



Adaptive capacity of local communities to flash floods and landslides: Comparison of indigenous and non-indigenous people in Eastern Mindanao

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Abstract

The paper assessed and compared the adaptive capacity of indigenous peoples (IPs) to non-IPs in five villages that were affected by Typhoon Bopha (Pablo) in Eastern Mindanao in 2012. The flash flood and landslide disasters were caused by exposure to heavy rainfall combined with sensitivity of the environment in the region. Because these climatic and ecological risks are expected to persist in the future, it is necessary to assess the capacity of the communities to adapt to the socio-economic impacts of disasters. The assessment was based on survey data that were analyzed using factor and cluster analyses. The factor analysis was used to identify the most relevant factors affecting adaptive capacity and cluster analysis was used to develop typologies of adaptive capacity. The results revealed that a higher number of IPs have low and very low adaptive capacity than non-IPs. The main factor that lowers the adaptive capacity of the former is (lack of) access to resources including education and calamity support as well as skilled and contract-basis types of employment. The IPs have low adaptive capacity to both short- and long-term impacts of typhoon-induced floods and landslides. Education and capacity building are essential to improving IPs' access to resources and thus increasing adaptive capacity.

Keywords: adaptive capacity · climate change · disaster · indigenous people · Philippines · vulnerability

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Introduction

Adaptive capacity is one of the three dimensions of vulnerability. The Intergovernmental Panel for Climate Change (IPCC) (IPCC, 2001, 2007) defines vulnerability as the “degree to which a system is susceptible to, and unable to cope with, the adverse effects of climate change, including climate variability and extremes”. It is a function of adaptive capacity, sensitivity and exposure. On the one hand, exposure in the Philippines is significantly linked to the impacts of climate change, in particular the increasing intensity and frequency of tropical cyclones that make the country one of the most vulnerable worldwide. According to the German Watch, the Philippines ranked fourth in the Long-Term Climate Risk Index with annual average of 862 deaths, 2.76 billion USD losses, and 0.63% gross domestic product (GDP) lost for the period 1996-2015 (Kreft, Eckstein & Melchior, 2016). An average of 20 tropical cyclones enter the Philippine Area of Responsibility (PAR) every year, which is about 25% of the global occurrence of tropical cyclones (Faustino-Eslava, 2011; Huigen & Jens, 2006). On the other hand, sensitivity is caused by environmental degradation, in particular significant deforestation in upland and coastal areas. The environment has been substantially degraded from anthropogenic activities resulting in the decline of mangrove forests by 80% in the last 50 years, and of upland forests by about 21 million hectares between 1900 and 1990 (Eugenio et al., 2016). Like in many parts of the Philippines, forest areas in Eastern Mindanao are largely denuded mainly due to illegal logging, irresponsible mining and widespread land use conversion (i.e. forest to agriculture). For example, illegal logs with an equivalent USD value of 68,000 (Php 3.4 million) were confiscated by the government in Compostela Valley Province in 2005, farms increased by 10.9% in Caraga or Region XIII from 1991 to 2002, and mining sites of 116,546 hectares proposed for 50 Mineral Production Sharing Agreements in Eastern Mindanao in 2008 are forest areas (Philippine Eagle Foundation, Conservation International-Philippines & Department of Environment and Natural Resources [DENR], 2008).

On December 14, 2012, Eastern Mindanao was devastated by Bopha (locally known as Pablo), one of the strongest typhoons in the Philippines with an average speed of 185 km/hr and gusts of up to 210 km/hr (National Oceanic and Atmospheric Administration [NOAA], 2012). Bopha was a category five typhoon, the highest scale under the Saffir-Simpson Hurricane Wind Scale of the National Oceanic and Atmospheric Administration (NOAA). The National Aeronautics and Space Administration or NASA (2012) estimated that heaviest rain of over 240 mm (~9.4 inches) was located near the coast of eastern Mindanao including Compostela Valley. The amount of rainfall exceeded the mean monthly rainfall of 206 mm in the province (Narisma et al., 2014) and far above the minimum of 70 mm daily rainfall that was estimated as a threshold for early landslide advisory (Nolasco-Javier, Kumar, Arlene & Tengonciang, 2015). The heavy rain fell on the upland watershed area in Andap causing flash floods (Mines and Geosciences Bureau [MGB] & DENR, 2012).

The geomorphological landforms in Andap and surrounding areas consist of thick fluvial deposits consisting mostly of unconsolidated clay, silt, sand and rock boulders (MGB & DENR, 2012), which can be easily washed out by heavy rainfall. The landslide susceptibility map shows that the province is mostly marked red or high risk and has several portions marked purple or very high risk (Villanueva, 2012). The flash floods and landslides caused by Bopha affected more than 6 million people, killed at least 1,000 people, damaged more than 200,000 houses, and destroyed about 1 billion US\$ of agricultural products, infrastructure and private properties in Eastern Mindanao (Eugenio et al., 2016). New Bataan in the Compostela Valley Province was the most affected municipality, where thick mud and huge rocks covered largest areas of many villages, burying lives and livelihoods of many people (Acosta et al., 2016; Manuta, Eugenio & Macandog, 2018).

Like in many parts of Mindanao, New Bataan is home to many migrants from other islands in the Philippines, but also to many indigenous peoples (IPs) (Tigno, 2006). Although the IPs are officially recognized by the Philippine Constitution and the Indigenous Peoples' Rights Act, there are no accurate figures on the population of the IPs due to absence of formal census. Data on IPs in the Philippines continue to be based on estimates, which are around 10-20% of the total population or 102.9 million (Hansen, Jepsen & Jacquelin, 2017) and living in 65 out of 78 provinces (Carino, 2012). About 61% of the IPs live in Mindanao, as compared to only 33% in Luzon and 6% in the Visayas (ADB, 2002). The importance of Mindanao as home to many IPs makes it an interesting case study for assessing adaptive capacity to flash floods and landslides. Most Philippine IPs continue to live based on their traditional and livelihood practices (Sobrevila, 2008; Balilla, Anwar-McHenry, McHenry, Parkinson & Banal, 2012) and in remote areas far from access to basic social services and economic opportunities (Hansen et al., 2017). But with the increased migration from other regions and mobility of local population in Mindanao, many of the IPs have been influenced into the non-traditional forms of livelihood (i.e. cash crop farming, commercial fishing, logging, and mining) of the non-IPs including migrant settlers and lowlanders (Philippine Eagle Foundation et al., 2008). The lack of access to social services and economic opportunities as well as change in livelihood practices could have an impact on the IPs' capacity to address climate change impacts.

Only few studies investigated the adaptive capacity or adaptation practices of IPs in the Philippines (e.g. Bernardo, et al., 2014; Hiwasaki, Luna, Syamsidik & Marçal, 2015; De los Santos et al., 2017) and none so far in the Compostela Valley. Since the landslide and flash flood events in 2012, no systematic study has been conducted to compare the adaptive capacity of IPs and non-IPs in New Bataan's most affected communities. This paper contributes to the assessments of adaptive behaviour with the ultimate goal of stimulating adaptation support to the most vulnerable people. In particular, it aims to identify the sources of vulnerabilities and the level of adaptive capacity between

these two community groups. It is an important extension of the study on loss and damage by Eugenio et al. (2016) in the same municipality. This paper highlights the differences between IPs and non-IPs in terms of their adaptive capacity to recover from the impacts of household and livelihood losses and damages.

