluntarily to an evacuation center	83	41.50	88	44.00
Wait first for advise to evacuate	26	13.00	27	13.50
Avail of housing and crop insurance	60	30.00	75	37.50
Permanently move to a safer place	29	14.50	19	9.50
Attend trainings on CCA and DRM	149	74.50	152	76.00
Participate in community-organized activities	122	61.00	147	73.50

Those who were willing to evacuate reasoned out that the safety of their family would be assured. Availing of insurance would be of financial help and attending trainings would help them gain knowledge in disaster preparedness.

Participating in community-organized activities would also be spiritually uplifting for them.

Those who were not willing to evacuate thought that it was safer to stay at home and that it was difficult to stay in evacuation centers. Many were not willing to move permanently to a safer place, and this was understandable because majority of them owned their houses and the lots, and they had no other place to go. They also thought that it was expensive to move and that typhoons would come anywhere they go anyway. Respondents who were not willing to attend trainings or participate in community-organized activities thought that they were already old for such activities. They also said that they could obtain information about the typhoon from television and radio. Households who were not willing to take up insurance reasoned out that they lacked funds, their property was not worth insuring, and it was hard to trust an insurance company.

Respondents who were not sure if they would evacuate said that their decision depended on how strong the typhoon was going to be, thus they had to first assess the situation. Their concern in taking up insurance was the insurance company's credibility. Their participation in training and community-based activities depended on the duration of these activities as they had other work to do.

Household needs to deal with typhoon events

The two most important needs cited by the households to deal with typhoon events such as Milenyo were financial assistance and the building of strong infrastructure. Forty-five percent (45%) said they were no longer hoping and leaving things to fate.

5.5 Perception Toward Future Risks and Lessons Learned

Majority of the respondents (95%) "agree" to "strongly agree" that their experience with an extreme typhoon event such as Milenyo was a matter of fate over which they had little control (Figure 18). Among these respondents, 34 percent had elementary education, 4 percent reached high school, and 16 percent had college education.

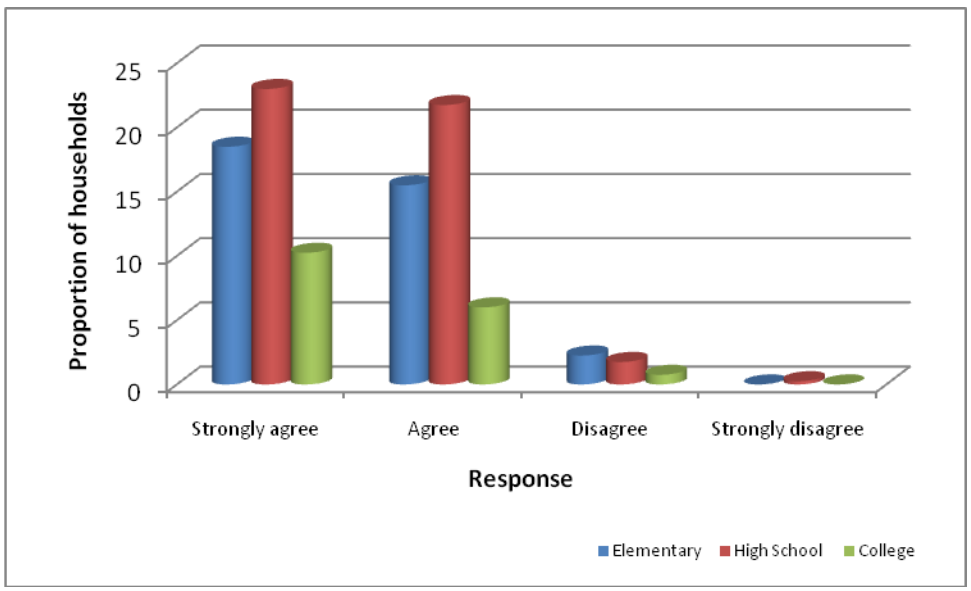

Figure 18. Proportion of households that believed that the incidence of a strong typhoon is a matter of fate

Moreover, 56 percent of respondents were not sure if future typhoon events would be more severe or just about the same as what they have experienced with Milenyo. Those who thought that future events would be more severe (18%) reasoned out that natural resources were overexploited, and climate change would induce more rainfall.

Even while being unsure of the severity of future typhoons, majority of the households (53%) expressed no plan to prevent their possible impacts. Those with a plan were thinking of moving to other places or were working hard to prepare for a typhoon.

The major lesson the households learned from their experience with Typhoon Milenyo was to be alert/prepared. Others realized that it was necessary to improve or secure the house and to prepare a household's basic necessities.

