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Understanding the Social Adaptive Capacity Needs of Landslide Prone Communities of Barangay Patitinan, Sagñay, Camarines Sur

Cristina P. Lim¹

ABSTRACT

The study identified the likely indicators of the social adaptive capacities of communities of Barangay Patitinan, Sagñay, Camarines Sur, a known landslide prone barangay. Results from a previous survey, focus group discussions, and key informant interviews were used to assess and ascertain these indicators. All likely indicators were present in Barangay Patitinan. Though all indicators identified were present in the communities of Barangay Patitinan, there are still aspects of these indicators that can be improved further. Thus, the study recommends bioengineering approach that not only leads to slope stabilization but also promotes biodiversity, diversification of income opportunities, strengthening community's engagement in development planning through collaboration between the Barangay Disaster Risk Reduction and Management Council and the Barangay's Environment Committee, development of a participatory comprehensive plan, development of activities that promote cooperation and cohesion, and finally, the conduct of other related researches.

Keywords: *social adaptive capacity, resiliency, landslide, disaster risk reduction*

Introduction

Adaptive capacity is defined as the ability of systems, institutions, humans, and organisms to adjust to climate change and potential damages while taking advantage of opportunities and cope with its consequences (Intergovernmental Panel on Climate Change 2014, p. 1,758 as cited in Petersen *et al.* 2018 and Ambrosio and Kim 2019). Adaptive capacity focuses on human systems (i.e., poverty, livelihoods, food security, economic development, etc.) and institutions covering both ecological and social aspects. That is, adaptive capacity can be ecological and social.

Ecological adaptive capacity is the capability of an ecological system or other complex systems to change its basin of attraction in response to change such that the current regime is maintained (Angeler *et al.* 2019, p. 4). On the other hand, social adaptive capacity has been defined by Smit

and Wandel (2006), as cited in Whitney *et al.* (2017, p. 1) as the ability of human actors and communities to respond to change and maintain its human wellbeing over time.

Related to the concepts of social and ecological adaptive capacities is the term resiliency. The Overseas Economic Cooperation Development (OECD 2013) defined resilience as “the ability of individuals, communities, states and their institutions to absorb and recover from shocks, while positively adapting and transforming their structures and means for living in the face of long-term changes and uncertainty.” The United Nations offers a

Author's Information

¹Director, Center for Sustainable Communities,
Partido State University (PSU),
Goa, Camarines Sur
shotylim@yahoo.com



more straightforward definition which viewed resilience as “anticipating, planning and reducing disaster risk to effectively protect persons, communities and countries, their livelihoods, health, cultural heritage, socioeconomic assets, and ecosystems (Preventionweb.net 2020). The ideas of ‘bounce back’, ‘spring forward’, and ‘build back better’ are often used in the context of resilience.”

Social adaptive capacity and resilience, however, are two different concepts. Resilience is concerned with the interplay of human and natural systems. On the other hand, social adaptive capacity emphasizes the skills and mechanisms (i.e., knowledge, practices, processes, properties, etc.) established by the human system to contribute to resilience. It is concerned with the ability to live and reproduce, including the viability of social and economic activities of humans. Resilience goes hand-in-hand with the social adaptive capacity. In this context, resilience can be defined as the ability of a community to cope with the external stress and disturbances brought about by social, political, and environmental change. Environmental changes brought about by hazards such as typhoons, landslides, and earthquakes for such a long time drive humankind to be more resilient and adapted to its impacts.

Located along the Pacific Ring of Fire's western rim, a belt of active volcanoes, major earthquake faults, and the Pacific typhoon belt, the Philippines has been considered one of the disaster-prone countries. The New Humanitarian (2010) reported the Philippines as the most landslide prone country, followed by Indonesia, India, and China, respectively. The same source revealed that the Mines and Geoscience Bureau (MGB) estimated that 80% of the country's total land area is landslide prone. The landslides occurrences in the country also increase as the amount of rainfall per season increases.

Evidence of this phenomenon was the onslaught of Typhoon Usman in 2018, which triggered the softening of the soil causing soil erosion resulting in a landslide that rendered 46 dead and 12 missing in Barangay Patitinan, Sagñay, Camarines Sur. During the landslide, there was a gush of soil (approximately equivalent to 4 to 6 hectares) and gravel, which rushed downstream in Sitio Garang, one of the *sitios* in the barangay (Macatangay 2019). Data from the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA 2018) showed that Typhoon Usman dumped large volumes of rainfall in parts of Luzon and the Visayas in just two days, which was almost equivalent to an average December rainfall (Table 1). The landslides and rockslides affected *Sitios* or zones of *Garang*, *Abobo*, and *Igot* of the barangay.