Materials and Methods

Case Study and Survey Area

The municipality of New Bataan, which is about 689 square kilometres, accounts for 14.8% of the total land area in Compostela Valley (National Statistical Coordination Board [NSCB], 2014). It is the province's second largest municipality in terms of land area but the fourth smallest in terms of population (47,470 people or 6.9% of total population). There are 12,562 households living in 16 villages in New Bataan, with an average household size of 5 persons (NSCB, 2014). Agriculture is an important sector in New Bataan covering 24.57% of its total land area and employing half of the economically active population. The Municipal Office of New Bataan reported about 450 retrieved casualties and 8,000 damaged houses in April 2013 (Eugenio et al., 2016). The case study villages include Andap, Bantacan,

Cabinuangan, Cogonon and Kahayag. The human losses and property damage were highest in the villages of Andap and Cabinuangan. In Andap, the village center was covered by debris flows which buried houses, school, resorts, health centers and other village facilities. The main characteristics of the five villages are described briefly below.

Andap is situated at the mouth of a mountain drainage network at the base of steeply slopes. It is nestled on an alluvial fan, normally found at the base of mountains where water drains, making the village very vulnerable to floods and landslides. Andap is a rural area, covering the largest area of the municipality (20.32% of the total land area) (Table 1). Before the disaster, it was a popular tourist destination with its beautiful resorts (i.e. the famous Bamboo inland resort) and mountainous surroundings. After Typhoon Bopha, it sustained the most impacts in terms of deaths (70), missing people (290) and damaged houses (1,250) in the municipality of New Bataan.

Bantacan is bounded on the south of Cogonon. There were at least three casualties and one injured in Bantacan after the typhoon and about 600 houses were partially or totally damaged. At the time of writing, there are still 148.34 hectares of the damaged land area that cannot be utilized for agricultural purposes.

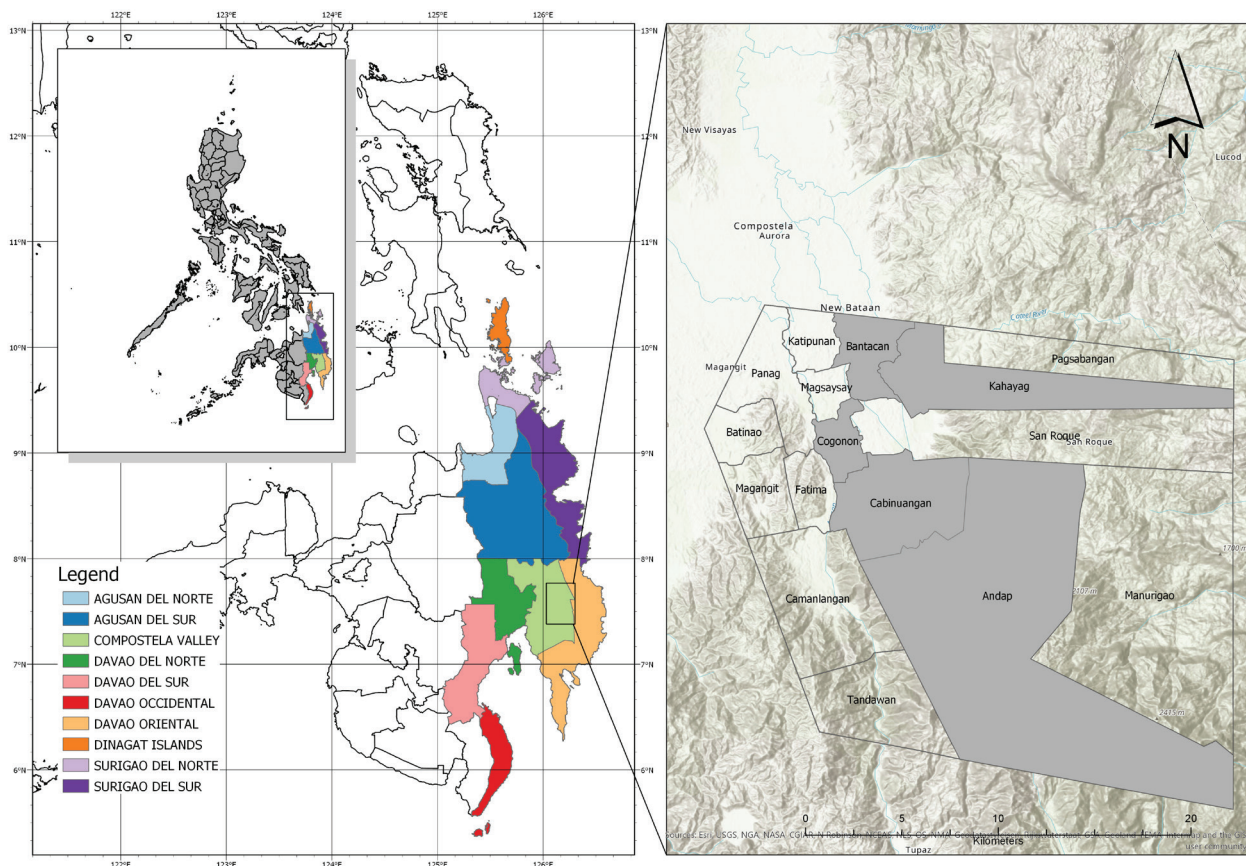


Figure 1. Location of case study villages in the municipality of New Bataan

Cabinuangan is the main growth center in New Bataan. It is the urban area in the municipality with the largest number of population (10,390). It has a total land area of 2,998 hectares where only 3.24% is forest area. Second to Andap, it has experienced the largest impacts from typhoon disasters with 66 deaths, 144 missing people and about 1,900 damaged houses.

Cogonon is one of the smallest villages in the municipality with only 1.18% of the total land area. Cogonon was not as severely damaged, but it is one of the poorest communities in New Bataan because of little non-agricultural income opportunities.

Kahayag used to be part (i.e. sitio) of Bantacan and was formerly known as Simsimin. The village was later renamed Kahayag which means “enlightenment.” Pioneer residents in the area were indigenous communities of Mandaya and Matikadongs. As early as 1958 many logging companies settled in the area and built bridges and roads for its logging concessions. After Typhoon Bopha, there were no reported casualties in the village, but around 400 houses were damaged.

The study used a structured survey questionnaire combining multiple choice and open-ended questions. The questionnaire covered among others: (1) socio-economic and demographic profiling, (2) overview of livelihood activities, (3) typhoon-induced disaster experiences, (4) disaster recovery and adaptation strategies, and (5) health and social networks. The household surveys were conducted on November 18-21, 2014 and March 16-20, 2015. Multiple-stage sampling was applied in selecting survey respondents. The first-stage sampling involved stratification at the municipal level wherein stratification criteria included level of damage and economic characteristics. The second-stage sampling aimed at determining the sample size at the village level which was calculated using the Cochran method at a 95% confidence level and 8% confidence interval (Cochran, 1997). The third-stage sampling involved stratification at the village level to capture different livelihood sources. Stratification at this level aimed at determining how the nature of livelihood (non-agriculture versus agriculture, i.e. coconut, banana and other perennial crops, abaca, and others) influences preferences for adaptation strategies. Finally, random sampling was employed in

identifying the survey respondents. The main socio-economic characteristics of the respondents and IPs are presented in Table 2. The total number of respondents is 438, with the IPs accounting for 31%. The number of female respondents was higher because their husbands are usually working during daytime. The survey covers, however, questions about the household, so information about the work of the spouses was also considered in the analysis. Many of the surveyed IPs have moved from remote to more accessible villages in New Bataan. This explains why there is slightly less IPs who are living in their villages for over 30 years as compared to the non-IPs (Table 2). During the conduct of the survey, it was not possible to travel to very remote areas due to security reasons including political conflict and landslide risk.