While the household respondents believed that there were existing programs addressing adaptation to typhoons in their locality such as the disaster protocol, they also pointed to the other role of LGUs in minimizing risks and in facilitating rehabilitation recovery. These pertain to an early warning system, information campaign, and monitoring system. Many believed that PAGASA forecasts were reliable, but others pointed to the need for localized forecasting. Community organizations, for instance, could help in providing financial assistance and other services such as in a warning system, in information dissemination, and in rescue and relief operations.

6.0 THE ROLE OF COMMUNITY ORGANIZATIONS IN ADAPTATION TO TYPHOON MILENYO

Three local community organizations (LCOs) in San Juan and eight in Tanauan were covered by the study. The community organizations interviewed included barangay- based and/or municipality or city-based fisherfolks organizations, farmers' associations, civic organizations, and women, men and youth groups. The local community organizations' response actions differed considerably, primarily because disaster risk management was not part of their mission.

6.1 Adaptive Capacity of Local Community Organizations

Human Resource Indicators

These organizations had limited human resource capability. The number of officers ranged from eight to 33, and they did not have any regular staff. Their size also varied. The smallest in membership was Ticalan Farmers Association (TFA) with 20 members, while the biggest was Knights of Columbus (KC) with 200 members. Their total membership constituted only less than 1 percent of the total community population. Also, none of these LCOs was organized in connection with DRM or CRM.

In Tanauan City, the eight LCOs were rural-based and represented the different sectors of the community, i.e., elderly, farmers, fisherfolks, religious, and interestingly, gender groupings. The biggest local organization was Ambulong Senior Citizens Organization with 215 members, while the smallest was Barangay Lithurgical Council with 10 members. The number of officers ranged from seven to 11, while total membership constituted about 0.83 to 18.94 percent of the total

population in the areas where they operated. None of these organizations were formed in connection with DRM. One farmer association in San Juan had members who have attended disaster management training.

Economic/Financial Resources

The community organizations varied significantly in their level of economic or financial resource capability, although most of them had limited resources, and they sourced their funds from their own members' annual dues and membership fees.

In San Juan, the biggest community organization in terms of financial resources was the Rotary Club. Its members paid PhP4,800 (US$100) annually, and it had a total annual collection of about PhP129,600 (US$2,700). The smallest was Knights of Columbus with its members paying only about PhP480 (US$10) per year.

In Tanauan City, the biggest community organization was Ambulong Senior Citizens Organization, while the smallest was the *Kalipunan ng Liping Pilipina* (KALIPI) or Filipino Women's League. These community organizations collected membership and annual dues of PhP62,350 (US$1,298) and PhP3,640 (US$75), respectively. These organizations' main source of funds was membership dues, which ranged from PhP10 per member (US$0.21) for KALIPI to PhP200 per member (US$4) for Altura Farmers Association per month.

Among all the community organizations interviewed, only KC and RC set aside financial resources for disaster relief assistance in the amount of PhP20,000 (US$416) and PhP30,000 (US$625), respectively.

Institutions and Networks

KC and RC conducted meetings regularly in accordance with their charters. KC conducted an average of two meetings per month while RC conducted an average of four meetings per month. TFA, which was newly reorganized, had held only one meeting and this was attended by all its members. Only KALIPI in Tanauan City conducted regular meetings, but members of the other LCOs were generally easy to mobilize, particularly during emergency situations.

Community organization members contributed cash and/or material support to other community members in case of emergencies. The values of sharing and ~~–b~~ayanihan" were quite strong in these communities.

Many members of the local community organizations were also members of other groups/organizations. For instance, the key informant from TFA was a former member of the local legislative body. The local KC and RC were affiliated with the provincial and national chapters of their organizations.

In Tanauan City, the local KALIPI and Senior Citizens organization Chapters were affiliated with municipal-level organizations. However, some organizations such as the Empowerment and Reaffirmation Paternal Abilities Training (ERPAT), Gran Boys, and Altura Farmers' and Fisherfolks' Association existed only in the study areas.

All these LCOs were organized mainly for social and civic purposes, but members helped LGUs in relief and rescue operations during times of calamity. For instance, ERPAT members helped to bring Typhoon Milenyo victims to the hospitals and KALIPI helped barangay officials in warning people at risk from Typhoon Milenyo, while KC and RC helped in relief operations.

Knowledge and Skills

The level of education of the community organization leaders varied considerably depending on the type of organization. Leaders of KC and RC had an average of 14 years of education, while the TFA leader had only six years of education.