Table 1. Amount of rainfall (in millimeter) during tropical depression Usman, 2018

Station	December 28-29, 2018	Normal December
Daet, Camarines Norte	573.2	588.0
Legazpi City, Albay	460.1	520.2
Cataman, Northern Samar	446.8	828.2
Alabat, Quezon	430.7	636.6
Virac, Catanduanes	384.1	451.8
Juban, Sorsogon	368.2	N/A
Masbate City, Masbate	277.0	258.9
Tayabas City, Quezon	244.7	421.0
Borongan City, Eastern Samar	195.2	674.8
Infanta, Quezon	167.1	675.8

Source: DOST-PAGASA Tropical Cyclone File Report, December 28-29, 2018

While efforts to mitigate adverse impacts of landslides and rockslides are being made such as planting of backyard plants (i.e., guyabano) and trees (i.e., Narra, Ipil-Ipil, Acacia, etc.) in their mountains and along the road and the mountain cliff, as well as prepare its community by assigning an evacuation center, these efforts seemed to be insufficient to reduce the risks. The insufficiency of mitigation strategies in dealing with the climate change impacts calls for complementary improvement in the adaptive capacity level of the communities and the ecological systems.

The first step towards improving a communities' social adaptive capacity is assessing its presence in the community. Identification and assessment of social adaptive capacity lead to potential resilience-building policies. This assessment must, however, be community-specific as different communities would likely have different capacities. Such a site-specific assessment has not been done in a landslide and poverty-stricken community such as Barangay Patitinan. Thus, in this light, the study attempted to identify and understand the likely indicators of social adaptive capacities of a landslide prone community, specifically Barangay Patitinan. This study is meant to enlighten the community members on their existing social adaptive capacities. Though descriptive, the study also anticipates that the initial resilience-increasing activities initiated by the community members of Barangay Patitinan will be mainstreamed through various community groups or people's organizations in the community.

Methodology

Study Site and Method of Data Collection

As a part of a 4th class Municipality of Sagñay, Barangay Patitinan has a total land area of 1,324.35 hectares and is characterized by having a gently rolling terrain. From its municipality, the Barangay is a 30 to 45-minute jeepney or tricycle ride (Municipal Planning and Development Coordination 2017). Biscaro *et al.* (2017) reported that Barangay Patitinan also has a tropical rainforest climate (Af classification) and a significant rainfall at 2,719 mm, with precipitation even in the driest month. Rock slopes are also common, comprising a total of 68 rock slopes in the community of Patitinan. Out of the 68 rock slopes, there were 12 unstable rock slopes identified, and one of those was adjacent to the community of Patitinan. It was also reported that the steep-sided rock cliffs close to the Sagñay-Tiwi Bridge with very high altitude (at least 20 meters) are perceived as hazardous.

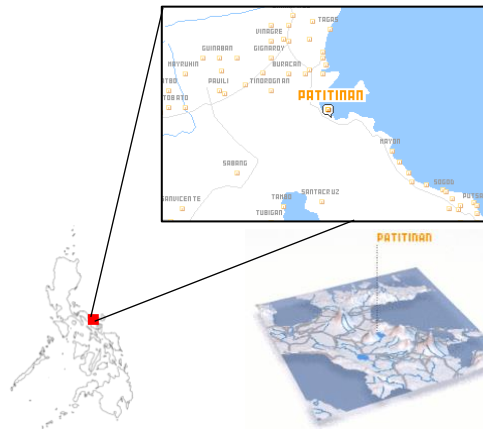


Figure 1. Locational map of the study site (Source: nona.net)

This study employed primary data gathering through key informant interviews (KII) with their lady chieftain, Indigenous Peoples' (IPs) representative members, the Municipal Agricultural Officer (MAO), and the Municipal Disaster Risk Reduction and Management Officer (MDRRMO). Focus group discussions (FGDs) were also conducted with various community sectors, including the elderly and IPs to understand their perceptions of hazards, practices related to DRRM, and local governance. A 5-point Likert scale was used to assess the level of trust in the local government's leadership. Secondary data gathering included the children imaging workshops and participatory rural appraisal (PRA) results in developing the country's DRRM plan. Aside from this, the study also used the results from a 2019 survey

conducted among 308 households in Barangay Patitinan (Lim, 2020). The 2019 household survey included the geophysical and social characteristics of the study site, sociodemographic characteristics, and the community's knowledge and experiences of landslides and other hazards.