Analytical Framework and Tools

Awareness-Ability-Action framework

We framed society's behavior to adapt to the impacts of flash floods and landslides based on IPCC concept of adaptive capacity: “the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences” (IPCC, 2001, 2014). This paper has mainly drawn from the work of Acosta et al. (2013), who developed their concept based on many previous studies (Moss, Brenkert & Malone, 2001; Yohe and Tol, 2002; Luers, Lobell, Sklar, Addams & Matson, 2003; Ivey, Smithers, de Loe & Kreutzwiser, 2004; Brooks and Adger, 2004; Haddad, 2005; Adger and Vincent, 2005; Alberini et al., 2006; Tol and Yohe, 2007; Acosta-Michlik, Kumar, Klein & Campe, 2008; Carpenter and Brock, 2008; Sharma and Patwardhan, 2008; Gupta et al., 2010; Acosta and Galli, 2013). Eugenio et al. (2016) modified the Awareness-Ability-Action framework to make it more suitable for local case study analysis. Here, the system refers to a society that has to cope with the consequences of climate extremes particularly typhoons and heavy rains causing flash floods and landslides. The framework considers three interrelated human dimensions of adaptive capacity – awareness, ability, and action. Eugenio et al. (2016) identified determinants for each dimension, i.e. knowledge and experience and social learning

Table 1. Characteristics of the case study villages in New Bataan

Village	Land area (hectares)	Population (number)	Households (number)	Damage and losses from typhoon
Andap	11,241	7,591	1,655	70 deaths, 290 missing, over 1,250 damaged houses
Bantacan	1,117	2,932	2,609	3 deaths, 600 damaged houses
Cabinuangan	2,998	10,390	2,364	66 deaths, 144 missing people, 1,900 damaged houses
Cogonon	652	1,223	285	No casualty, 300 damaged houses
Kahayag	3,644	1,494	330	No casualty, 400 damaged houses

Sources: Barangay Development and Security Plan 2011-2015; Consolidated Area Assessment Operation Pablo as of January 28, 2013, Municipality of New Bataan.

Table 2. Socio-economic characteristics of the survey respondents, New Bataan

Respondent Profile	Village					Community		All Respondents
	Andap	Cabinangan	Cogonon	Bantacan	Kahayag	Indigenous	Non-Indigenous	
Number of Respondents	114	105	79	70	70	136	302	438
Years of age								
30 and below	23.9	14.3	11.4	5.8	12.9	15.4	14.2	14.7
31-50	50.4	55.2	53.2	50.7	50.0	60.3	48.0	52.1
51-70	22.1	26.7	29.1	40.6	28.6	22.8	31.5	28.4
71 and above	3.5	3.8	6.3	2.9	8.6	1.5	6.3	4.8
Years of residence								
5 and below	20.0	8.6	12.7	9.1	10.4	19.4	9.5	12.6
6 to 15	11.8	17.1	12.7	21.2	14.9	20.1	12.9	15.2
16 to 30	28.2	30.5	31.6	30.3	26.9	29.9	29.2	29.5
31 to 50	33.6	35.2	24.1	25.8	37.3	21.6	36.3	31.6
50 and above	6.4	8.6	19.0	13.6	10.4	9.0	12.2	11.0
Level of Education								
No formal Education	4.4	3.8	3.8	5.8	5.8	11.0	1.7	4.6
Elementary	41.2	37.1	26.6	31.9	37.7	47.8	29.8	35.6
High School	44.7	34.3	57.0	43.5	49.3	33.8	50.3	45.0
Vocational/technical	4.4	7.6	1.3	1.4	1.4	2.9	4.0	3.7
College/University graduate	5.3	17.1	11.4	17.4	5.8	4.4	14.2	11.2
Gender								
Male	32.5	52.4	45.6	30.4	54.3	30.9	48.5	42.8
Female	67.5	47.6	54.4	69.6	45.7	69.1	51.5	57.2
Civil Status								
Single	3.5	3.8	3.8	7.2	2.9	4.4	4.0	4.1
Married	76.3	83.8	68.4	73.9	78.3	75.0	77.5	76.6
Widow/Widower	11.4	8.6	19.0	13.0	8.7	8.1	13.6	11.9
Others	8.8	8.9	5.8	3.8	10.1	12.5	5.0	7.3
Community type								
indigenous	31.6	34.3	17.7	42.9	28.6	-	-	31.1
non-indigenous	68.4	65.7	82.3	57.1	71.4	-	-	68.9

Note: The values refer to the percentage of respondents in each variable category and each village.

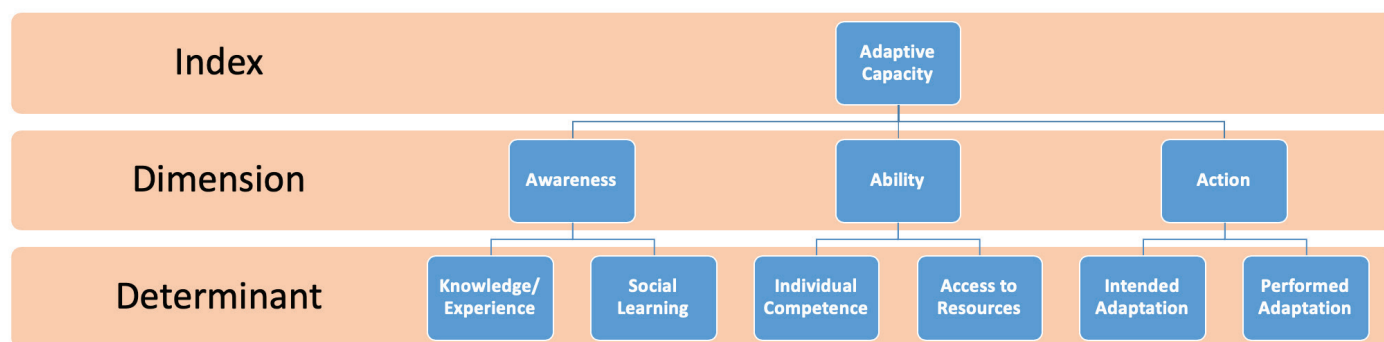


Figure 2. Determinants and dimensions of adaptive capacity based on Awareness-Ability-Action framework

for awareness, individual competence and access to resources for ability, and intended adaptation and performed adaptation for action (Figure 2). The dimensions and their determinants are discussed in details in Eugenio et al. (2016) and described briefly below.

Awareness. Awareness provides knowledge that creates an individual's ability to plan an adaptation action. Any action performed provides an experience, which then adds up to the knowledge that may lead to an increased, or even changed, awareness of an individual. Social learning is important due to the role of social structures for the exchange of knowledge and behavioral change, which support the development and diffusion of adaptations.

Ability. Unless cognitive barriers are addressed, a high level of adaptive capacity of individuals will not automatically facilitate adaptive behavior. Competence, which results from the linkage between information, knowledge, and action, can help to remove cognitive barriers and thus enable an individual to adapt. But competence alone is not sufficient to produce one's ability to cope with landslides disaster. Access to resources is a necessary condition to take adaptation actions.

Action. Following the IPCC (2001, 2014) definition, two types of adaptation actions were identified for the framework – intended and performed adaptation. Intended adaptation refers to the intention of an individual to perform a set of adaptation actions based on the expected climatic stimuli or their effects. Performed adaptation is the realization of adaptations or performance of the intentional actions. The translation of intended adaptations into performed adaptations depends on similitude of expectations to the actual climatic stimuli or their effects, reliability of available resources when a disaster occurs, and extent of loss and damage are not beyond adaptation. Finally, performed adaptations create new knowledge or experience that improves the competence of an individual in performing future adaptations.