In Tanauan City, organization leaders of KALIPI, Barangay Lithurgical Council, and Ambulong Senior Citizen had an average of 14 years of education, while the rest of the LCO leaders had six years of education. None of these LCOs conducted a training on disaster risk management for their members. Many of the KC and RC members learned about disaster risk management from their schools and business associations, while only KALIPI members have attended a training on disaster management.

Technology and Infrastructure

In San Juan, information about Typhoon Milenyo was sourced from radio and television alone. RC and KC disseminated the information about climate change events through text messaging, while TFA did not participate, as an organization, in any Typhoon Milenyo-related activity. The COs did not own any means of transportation/ equipment.

Most of the LCOs interviewed, except for KC in San Juan, did not have an evacuation center in case a climate change-induced event or disaster occurred. KC had a clubhouse near the church that could be used as evacuation center. The evacuation centers used by the LGUs were public school buildings, barangay halls, or churches.

6.2 Adaptation Strategies Undertaken by Community Organizations

Community organizations in the study areas do not have mandates explicitly related to climate-related disaster management. However, with the general mission of providing service to the community, some COs got involved particularly in relief operations in times of calamity.

In Tanauan City, members of KALIPI participated in early warning campaign of barangay officials before Typhoon Milenyo occurred. Ambulong Fisherfolks' Association helped in evacuating people to safer places and in reinforcing neighbors' houses. It also monitored the situation of the families living along the lake's shore. Some members of ERPAT helped in emergency cases like bringing injured person to the hospital (Table 20). In San Juan, some KC and RC members communicated with other members about the status of the Typhoon Milenyo in their locality.

It was after the typhoon that other COs like the KC, Rotary Club, and ERPAT helped in relief operations. KC and RC distributed relief goods to affected people. KC and RC funded their relief operation out of their own internal budget. They distributed relief goods to the affected families of San Juan. KC also contributed about PhP15,000 (US$312) to Typhoon Milenyo victims in Albay Province. As socio-civic organizations, these COs would carry out similar activities in future typhoon events like Milenyo and if the situation calls for their assistance.

Table 20. Adaptation strategies done by community organizations for Typhoon Milenyo, September 2006

Type of Adaptation	San Juan	Tanauan City
Prior to Milenyo		
Behavioral	*Fisherfolks' Association:* - brought people to safer place - helped in reinforcing houses	*KALIPI:* - participated in early warning campaign of barangay officials *Ambulong Fisherfolks Association:* - brought the people to a safer place - helped in reinforcing houses *Farmers' Association:* - helped in warning the residents of the coming typhoon
During Milenyo		
Behavioral	*Fisherfolks' Association:* - monitored bancas and families living in the lakeshore	*KALIPI:* -monitored the situation in the barangay *Ambulong Fisherfolks Association:* -monitored fishing boats and families living in the lakeshore *ERPAT:* - helped in emergency cases - brought injured to the hospital
Post Milenyo		
Behavioral	- distributed relief goods (worth PhP20,000 (US$416) from KC and PhP30,000 (US$625)from RC) - RC conducted medical mission	All LCOs helped in clearing activities. *ERPAT:* - helped in emergency cases - brought injured to the hospital - helped in cleaning activities *Gran Boys* - monitored houses/ families
Financial		- Senior Citizens Association donated funds for relief operation

The COs also experienced some losses from Typhoon Milenyo. The Ambulong Fisherfolk Association, in particular, reported that its members incurred damage and losses because of Typhoon Milenyo. A total of 10 fishing boats were damaged and four were reported missing. However, such an event also created opportunities that others were able to benefit from. For instance, the destroyed fish cages in Taal Lake, causing huge losses to fish cage owners, gave opportunity for small fisherfolks to catch the fish released from the fish cages. One fish cage was also blown by windstorm to the shores of Barangay Ambulong. This gave the fisherfolks as well as other local residents additional income for about two weeks after Typhoon Milenyo.

6.3 Other Adaptation Options Identified by Community Organizations

According to the COs, the most vulnerable groups in their community were the children and the people living near the river. The COs suggested that the people should be more responsive and more alert to typhoon events.

The COs also considered the lack of information about climate change as a factor that caused failure. KC and RC key informants believed that the information dissemination of LGUs was not enough and that it was constrained by lack of funds. Hence, the COs said that information campaign must be enhanced, and the campaign must be financed. They likewise recommended the conduct of massive IEC,

particularly on disaster preparedness and training/lecture on the preventive health measures.

7.0 LESSONS LEARNED AND RECOMMENDED COURSES OF ACTIONS

Judging by the key informants' responses about their adaptive capacity, adaptation behavior, and strategies, LGUs need some conceptual and operational reorientation in order to enhance their capability to address future typhoon events. The challenge is for the LGUs to review their capability, knowledge level, and systems and procedures in responding to typhoon and flooding in the context of climate change and climate risk management.