Social Adaptive Capacity Indicators for Resilience

The social adaptive capacity indicators by Whitney *et al.* (2017) were adopted and modified to identify and understand the social adaptive capacities present in the communities of Barangay Patitinan. Table 2 summarizes the four broad social adaptive capacity categories and its corresponding indicators.

Table 2. Social adaptive capacity indicators

Category	Indicator
Access to assets	Community infrastructure Access to household assets Level of education Access to markets Social network and institutions Natural capital
Diversity and flexibility	Availability of livelihood and income diversity Economic opportunities Occupational mobility Level of dependence on declining natural resources
Learning and knowledge on disasters and risks	Knowledge on DRR related concepts and laws Sources of information on natural hazards Activities before, during, and after a disaster
Governance	Trust in leadership Community engagement Local environmental institution

Access to Assets

This category includes the existing community infrastructures, ownership of the residents of material and durable (i.e., house, car, etc.), level of education, access to markets, social networks and interaction, and natural capital. Access to assets and resources such as land, housing, and basic services more likely enables community members to recover faster from disasters (Wisner *et al.* 2004).

Community Infrastructure

Community infrastructures include schools, health facilities, housing, community and sports facilities, and other infrastructures that provide the community needs (i.e., water, power, and communication). These facilities provide social and economic services and opportunities for the community members to improve their human capital. It also enhances communication and access to information which can reduce vulnerabilities among community members.

Access to Household Assets

On the other hand, access to household material assets refers to the type of housing materials used and ownership of vehicles. Durable materials are used to build the house structure to withstand the impact of disasters. Meanwhile, acquiring a vehicle makes an individual more mobile and enables them to reach disaster information centers, evacuation centers, and hospitals during disasters. Also, being accessible to the market is essential in fostering adaptive capacities as it allows greater economic exchange and growth opportunities.

Level of Education

The level of education refers to formal schooling, which is considered as a critical factor in people's risk levels or their capacity to cope with and adapt to disasters. Formal education has a strong negative relationship with mortality from climate-related disasters (Adger *et al.* 2004, as cited by Wamsler, Brink, and Rantala 2012). It has also been identified to positively and directly affect awareness and understanding of existing risk, access and provision of information on risk reduction, acceptance and adequate use of institutional support, and improvements in residents' coping strategies (Wamsler, Brink, and Rantala 2012). In the Philippine context, the RA 10121 has institutionalized the National DRRM Plan, which included integrating disaster-related law, concepts, skills, and attitude to the curriculum for basic and tertiary levels. This law reinforces knowledge and awareness of risks.

Social Network and Institutions

Social networks and institutions are necessary for facilitating economic wellbeing and security. It is an important element in coping with a hazard or climate variability or shocks (Adger 2003, Abid, Scheffran, and Zulfqar 2017, Cohen *et al.* 2016). Mutual support among family members and community members has been an effective strategy in building resilience within households and the community.

Natural Capital

Lastly, natural capital pertains to natural assets such as forest resources, farmland (upland and lowland), water resources, poultry, and livestock. Productive natural resources or capital imply greater availability of food, especially during a community recovery after a disaster.

Diversity and Flexibility

Diversity and flexibility refer to the community's available livelihood and income, economic opportunities, level of dependence on natural resources, and occupational mobility. It pertains to the presence of a more varied domestic production structure and trade primarily to increase productivity, create jobs, and provide the base for sustained poverty-reduction growth. Some indicators originally identified in Whitney *et al.* (2017) were merged since the results gathered for the study were interrelated for these indicators (i.e., access to markets, availability of livelihood and income diversity, economic opportunities, occupational mobility, natural capital, and level of dependence on declining natural resources).

Availability of Livelihood and Income Diversity

By definition, livelihood and income pertain to the community members' sources of living which provide and secure their household's basic needs (i.e., food, clothing, shelter, social relationships, and others). The more diverse the livelihood, the higher the ability of the community to adapt to the impact of disasters.

Economic Opportunity

Economic opportunities refer to a business situation or community circumstance that is appropriate for the advancement of the local community's economic interests by providing a stimulus to the community's economic growth. Economic diversification or diversified productive base offers greater economic opportunities that help economies or communities withstand downturns and capitalize on growth opportunities (Davies and Tonts 2010, Cowell *et al.* 2013 as cited by Martin n.d.). Economic diversification helps strengthen the long-term growth and adaptive capacity of the community to changing conditions. Diverse livelihood and sources of income and economic opportunities are correlated with a higher ability to cope with shocks (Cinner and Bodin 2010, Kotschy *et al.* 2015, as cited by Cohen *et al.* 2016).