Statistical Tools

Two types of analytical tools were applied in this paper, factor and cluster analyses. Cluster analysis was the main quantitative tool used to identify the adaptive capacity of respondents in the three villages in New Bataan. However, the wide range of data on socio-economic variables and disaster-related experiences that were collected from the survey would have rendered the analysis quite complex and unmanageable. To improve interpretability of the results, factor analysis was first conducted to reduce the number and identify the most relevant input variables for the cluster analysis. A total of 51 socio-economic variables representing the different determinants of adaptive capacity were used. The “factors” generated from factor analysis were used as input to the cluster analysis. The statistical results from the factor and cluster analyses are presented in Appendix 1. The results were used for identifying the typologies of adaptive capacity (e.g. high adaptive capacity, low adaptive capacity) for each cluster. Statistical Package for the Social Sciences (SPSS) was used for conducting both factor and cluster analyses.

Results and Discussion

Flood and Landslide Disasters

Impacts on Household

About 58% of the respondents consider lack of food as the most important impact of flood and landslide on households in New Bataan (Table 3). This result is followed by lack of drinking water, which caused problem among 28% of the respondents. While the number of IP and non-IP respondents who suffered from lack of drinking water was almost the same, there were more IPs (64.7%) who expressed concern about lack of food. This is likely due to poor access to the remote areas where the houses of many IPs are located. The slightly higher problem on availability of drinking water among non-IP respondents is due to the contamination of water and damage

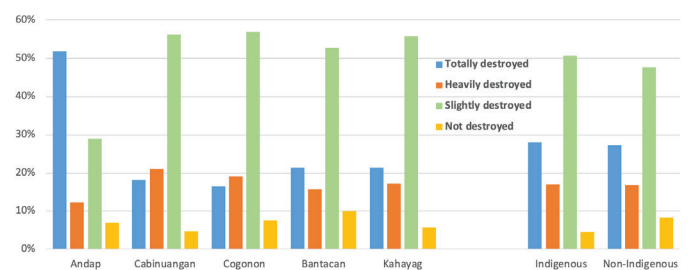
Table 3. Most important impacts of the disaster on households, New Bataan

Experience	Village					Community		
	Andap	Cabinuangan	Cogonon	Bantacan	Kahayag	Indigenous	Non-Indigenous	All Respondents
Lack of food	46.5	67.6	46.8	64.3	65.7	64.7	54.6	57.5
Lack of drinking water	25.4	25.7	45.6	20.0	24.3	26.5	28.6	28.1
Loss of livelihood	7.0	0.0	3.8	5.7	1.4	2.2	4.3	3.7
Homelessness	8.8	0.0	0.0	1.4	1.4	2.2	3.0	2.7
Damages of house	0.9	5.7	0.0	0.0	1.4	0.7	2.3	1.8
Lack of electricity	1.8	1.0	0.0	1.4	2.9	1.5	1.3	1.4
Destruction of farm	0.9	0.0	0.0	4.3	0.0	0.7	1.0	0.9
Temporary shelter	0.0	0.0	2.5	1.4	1.4	0.0	1.3	0.9
House relocation	1.8	0.0	0.0	1.4	0.0	0.0	1.0	0.7
Lack of medicine	1.8	0.0	0.0	0.0	0.0	0.0	0.7	0.5
Lack of transportation	0.9	0.0	0.0	0.0	0.0	0.0	0.3	0.2
Destruction of roads	0.9	0.0	0.0	0.0	0.0	0.0	0.3	0.2
Destruction of forest	0.0	0.0	1.3	0.0	0.0	0.0	0.3	0.2
Elementary	41.2	37.1	26.6	31.9	37.7	47.8	29.8	35.6
Number of respondents	114	70	105	79	70	136	302	438

Note: The values refer to the percentage of respondents in each village and community who considered the experience as the most important causes of discomforts or problems in their households.

on water system from floods and muds in the lowland areas. The highest number of respondents who were affected by lack of drinking water was found in the village of Cogonon. Those affected by lack of food were mostly residing in Cabinuangan, Bantacan, and Kahayag. Because Andap was most devastated by landslides and flash floods, food relief was concentrated on this village. In case of Cogonon, the village is small, and most households are accessible for post-disaster emergency support as compared to the other four villages. Loss of livelihood (7.0%) and homelessness (8.8%) are largest in Andap because the village is located at the foot of the mountain where the landslide impacts were highest.

House damages were highest in Cabinuangan because it is the most urbanized village with very high housing density (Table 3). About 5.7% of the respondents in this village considered damages on their houses as a serious problem. This percentage is higher than in Andap where only 0.9% of the respondents complained about house damages. Figure 3 reveals, however, that houses of more than 50% of respondents in Andap were

**Figure 3.** Extent of house damages from flood and landslide in New Bataan

Note: The percentage values refer to the proportion of respondents in each village and community who experienced the property impacts.

totally destroyed. In contrast, only less than 20% experienced total destruction of houses in Cabinuangan. The respondents in Andap considered house damages as a less important disaster impact because they were most affected by the deaths and injuries of family members, relatives, and neighbors. The extent of property damages in the rest of the villages was almost similar, both for IPs and non-IPs (Figure 3). Across all villages, less than two percent of the respondents consider house relocation, lack of medicine, lack of transportation, destruction of roads, and destruction of forest as important impacts of flood and landslide (Table 3).

Impacts on Livelihood

The main livelihood of the respondents is farming particularly among the IPs (Table 4). About 54% of IP respondents are farmers, and the number decreased by about 2% after the disaster. In contrast, there are only about 31% farmers among the non-IP respondents which decreased by about 5% after the disaster. Business, sales or self-employment are the other means of livelihood of the non-IPs, which slightly increased from 20.07 to 22.70% after the disaster. In contrast, these types of livelihood are less common among the IPs. Some IPs work in mining (3.68%), and the number of IP miners are higher both before and after the disaster. While there are only a few shifts in the types of livelihood among the IPs, changes in livelihoods are prevalent among non-IPs. Fishing and livestock raising turned out to be new sources of livelihood for both IPs and non-IPs. Part-time employment increased among IP respondents and decreased among non-IP respondents after the disaster. Jobs in mining, carpentry, local governments and school, offer new sources of livelihoods for some non-IP respondents. The negative impacts of disaster on the non-IPs are higher, with the number of non-IP respondents with no sources of livelihoods increasing from 7.57 to 11.18%.

Figure 4 further shows the extent of loss of livelihoods among the non-IPs. A higher number of non-IP respondents lost their livelihoods because their lowland farms were buried in rocks carried by the flash floods, while the IP respondents continued their farming activities because most of them were in the uplands. Consequently, the decrease in income was also lower among IP than the non-IP respondents (Figure 4). At the village level, loss of livelihoods was highest in Cogonon and Andap, but more respondents in the latter village had the capacity to change their livelihoods after the disaster. The decrease in income was lowest among respondents in Cabinuangan because only a few of them depended on agriculture-related livelihoods.

Typologies of Adaptive Capacity

Using the factor values for the cluster analysis resulted in four clusters, which represents varying levels of adaptive capacity of the respondents. Figure 5 shows the mean values across factors of adaptive capacity, with clusters 1 and 2 showing positive mean values and clusters 3 and 4 showing negative mean values. The

Table 4. Types of livelihood of IPs and non-IPs before and after the disaster, New Bataan

Types of livelihood	IP		Non-IP	
	Before disaster	After disaster	Before disaster	After disaster
Farmer	53.68	51.47	30.92	25.66
Fisher	-	-	-	0.33
Livestock raiser	-	0.74	-	0.33
Firewood-gatherer	2.21	2.21	0.66	0.33
Charcoal maker	-	-	0.33	0.33
Forest products gatherer	1.47	1.47	1.32	0.99
Copra producer	2.21	2.21	1.97	1.97
Miner	3.68	3.68	2.96	3.29
Carpenter	0.74	0.74	2.63	4.28
Part-time employee	4.41	5.88	6.58	3.95
Contract employee/ Laborer	3.68	3.68	9.21	9.54
Laundry/Maid	1.47	1.47	1.64	0.99
Mechanic	2.21	0.74	3.95	1.64
Driver	3.68	3.68	3.62	3.62
Business/Salesman/Self-employed	6.62	6.62	20.07	22.70
Official, teacher	2.21	2.94	1.32	3.62
Pensioner	0.74	1.47	1.64	1.64
Others, specify	0.74	0.47	0.33	0.99
Several livelihoods	5.15	5.15	3.29	2.63
No sources of livelihood	5.15	5.41	7.57	11.18

The values refer to the percentage of respondents in each community who are engaged in particular type of livelihood.