Other challenges include: mobilizing COs as partners in climate risk management; educating and empowering the community to make CRM decisions independent of government initiatives; and mainstreaming CRM in the local development plan to facilitate resource mobilization. Mainstreaming CRM in the local plan is preferable to treating it as a calamity-based response with the LGU's calamity fund as the main budget source.

7.1 Lessons Learned

Significant lessons can be drawn from the experiences of San Juan and Tanauan City with Typhoon Milenyo and other typhoons that have caused severe damages in the recent years. These lessons have operational and policy implications as well as national and local applications. These can be used by the LGUs to improve their adaptive capacity and adaptation strategies. To synthesize the lessons, the LGUs' experiences were compared with good practices cited in the literature.

Among the lessons learned are the following:

1. LGUs and communities have to enhance their adaptive capacity and reorient their current adaptation strategies. The usual relief, rescue, and evacuation operations are no longer effective and could hardly be sustained considering the increasing intensity of Philippine typhoons and consequent flooding that may occur in the future. LGUs should institute effective and sustainable adaptation strategies, with the goal to prevent the recurrence of disaster and to develop higher level of resilience.
2. Preparedness does not only mean stocking of relief goods and preparing rescue equipment. It includes the ability to prevent risks from turning into disasters. It also includes an early warning system that can inform the people and decision makers to make timely and accurate decisions based on a commonly understood set of indicators.
3. It is important for LGUs to have a localized flood warning system and not rely fully on national level forecasts, which only contain information on typhoons, wind direction, and wind velocity.
4. The LGU officials and the people have yet to fully understand the implications of climate change and the changing typhoon intensity. They have to comprehend that the associated risks are not only incidental, but these have a certain degree of certainty, and that such extreme events could possibly recur more certainly in the future than before. The people's awareness of these climate change-related risks and the level of response needed to mitigate their adverse impacts could motivate people to improve their adaptation behavior.

Adaptive capacity of households to extreme climate events such as a typhoon indicates the households‘ ability to adjust its characteristics or behaviors to expand its coping range under such event. The indicators used to assess adaptive capacity of households were categorized into: a) infrastructure, b) economic, c) technology, d) social capital indicators, and e) skill and knowledge.

Typhoon Milenyo (with international name Xangsane) was the extreme climate event addressed in this study. This typhoon brought more strong winds than rainfall, causing rivers to overflow. Flooding in the lowland areas was associated with water coming from uplands aggravated by clogged waterways. Over 50% of the sample households reported a little damage, while 30% experienced severe damage.

Based on the overall adaptive capacity index, lowland and coastal households were of equal standing at the rate of 0.48. However, in specific indicators, lowland households fared better in infrastructure and technology, while coastal households fared better in social capital and economic adaptive capacity. On the other hand, lowland households were weak in social capital, and coastal households in skills and knowledge.

Households depending on non-farm and self-employment sources and waged labor had higher income than those depending on resource-based livelihood such as agriculture and fishing. Lowland households suffered the most losses in agricultural production, practically wiping out their expected earnings. Thus, it took them longer (more than half year) to recover from losses/damages. Losses in income from businesses and employment were relatively lower, accounting for 2 to 7 percent of their annual income. Hence, recovery was from one to two months after the typhoon. Some benefits derived from Typhoon Milenyo were higher fish catch from damaged fish pens and increased sales of retail stores.

Most households obtained information on climate events from television and radio and observed the rare interaction on climate-related issues in the community. With their experience with Typhoon Milenyo, majority of the respondents agreed to strongly agreed that the typhoon was a matter of fate over which they had little control. Being unsure of the severity of future typhoons, majority of the households (53%) expressed no plan to prevent their possible impacts.

Majority had not joined any community organization or attended any training on disaster preparedness. During Typhoon Milenyo, collective actions were limited to disseminating early warning information, assisting in evacuation and rescue operations, and distributing relief goods from LGUs.

Households practiced behavioral adaptation measures they knew or others were doing. These included ensuring basic necessities of the households such as food, water, and other household needs and looking after the safety of the family and household assets. Households were not able to do other possible options because of financial constraints. Further, they did not expect the typhoon to be that strong and destructive.

Although majority of the households had easy access to shelter and similar facilities, they would rather stay at home believing that they were safer in their own houses than in an evacuation center. More so, many were not willing to permanently move to a safer place because of their attachment to their properties, e.g., house and lot which they owned.