Occupational Mobility

Occupational mobility refers to the ability or ease by which an individual can move from one economic activity to another. Studies have considered occupational mobility a vital indicator of adaptive capacity conferring risk spreading and flexibility to households when facing perturbations (McClanahan *et al.* 2006, Maldonado and Moreno-Sanchez 2014).

Level of Dependence on Natural Resources and Declining Natural Resources

Communities are often directly dependent on goods and services from ecosystems such as food, medicines, building materials, and fuel. However, too much dependence, extraction, and mismanagement of resources make the ecosystem more vulnerable to environmental degradation and impacts of extreme climatic events. Biodiversity loss is also an attendant effect of this overdependence and overextraction.

Overdependence on declining natural resources creates a cycle of extraction and degradation that makes a community highly vulnerable to impacts of natural disasters and man-made shocks. Studies have shown that those who are highly reliant on agriculture and fishing as their main source of income are more vulnerable to the impacts of climatic conditions. In effect, the high dependence of community members on declining natural resources reduces the adaptive capacity of the community (Cinner and Bodin 2010, Kotschy *et al.* 2015, as cited by Cohen *et al.* 2016).

Learning and Knowledge on Disasters and Risks

Acquiring knowledge on DRRM-related concepts, laws, local practices, causes, and its impacts on human activities and the environment capacitates community members in developing community plans and effective strategies for implementing and monitoring, and evaluating activities, and mobilizing community groups in capacity building activities related to disasters and risks.

Governance and Institutions

Trust in Leadership

Good governance entails public trust and transparency among its constituents, driving more people to participate and attain investments in projects geared towards community adaptation. Trust in the government means trust with its leaders, which is crucial in the efficiency and effectiveness of government operations. A trust which is anchored on respect and fairness binds the leader and its constituents. This improves compliance with rules and regulations, making it easier for the government to implement adaptation strategies with long-term benefits (Mineo 2014, OECD 2013).

Community Engagement

The success of disaster-related programs led by community leaders highly depends on the community's engagement, especially in crafting disaster-related programs, activities, and policies, which are also critical components for adaptive capacity in disasters. Community engagement generates broad public support and accountability of the community in their decision-making, thus enhancing their capacity to change in response to disturbances (Otosí 2019, Ambrosio and Kim 2019, Smith, Leitch, and Thomsen 2016)

Local Environmental Institution

At the community level, the local environment institution shapes the community's responses to the environmental impacts and challenges and capacitates the vulnerable social groups. The local environment institutions act as managers and protectors of the existing community's natural resources, set the direction, and implement rules and regulations in managing the natural resources in the event of the disaster. They are also intermediaries for external support for adaptation, particularly during the recovery phase. They can lead the

community to respond to climate change and disaster impacts. Setting up these institutions and enhancing their knowledge and skills will help strengthen their social adaptive capacities. Without local environment institutions as intermediaries and facilitators, rural communities will find it costlier to pursue effective adaptation strategies.

Results and Discussion

Sociodemographic Characteristics

Survey results revealed that female dominate Barangay Patitinan (57%) and that the majority of the population was married (58%). Results also show that the Patitinan household has an average size of five household members with an average age of 47. Indigenous people (IPs) also account for a good number of the population comprising 24%. IPs population are dominated by the *Tabangon* (74%) followed by *Agta Cimarron* (22%). The dominant religion in the community is Roman Catholic (98%).

Barangay Patitinan's Social Adaptive Capacity

This section identified and discussed the likely social adaptive indicators for the communities of Barangay Patitinan. It is important to understand the likely social adaptive capacities present in the area since the communities were found to be vulnerable to the impacts of landslides and typhoon Usman.

Access to Assets

In the access to assets category, the social adaptive capacity indicators likely present in the communities, and their components are summarized in Table 3 below.