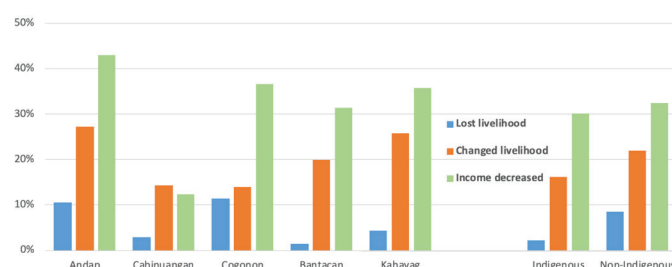


Figure 4. Impacts of flood and landslide on livelihoods in New Bataan

Note: The percentage values refer to the proportion of respondents in each village and community who experienced the property impacts.

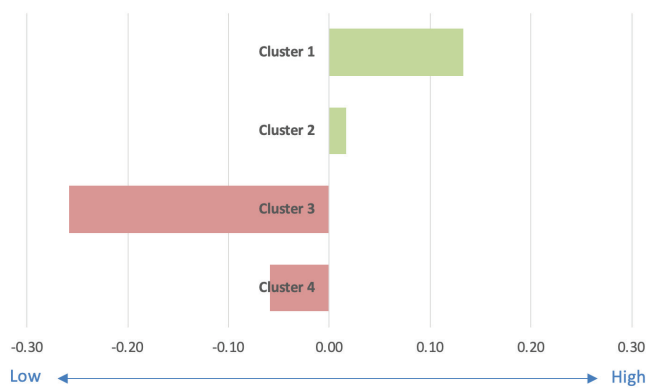


Figure 5. Mean value for all factors of adaptive capacity (AC), by cluster

Note: Cluster 1 has very high AC having a higher positive mean value; Cluster 2 has high AC having a lower positive mean value; Cluster 3 has very low AC having a higher negative mean value; and Cluster 4 has low AC having lower negative mean value. The specific determinants that contributed to the mean value in each cluster are presented in Table 5.

factors represent variables that have “eigenvalues” greater than one and highest contribution to the variance in the determinants of adaptive capacity (Appendix 1). High factor value implies that the respondents in a particular cluster have high capacity on specific determinants. Positive values thus mean higher adaptive capacity, while negative values mean lower adaptive capacity. Respondents in Cluster 1 with higher positive mean factor of 0.13 have very high level of adaptive capacity, and those in Cluster 2 with lower positive factor of 0.02 have only high level of adaptive capacity. In contrast, respondents in Cluster 3 with higher negative factor of 0.26 have very low adaptive capacity, and those in Cluster 4 with lower negative factor of 0.06 have low adaptive capacity.

Table A3 in the Appendix describes the two most important factors for each determinant and variables for each factor, which were identified from the factor analysis. The two factors (F1, F2) for each of the six adaptive capacity determinants are as follows:

- (1) previous landslide experience (F1) and level of knowledge (F2) for knowledge and experience
- (2) membership in organizations (F1) and information from the community (F2) for social learning
- (3) ability to support household (F1) and level of self-confidence (F2) for individual competence
- (4) access to adaptation support (F1) and reliable sources of household income (F2) for access to resources
- (5) effectiveness of community measures (F1) and household measures (F2) for intended adaptation
- (6) number and relevance of external support (F1) and success of implementing family support (F2) for performed adaptation.

The factors consist of two or three variables, except for factor 1 of social learning (i.e. membership in organizations) which has five variables. Moreover, Table A3 presents the mean values of the factors for each cluster and determinant of adaptive capacity.

Based on the average values of the two factors, we ranked the clusters from 1st to 4th, with 1st having the highest capacity for the respective determinants. Among the four clusters, Cluster 1 ranks 1st in social learning and 2nd in three other determinants of adaptive capacity including access to resource, intended and performed adaptations. Although Cluster 2 ranks 1st in access to resources and performed adaptation, it ranks only 3rd and 4th in four other determinants. Cluster 3 ranks 1st in both knowledge/experience and individual competence but, like Cluster 2, it ranks only 3rd and 4th in four other determinants. Finally, Cluster 4 ranks 1st in intended adaptation and 2nd in three other determinants.

Table 5 compares the mean values of the determinants of adaptive capacity for IP and non-IP respondents in the four clusters. Social learning, intended adaptation, and performed adaptation contribute to the very high adaptive capacity of both IPs and non-IPs in Cluster 1. Access to resources among the IPs is much lower than the non-IPs because of the IP respondents' lack of crop failure insurance, education support, and calamity support as well as less number of household members with skilled related income sources and employment contract. These can be attributed to the lack of education among the IPs with almost 60% without formal education or reaching only elementary education (Table 2). As compared to the non-IPs in Cluster 1, the IPs in the same cluster have relatively higher knowledge and experience on the local environment. About 45% of all IPs belong to Cluster 1 with very high adaptive capacity as compared to 35% of the non-IPs (Table 5). The determinants that differentiate Cluster 1 and Cluster 2 among the IP respondents are lower social learning, intended adaptation, and performed adaptation, while those for the non-IP respondents are knowledge and experience as well as social learning. Only 11% of the IP respondents have high adaptive capacity. This percentage is small compared to the 30% of the non-IP respondents.

Access to resources, intended adaptation, and performed adaptation are the determinants that contribute to the very low adaptive capacity for both the IP and non-IP respondents in Cluster 3 (Table 5). Also, non-IP respondents have very low social learning, particularly on membership in organizations. Intended adaptation is higher for Cluster 4 than Cluster 3, contributing to slightly better adaptive capacity of the IP and non-IP respondents in the former cluster. There are more IPs with low and very low adaptive capacity than the non-IPs. Figure 6 reveals that the largest number of IPs with very low adaptive capacity are in Bantacan, while those of non-IPs are in Kahayag. More than 50% of the IPs in Cabinuangan, Cogonon, and Kahayag have very high adaptive capacity. The majority of non-IPs with very high adaptive capacity are living in Cogonon. Overall, IPs and non-IPs in Cabinuangan and Cogonon have better adaptive capacity, with relatively low number of respondents with a low and very low level of adaptive capacity.