These findings conform to the ―green gap" analysis of Liverani (2009). Households' awareness of a climate change-related event has not been translated to individual actions. This non-translation was not only because of the low adaptive capacity of households but also because of their attitude and perception over climate change-related problems and solutions. This ―green gap" in public attitudes partly stems from how climate science has been communicated and how people's minds' have (mis)understood climate dynamics. Knowledge about climate change is not always expected to lead to action for several reasons: 1) people prioritize between a set of needs, and 2) people assess both the market and non-market implications of their decisions.

While the household respondents believed that there were existing programs addressing adaptation to typhoons in their locality such as the disaster protocol, they also pointed to the other role of LGUs in minimizing risks and in facilitating rehabilitation recovery. These pertain to an early warning system, information campaign, and monitoring system.

7.2 Recommended Courses of Actions that LGUs Should Undertake

In the immediate future, the LGUs should improve their adaptive capacity, particularly in institutional framework and governance. They should then translate this capacity in formulating plans and strategies that would increase the resilience of communities to climate-change related events such as intense typhoons. The following measures are recommended:

1. Review the DRM framework and formulate appropriate CRM strategies that are generally proactive to typhoon and flooding;
2. Strengthen IEC programs by enriching the substantive content of lecture materials and by formulating a system of communicating and disseminating relevant information to decision makers and the general public. Aside from a clear and scientific discussion of the climate change phenomenon and its impact, the lecture should emphasize mitigation and adaptation strategies that the people can undertake to mitigate climate change and minimize its adverse impacts;
3. Conduct science-based vulnerability analysis and prepare a vulnerability map to identify vulnerable sectors and areas;
4. Formulate a localized and community-based early warning system that specifies climate parameters that should be monitored and understood for critical decision points;
5. Communicate early warning information to people to develop their skills in monitoring and interpreting critical climate parameters for appropriate and timely adaptation decisions;
6. Communicate early warning signs to policy and decision makers so they can formulate appropriate policies and make timely decisions;
7. Maintain a knowledge management system wherein climate-related data will be systematically stored and retrieved for planning and policymaking purposes; and
8. Consider CRM as a development activity that integrates preparedness; adaptive capacity enhancement and adaptation strategies improvement; and

monitoring, evaluation, and upgrading into the municipal development plan and regular workload of LGU staff.

The multi-stakeholder nature of adaptation to climate change implies that the solution rests not on a single actor but on all affected sectors. Policymakers need to be aware of the barriers to action, and treat policy options accordingly. As pointed out by Liverani (2009), relevant policy areas include: communications, institutional measures, and social norms. Well-designed climate communication campaigns that address individuals as members of a local community can empower them to act.

The following recommendations in communication strategies can change people‘s behavior:

1. Convince people about the seriousness of the problem related to climate change by making clear to them the magnitude of possible losses that they may incur and the probability of severe personal losses that may occur in the immediate future. It may also help to emphasize the impacts of memorable events (e.g., Typhoon Milenyo) and likely further events.
2. Clarify to people the most effective adaptation strategies to counter their vague and incorrect ideas about the problem.
3. Inform people about relevant social policies and public action and how the changes in the individual action and community can help combat climate change.
4. Point out that effective adaptation is one‘s moral obligation to society and the future generation.
5. In terms of adaptation decisions, give priority to proactive actions reducing future risk. However, since significant risks will remain, then also provide for reactive approaches to recover from unavoidable impacts.

Beyond communication, the suggestion of Liverani (2009) for climate policy is to design interventions that take into account psychological and social constraints to positive action. Effective adaptation interventions should include institutional measures that address communities‘ own perceptions of risk, vulnerability, and capacity. The institutionalization of participatory self-assessments for local, and even national disaster preparedness, adaptation planning, and mitigation targets can be useful in this. Given some level of uncertainty in forecasting climate events and possible impacts, policy makers should ensure continuous monitoring of underlying climate parameters that signal stress and shock, and of aspects of adaptive capacity.

Social norm-based appeals for pro-environmental behavior are superior to traditional persuasive appeals (Liverani 2009). Social norms are established patterns of behavior that most people approve of, or the yardstick individuals use to assess the appropriateness of their own behavior. The basic idea is that individuals want to act in a socially acceptable way and tend to follow the lead of others, particularly when the others are numerous and appear similar to them. Rather than look for clues about how to behave when unsure about conduct and outcomes, people rely on what others do. It points to the potential role of social capital in enhancing adaptive capacity (Beckly et al. 2002 cited in Swanson et al. 2007). Building social capital would be crucial to collectively combine and mobilize different forms of capital within institutional and relational contexts to meet challenges brought about by climate change-related events.

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