Table 3. Summary of the likely social adaptive indicators on Access to Assets of Barangay Patitinan, Sagñay, Camarines Sur

Social Adaptive Capacity Indicator	Indicator Component/ Descriptor
Community infrastructure	Community church/chapel Barangay daycare center Barangay elementary school Barangay health center Barangay hall Covered court Senior citizen's building Community water system Community toilet Waiting shed View deck Guard lighthouse Bridge Seawall
Access to household material assets	Houses made of mixed materials but mostly light materials Very few of community members own fishing boats, motorcycles, tricycles and jeepneys
Social network and interaction	Government agencies and SUC Private organizations and associations People's organizations
Levels of education	42% completed elementary level only

Community Infrastructure

Barangay Patitinan have different community infrastructures (see Figure 2) such as community church or chapel, Barangay daycare center, Barangay elementary school, Barangay health center, Barangay hall, covered court, Senior citizen's building, community water system,

and community toilet. Only the covered court, daycare center, and the chapel were used as shelter by few families during typhoons. There is also a community water system in the area, but only a few households are connected. Hence, the inaccessibility of some community members to potable water. Other than these, they also have view deck used by tourists to view some scenic attractions. The guard lighthouse structure is standing but not functional. The bridge allows them to be more mobile around the municipality and other towns and access other resources. The sea wall was constructed as a defense to storm surge and other impacts of typhoons in their coastal area. However, most of these infrastructures need to be refurbished, upgraded, and maintained.



Figure 2. Community infrastructures in Barangay Patitinan, Sagñay, Camarines Sur

In terms of the basic needs, an electric cooperative solely provides electricity to the community. An existing telecommunication facility is also available, but the mobile signal seem to be weak. Financial institutions and commercial establishments are still unavailable in the community. Financial institutions can provide credit services for the community, and commercial establishments can offer alternative goods and products that can benefit disaster preparedness and recovery.

Access to Household Material Assets

In terms of household material assets, survey results also revealed that the houses in the community are not sturdy to withstand strong winds or heavy rains. Twenty-seven percent of the respondents used a mix of mostly light materials (i.e., *nipa*, *cogon*, and *anahan*), while 23% used a mix of mostly strong materials (i.e., galvanized iron, tile, and concrete), and 2% used mostly salvage materials or recycled and reclaimed building materials. The community residents' means of transportation identified were riding a jeepney going to the town proper while a few community members own vehicles such as fishing boats (9%), tricycles (2%), and jeepneys (1%).

Social Network and Interaction

The accessibility of the community can also be related to the social networks and interactions of Barangay Patitinan. Generally, their social networks and interactions with other agencies and organizations were limited. Prior to the landslide incident, the Department of Social Welfare and Development (DSWD), Bicol National Association in America (BNAA), Department of Agriculture (DA), and their LGU provided alternative livelihood, access to water system, developed flood control schemes, established a daycare center, and provided financial assistance (i.e., conditional cash transfer, scholarships, and calamity assistance) to the residents. These programs and activities were coordinated and facilitated through their village head. After the massive landslide, more government agencies, local and international organizations, and associations, and state universities and colleges (SUCs) coordinated with the community for humanitarian activities such as relief assistance and psychosocial counseling (e.g., Educo, Riders, Rotary Knights of Columbus, Rotary Club, Social Economic Development Program, National Commission on Indigenous Peoples, Department of Health, Department of Trade and Industry, Department of Environment and Natural Resources, Department of Labor and Employment, and the Partido State University).

According to the KII, social relationships within the village are also known as *dayupot*, which means close, strong, and sincere, indicating a high level of social capital or strong presence of a good relationship. This social relationship also denotes norms of trust and reciprocity or solidarity. This was manifested during Typhoon Usman and the attendant landslides. Many families took in landslide victims, treated them as members of the family, gave them food to eat, clothes to wear, and bed to sleep on. They also listened to their agonizing stories, comforted them, and made them feel that they were not alone. After the typhoon, men voluntarily joined the municipal search and rescue team, brought corpses of men, women, and children to the covered court, and got them ready for burial. Community members had their share of cleaning the surrounding, particularly the public school where the mud was knee-deep, repairing water tanks that exploded with the heavy downpour of rain and water pipes that broke due to flooding and mudflow, preparing food packs, and distributing them to the evacuees. This communal unity and cooperation or locally known as *Bayaniban* spirit, which is founded on Filipino values of *pakikisama* and *pakikisalamuha* (camaraderie, unity, and togetherness), was evident in the community, particularly during times of crises.

Levels of Education

Levels of education are very low, with the majority (42%) having completed primary education, while a fifth (21%) had some primary or elementary education. Even fewer respondents completed secondary schooling (17%), and 14% attended but did not finish high school. Very few (3%) had some tertiary schooling, and 1% completed college. There is 2% which had no formal schooling.