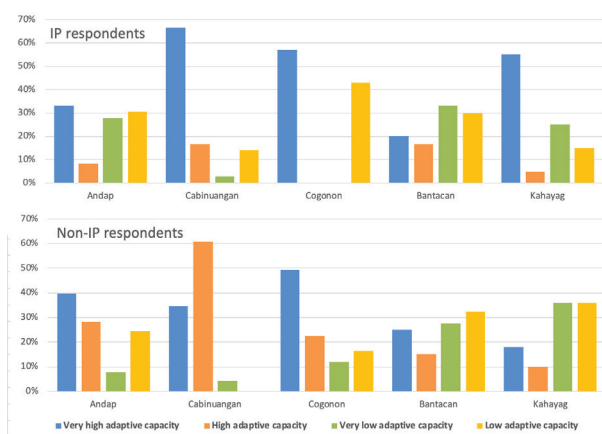
Table 5. Mean values of the determinants of adaptive capacity (AC), by community

Determinants	IP Cluster				Non-IP Cluster			
	1	2	3	4	1	2	3	4
	Very high	High	Very low	Low	Very high	High	Very low	Low
Knowledge & experience	0.03 (0.51)	0.02 (0.36)	0.25 (0.58)	-0.04 (0.58)	-0.01 (1.02)	-0.13 (0.45)	0.08 (0.70)	0.03 (0.69)
Social learning	0.38 (0.51)	-0.52 (0.48)	0.10 (0.65)	0.04 (0.95)	0.39 (0.49)	-0.60 (0.39)	-0.15 (0.79)	0.00 (0.71)
Individual competence	-0.18 (0.77)	-0.13 (0.69)	0.08 (0.65)	0.04 (0.76)	-0.19 (0.82)	0.10 (0.55)	0.27 (0.54)	0.14 (0.62)
Access to resources	-0.16 (0.24)	0.17 (0.78)	-0.01 (0.71)	-0.16 (0.23)	0.06 (1.10)	0.18 (0.65)	-0.03 (0.56)	-0.14 (0.30)
Intended adaptation	0.17 (0.65)	0.09 (0.85)	-0.86 (0.48)	0.44 (0.57)	0.15 (0.62)	0.15 (0.51)	-0.91 (0.50)	0.13 (0.59)
Performed adaptation	0.28 (0.57)	0.22 (0.61)	-0.61 (0.60)	-0.48 (0.55)	0.36 (0.55)	0.41 (0.41)	-0.70 (0.68)	-0.51 (0.55)
Percent of respondents	45%	11%	19%	25%	35%	30%	15%	20%

Notes:

The level of adaptive capacity of the clusters is based on the overall values of the factors in Figure 5. The mean factor values in Table 5 reveals the specific determinants of adaptive capacity that contributed to the overall level of adaptive capacity.

Values in parentheses are standard deviation. Lower standard deviation means that the values in this cluster are relatively close to each other, and higher standard deviation means the opposite. The latter implies that the answers of the respondents to the questions included in the factor analysis have high variance. Lower standard deviations are thus preferred than higher ones.

**Figure 6.** Distribution of respondents by level of adaptive capacity and by village

Conclusions

The paper aimed to assess the adaptive capacity of IPs by comparing them to the non-IPs. The results revealed that a higher number of IPs have low and very low adaptive capacity than non-IPs. The main factor that lowers the adaptive capacity of the former is (lack of) access to resources including education and calamity support as well as skilled and contract-basis types of employment. Most IPs rely on agriculture-related livelihoods which are most vulnerable to floods and landslides. Only very few of them shifted to other types of livelihoods or diversified their sources of livelihoods. There are two possible reasons for the lack of flexibility or diversification among IPs.

First, many of them live in the upland area so that although their farms suffered from erosion, they could still be cultivated after the disaster. This is in contrast with many farms of the non-IPs in the lowland areas that were covered with thick sand and large stones. Second, the IPs have lower level of education and cannot easily find alternative non-agriculture livelihoods that require skills. These reasons are observed to have long-term implications on the adaptive capacity of the IPs. Considering the increasing risk from typhoons and high landslide risk in Compostela Valley, the IPs will need to shift or diversify their sources of income. Education and capacity building are key to increasing access to resources among the IPs, who have lower levels of education than the non-IPs. These will increase their ability to gain access to local government support and diversify their sources of livelihoods.

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Appendix 1 Description and results of statistical analyses

Factor analysis

Following the Awareness-Ability-Action framework in Figure 1, six-factor analyses were conducted using sets of variables corresponding to knowledge and experience, social learning, individual competence, access to resources, intended adaptation, and performed adaptation. The details of the 51 variables included in the factor analyses are presented in Table A1. To check how well the variables have loaded (or bundled) together, the authors used the Bartlett's Test of Sphericity to determine the level of significance of the correlation matrix. The criteria for acceptability of a factor solution were based on exclusion of items with factor loadings less than 0.60. The Kaiser-Meyer Olkin (KMO), a method that compares the observed with the partial correlation coefficients, was used to check the appropriateness of the data for the cluster analysis. A KMO with a value of 0.50 and higher were considered as

appropriate. KMO values far below 0.50 mean that the factor group is not good and individual variables should be checked (i.e. using anti-image matrix) and, if necessary, eliminated. The authors ran the models several times to come up with acceptable KMO values by eliminating redundant variables. The method applied for extracting the factors is the principal component analysis. The extraction is based on eigenvalues greater than 1. The eigenvalue measures the strength of a factor. Only factors with eigenvalues above one were considered to have met the minimum criteria for the analysis, i.e. correlation between the variables. Those selected factors with higher variances will be more useful for the cluster analysis. Finally, the authors used the rotated component matrix to allow us to identify the variables that loaded together. The method used for the factor rotation is varimax, which minimizes the number of variables that have high loading on a factor.

Table A1. Description of the variables included in the factor analysis

Variables	Question	Answer (numbers in parenthesis are the codes)
Awareness		
Knowledge & Experiences (KE)		
KE1	Number of years residing in the barangay	(1) Five years and below, (2) 6 to 15 years, (3) 16 to 30 years, (4) 31 to 50 years, (5) 50 years and above
KE2	Respondent's Age	(1) 30 years and below, (2) 31-50 years, (3) 51-70 years, (4) 71 years and above
KE3	Respondent's education level	(0) No formal Education, (1) Elementary, (2) High School, (3) Vocational/Technical School, (4) College/University graduate, (6) MS, PhD
KE4	Have you experienced floods or landslides in your Barangay before this flood/landslide (i.e. 2012 in Davao)?	(0) No, (1) Yes
KE5	If yes, please describe those previous floods or landslides with this one.	(0) No, (1) Knee level, (2) Waist level, (3) Head level, (4) Above head
KE6	Do you think that your household members are knowledgeable in performing the necessary actions during calamities?	(0) No, (1) Maybe, (2) Yes
KE7	Do you think there is a probability that such calamities will happen again in your community?	(0) No, (1) Maybe, (2) Yes
Social Learning (SL)		
SL1	Does your community/tribe have regular activities?	(0) No, (1) Yes, once a month, (2) Yes, once a week, (3) Yes, more than once a week
SL2	How often do you go to your church or mosque? Please tick your answer(s).	(0) Almost never, (1) Once a year, (2) After several months, (3) Once a month, (4) Once a week, (5) Several times a week, (6) Others
SL3	Are you a member of any organization, including your tribal organization(s)?	(0) No, (1) Yes
SL4	If yes, please provide the following information about your membership in this organization(s). Type of organization	

Table A1. Continued

Variables	Question	Answer (numbers in parenthesis are the codes)
SL3	Are you a member of any organization, including your tribal organization(s)?	(0) No, (1) Yes
SL4	If yes, please provide the following information about your membership in this organization(s). Type of organization	
SL5	Position in the Organization	(0) None, (1) Member, (2) Officer
SL6	Participation in the organization - before	(0) Question not relevant, (1) Inactive, (2) Active
SL7	Participation in the organization - after	(0) Question not relevant, (1) Inactive, (2) Active
	What sources of information about the consequences of flood/landslide?	(0) No, (1) Before the disaster, (2) After the disaster, (3) Both after and before the disaster
SL8	Municipal Officials	
SL9	Barangay Officials	
SL10	Friends	
SL11	Neighbors	
SL12	Non-government organizations (NGOs)	
Ability		
Individual Competence (IC)		
IC1	Total number of HH members (i.e. respondent, spouse, children, others) with physical and mental disabilities	(1) 7 and above, (2) 5-6 persons, (3) 3-4 persons, (4) 2 persons, (5) 1 person, and (6) None
IC2	Total number of HH members (i.e. respondent, spouse, children, others) with chronic diseases	(1) 7 and above, (2) 5-6 persons, (3) 3-4 persons, (4) 2 persons, (5) 1 person, and (6) None
	What kinds of support does your family usually get from/ give to your relatives, friends, or neighbors? Please tick your answer(s).	(0) No, (1) Get from others, (2) Give to others, (3) Both above
IC3	taking care of children	
IC4	farm activities	
IC5	financial support	
IC6	selling family harvest	
	Rank 3 important feelings on devastation	(1) Most important, (2) Important, (3) Less important, (4) Not important
IC7	Fear	
IC8	Self-pity	
IC9	Loss of hope	
IC10	What is the size of your household?	(1) more than ten persons, (2) 7-9 persons, (3) 4-6 persons, and (4) 1-3 persons
IC11	Total number of small/minor children (18 years and below)	(1) 7 and above, (2) 5-6 children, (3) 3-4 children, (4) 2 children, (5) 1 child, and (6) None
	Total number of children with education in high school and below	(1) 7 and above, (2) 5-6 children, (3) 3-4 children, (4) 2 children, (5) 1 child, and (6) None
IC12	How will you describe the structure of your household?	(0) Single, (1) Nuclear, (2) Extended

Table A1. Continued

Variables	Question	Answer (numbers in parenthesis are the codes)
Access to resources (AR)		
AR1	education support	
AR2	calamity support	
AR3	crop failure insurance	
AR4	Total number of HH members (i.e. respondent, spouse, children, others) with skilled related income sources	(1) None, (2) 1 person, (3) 2 persons, (4) 3 persons, (5) 4 persons and above
AR5	Total number of HH members (i.e. respondent, spouse, children, others) with employment contract related income sources	(1) None, (2) 1 person, (3) 2 persons, (4) 3 persons, (5) 4 persons and above
AR6	Total number of HH members (i.e. respondent, spouse, children, others) with external income sources	(1) None, (2) 1 person, (3) 2 persons, (4) 3 persons, (5) 4 persons and above
AR7	Total number of HH members (i.e. respondent, spouse, children, others) with no sources of income	(1) None, (2) 1 person, (3) 2 persons, (4) 3 persons, (5) 4 persons and above
	Rank 3 important feelings on devastation	(1) Most important, (2) Important, (3) Less important, (4) Not important
IC7	Fear	
Action		
Intended Adaptation (IA)		
	What set of procedures would you follow in case there is an emergent calamity?	
IA1	House procedure	(0) None, (1) Stay at home/indoors, (2) Pray, (3) Be informed about typhoon, (4) Alertness/preparedness, (5) Prepare/pack things, (6) Prepare and evacuate to safe place, (7) Go to people who provide support, (8) Others
IA2	Barangay procedures	(0) None, (1) I do not know, (2) Wait for instruction/news from officials, (3) Contact officials/ask for help or information, (4) Follow warning and officials, (5) Information dissemination [i.e. roving, meeting, seminar], (6) Evacuation/Relocation, (7) monitor situation [i.e. flood watch, water gauge], (8) others
IA3	Municipal procedures	(0) None, (1) I do not know, (2) Wait for instruction/news from officials, (3) Contact officials/ask for help or information, (4) Follow warning and officials, (5) Information dissemination [i.e. roving, meeting, seminar], (6) Evacuation/Relocation, (7) monitor situation [i.e. flood watch, water gauge], (8) others
IA4	Are there systematic ways of informing the public regarding the sudden occurrence of calamities in your community?	(1) Do not know, (2) No, (3) Yes
Performed Adaptation (PA)		
	What support and measures did you give/do on the actual incident of the flood/landslide to your:	
PA1	Family	(0) None, (1) stayed at home, hid somewhere safe, (2) Helped the family, gave clothing, (3) evacuated to LGU-assigned evacuation center (i.e. school), (4) Went to relatives/neighbor's house, (5) evacuated to the church, (6) Went to the roof, (7) Received food/assistance from relatives/organizations, (8) Ran to higher grounds, (9) Climbed coconut trees, (10) Prayed, (11) Combination of 8 & 10, (12) Evacuated to neighboring barangay/city

Table A1. Continued

Variables		Question	Answer (numbers in parenthesis are the codes)
PA2	Property		(0) None/ left the property without packing their things, (1) Stayed at home, (2) Packed things, placed in elevated parts and left home, (3) Followed officials' warnings, (4) Packed their bags and brought it with them
PA3	Did you seek for a loan or borrow money after the flood/landslide?		(0) No, (1) Yes
PA4	Did you receive any assistance from any programs that aim to assist disaster victims?		(0) No, (1) Yes
	If yes, please describe the disaster assistance program. Please use the corresponding codes below.		TYPE: (1) Food, (2) Medicine, (3) Drinking water, (4) Clothing, (5) Temporary shelter, (6) Housing relocation, (7) Money, (8) Cooking utensils, (9) Employment, (10) Livelihood support, (11) Others SOURCES: (1) Barangay office, (2) Municipal government, (3) Provincial government, (4) Religious Organization, (5) NGO's, (6) Private organization, (7) Private company, (8) Politician, (9) Others TIMING: (1) During the flood/landslide, (2) Directly after flood/landslide, (3) One week after flood/landslide, (4) One month after flood/landslide, (5) Few months after flood/landslide, (6) One year after flood/landslide, (7) Others DURATION: (0) No, (1) One day, (2) One week, (3) One month, (4) One to 6 months, (5) 6 to 12 months, (6) One year USEFULNESS: (1) Not useful, (2) Slightly useful, (3) Moderately useful, (4) Very useful, (5) Extremely useful
PA5	Total number of programs		(0) No programs, (1) 1 program, (2) 2 programs, (3) 3 programs, (4) 4 programs, (5) 5 programs, (6) 6 programs
PA6	Total types		(1) Food, medicine, drinking water, clothing, cooking utensils, (2) Temporary shelter, housing relocation, (3) Money, employment, livelihood support, others, (4) Combination of 1 & 2, (5) Combination of 2 & 3, (6) Combination of 1 & 3, (7) Combination of 1, 2 & 3
PA7	Total source		(1) Barangay office, Municipal Government, Provincial government, Politician, (2) Religious Organization, (3) NGO's, (4) Private organization, Private company, (5) Others, Relief goods, (6) Combined
PA8	Did you relocate your residence or do you have any plan to relocate your residence?		(0) No, (1) Yes
PA9	Were you able to reconstruct your house?		(0) No, (1) Yes

The factors were used as inputs to the clusters, which became the basis for developing typologies of adaptive capacity. The Bartlett's Tests in Table A2 show that the level of significance of all models is very high at less than 1% level. Moreover, the variables in most models loaded to 3 factors, except for access to resources and intended adaptation with only two factors each. The authors checked the variance of the factors to determine how well the variables contributed to the variation in each model. Factors with very high variance are preferred inputs to the cluster analysis because they can reveal the difference in adaptive attribute and behavior of respondents. Table A2 shows that the first two factors alone already contribute to about 50% of the variance in the models, except for the individual

competence and access to resources. For this reason, for each determinant, the authors only used Factors 1 and two as inputs to the cluster analysis. This is to facilitate better interpretation of cluster results.

Table A2. Total variance of factors and results of KMO and Bartlett's Test for each determinant

Factors	Initial Eigenvalues			Rotation Sums of Squared Loadings			Kaiser-Meyer-Olkin (KMO)	Bartlett's Test of Sphericity	
	Total	% Variance	Cumulative %	Total	% Variance	Cumulative %		Chi-Square	Sig.
Knowledge and experience									
Factor 1	1.938	27.686	27.686	1.889	26.984	26.984	0.508	713.504	0.000
Factor 2	1.410	20.149	47.835	1.407	20.097	47.081			
Factor 3	1.146	16.374	64.208	1.199	17.127	64.208			
Social learning									
Factor 1	4.630	38.580	38.580	4.601	38.344	38.344	0.855	4577.847	0.000
Factor 2	2.001	16.672	55.251	1.666	13.880	52.224			
Factor 3	1.107	9.222	64.473	1.449	12.073	64.297			
Individual competence									
Factor 1	2.123	17.690	17.690	2.109	17.578	17.578	0.607	533.581	0.000
Factor 2	1.457	12.144	29.834	1.405	11.709	29.287			
Factor 3	1.235	10.290	40.124	1.258	10.484	39.771			
Access to resources									
Factor 1	2.364	21.488	21.488	1.765	16.043	16.043	0.515	1478.563	0.000
Factor 2	1.877	17.064	38.553	1.748	15.887	31.930			
Factor 3	1.552	14.109	52.662	1.743	15.849	47.780			
Intended adaptation									
Factor 1	1.716	42.910	42.910	1.714	42.839	42.839	0.567	193.020	0.000
Factor 2	1.053	26.322	69.232	1.056	26.393	69.232			
Performed adaptation									
Factor 1	2.430	27.005	27.005	2.112	23.472	23.472	0.665	592.625	0.000
Factor 2	1.388	15.425	42.430	1.703	18.925	42.397			
Factor 3	1.143	12.697	55.127	1.146	12.731	55.127			

Cluster analysis

Cluster analysis is a convenient method for identifying homogeneous groups of objects, cases, and observations called clusters, where objects share many characteristics within a particular cluster and are very dissimilar to objects belonging to other (outside) cluster. Hierarchical grouping procedure was applied to determine the optimal number of clusters evident in the data. The authors checked its dendrogram, which gives an idea of how great the distance is between cases (i.e. respondents) that are clustered (i.e. the closer the distances, the

smaller the differences in between the cases, and vice versa). The authors used the number of clusters indicated by the dendrogram as input to the two-step clustering procedure. The two-step clustering algorithm used was log-likelihood distance measure because, unlike Euclidean Distance, it can handle both continuous and categorical variables. Figure A1 presents the cluster membership of the respondents generated from the two-step clustering. Cluster 1 has the largest number of respondents (37.3%) and Cluster 3 has the smallest number of respondents (16.6%). After identifying the cluster memberships of the cases in the clusters, a tabular analysis of the clustered attributes was

used to conduct matrix scoring (Table A3). Factor 1 in social learning has the largest number (5) of variables, while the rest of the factors have between 2 and 3 number of variables. The factors represent variables that have “eigenvalues” greater than one and highest contribution to the variance in the determinants of adaptive capacity (Table A2). High factor value implies that the respondents in a particular cluster have high capacity on specific determinants. Positive values thus mean higher adaptive capacity, while negative values mean lower adaptive capacity. The results of matrix scoring revealed that Cluster 1 has very high adaptive capacity and Cluster 2 has a high adaptive capacity. In contrast, Cluster 3 has very low adaptive capacity and Cluster 4 has low adaptive capacity.

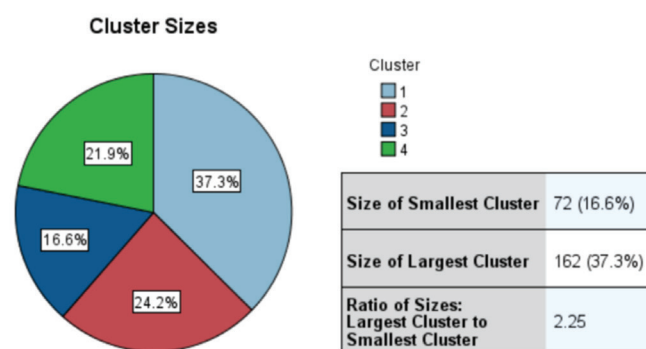


Figure A1. Cluster sizes and distribution

Table A3. Mean values of factors for the different determinants of adaptive capacity, by cluster

Factors of determinants		Description of the variables*		Cluster**			
				1	2	3	4
				Very High AC	High AC	Very Low AC	Low AC
Knowledge and experience		3rd	4th	1st	2nd		
Factor 1 - Previous landslide experience	Height of mud during previous landslide experience [1], Previous experience on landslide [2]	0.12 (1.41)	-0.18 (0.11)	0.05 (0.98)	-0.06 (0.58)		
Factor 2 - Level of knowledge	Years of age [1], Years residing in the village [2]	-0.11 (0.99)	-0.04 (0.86)	0.22 (1.09)	0.08 (1.07)		
Social learning		1st	4th	3rd	2nd		
Factor 1 - Membership in organizations	Membership in organizations [1], Active participation before [2] and after [3] the landslide, Position in the organization [4], Type of the organization [5]	0.92 (0.51)	-0.82 (0.52)	0.02 (0.99)	-0.74 (0.58)		
Factor 2 - Information from the community	Most important sources of information include neighbors [1] and friends [2]	-0.15 (0.78)	-0.36 (0.63)	-0.14 (0.92)	0.77 (1.31)		
Individual competence		4th	3rd	1st	2nd		
Factor 1 - Ability to support household	Characteristics of the household in terms of the number of small/minor children [1], children with low education [2], and household members [3]	-0.10 (0.98)	-0.12 (0.92)	0.23 (1.01)	0.13 (1.09)		
Factor 2 - Level of self-confidence	Feeling of self-pity [1] and fear [2] during typhoons	-0.28 (1.36)	0.26 (0.65)	0.18 (0.61)	0.07 (0.64)		
Access to resources		2nd	1st	3rd	4th		
Factor 1 - Access to adaptation support	Availability of crop failure insurance [1], education support [2], and calamity support [3]	0.03 (1.34)	-0.12 (0.42)	0.15 (1.21)	-0.03 (0.41)		
Factor 2 - Reliable sources of household income	Number of household members with skilled related income sources [1] and employment contract [2]	-0.06 (0.84)	0.48 (1.47)	-0.21 (0.70)	-0.26 (0.54)		
Intended adaptation		2nd	3rd	4th	1st		
Factor 1 - Effectiveness of community measures	Procedures to follow in case of calamities at the village [1], municipal [2], and house levels [3]	0.22 (0.92)	-0.17 (0.75)	-1.25 (0.54)	0.75 (0.66)		
Factor 2 - Effectiveness of household measures	Systematic ways for informing community [1] and House procedures to follow [2] in case of calamities	0.10 (1.09)	0.45 (0.78)	-0.54 (0.80)	-0.27 (0.92)		

Table A3. Continued

Factors of determinants	Description of the variables*	Cluster**			
		1	2	3	4
		Very High AC	High AC	Very Low AC	Low AC
Performed adaptation		2nd	1st	4th	3rd
Factor 1 - Number and relevance of external support	Number [1], types [2] and sources [3] of assistance programs received after the landslide, Recipient of disaster assistance programs	0.40 (0.88)	-0.08 (0.66)	-0.67 (1.34)	-0.11 (0.89)
Factor 2 - Success of implementing family support	Relocated the family after the landslide [1], Type of support/measure given to family during the landslide [2], Reconstructed the house after landslide [3]	0.25 (0.90)	0.85 (0.75)	-0.66 (0.61)	-0.88 (0.52)

Notes:

*Values in brackets refer to the number of the variables in the factor analysis.

**Values in parentheses are standard deviation. Lower standard deviation means that the values in this cluster are relatively close to each other, and higher standard deviation means the opposite. The latter implies that the answers of the respondents to the questions included in the factor analysis have high variance. Lower standard deviations are thus preferred than higher ones.