Diversity and Flexibility

In this category, the availability of livelihood and income diversity, economic opportunities, and access to markets indicators were discussed collectively, and the overdependence on declining resources and natural capital since the results are interrelated. The summary of the identified likely indicators of Barangay Patitinan for this category is presented in Table 4.

Table 4. Summary of the likely social adaptive indicators on Diversity and Flexibility of Barangay Patitinan, Sagñay, Camarines Sur

Social Adaptive Capacity Indicator	Indicator Component/ Descriptor
Availability of livelihood and income diversity, economic opportunities, and access to markets	Vegetable farming, fishing, and livestock raising Broom making and wig making Construction-related jobs Transportation services

Table 4. Continued...

	Employees of government and private institutions Limited financial institution and commercial establishment Limited markets Limited transportation services or availability of transportation
Occupational mobility	Availability of job opportunities, low educational attainment
Level of dependence on declining resources, natural capital	Dependent on agricultural-based livelihood and natural resources products, namely, tiger grass, abaca, bananas, coconut, pineapples, sweet potato, cassava, taro, citrus, pili, guyabano, cacao, <i>santol</i> , <i>palay</i> , chicken, cows, pigs, ducks, trees (i.e., Narra, Mangachapoy, and Amoguis)

Availability of Livelihood and Income Diversity, Economic Opportunities, and Access to Markets

Barangay Patitinan's economy is mainly agriculture-based, with most of its households engaged in farming and planting banana, corn, cassava, taro, coconuts, sweet potato, pineapple, abaca, tiger grass, and *palay*, fishing (i.e., yellowfin tuna, sardines, bullet tuna, spanish mackerel, dolphin fish, grouper, and anchovies), and livestock raising. Abaca handicrafts and soft broom made from tiger grass are produced on a very small scale. Results of the survey showed that only a few were employed in construction-related jobs (15%) outside the community, followed by transportation services (4%) and wig-making (4%), and government or private institutions (2%).

Since 80% of their land is devoted to growing tiger grass, soft broom was their product in the community. Shawl-making or *hunlungan* using abaca fiber was very popular in the earlier days. However, the consumers' preference shifted to cotton fibers that are more convenient to produce than abaca shawl.

Markets for the community members' harvested goods and produced products (i.e., soft brooms) have been limited within the community. Agricultural products and crops (i.e., brooms, bananas, abaca, coconuts, etc.), when sold outside of the community, are brought mainly to the Municipality of Tiwi public market. This market is about 45 minutes via a tricycle ride from the Barangay. Since Tiwi's public market is more accessible to the buyers, producers preferred to distribute their goods to the public market than in Sagñay public market. However, it is notable that through intermediaries, some of the brooms produced by the residents of Barangay Patitinan are also marketed in Metro Manila. The accessibility of Barangay Patitinan and its limited available transportation is the constraining factor that hinders the buyers' access to products and the producers' access to other markets. The Pili-Tigaon-Albay road boundary should have promoted economic integration by linking Barangay Patitinan as an area of production for their farming goods and tiger grass product. However, the utilization of the said infrastructure is not yet fully realized by the community.

Furthermore, most community products are sold with very minimal processing and value addition. It was mentioned previously that the community still has no financial institutions and commercial establishments. The lack of such may have caused limited entrepreneurial activities and livelihood expansion and diversification.

Occupational Mobility

Occupational mobility for the community members of Barangay Patitinan is limited to off-farm jobs such as construction-related work in Sagñay, Tiwi, Naga City, and Metro Manila. Men usually do this off-farm work, and hence, mobility is only observed for men in the communities. This usually occurs during summer where demand for construction work is at its peak. When construction work is completed, they go back to Barangay Patitinan and

resume their work on the farm. In the absence of men, women are left to tend the farms. Occupational immobility is due mainly to the inaccessibility of the community and the low educational attainment of the community members. Mobility and opportunities for alternative jobs are limited.

Natural Capital and Dependence on Declining Resources

Products available in Barangay Patitinan are bananas, coconuts, and abaca. Key informants interviewed claimed that at least 80% of the land is devoted to planting tiger grass which is usually used as raw material to produce soft brooms. The remaining lands were dedicated to planting fruits and crops such as pineapples, sweet potato, cassava, taro, citrus, pili, guyabano, cacao, and *santol*, which are primarily for home consumption. A very small portion of the land is devoted to planting *palay*. The residents also raise backyard chickens, cows, pigs, and ducks. Fish is abundant in the coastal areas of the barangay.

The preceding discussion showed that basic necessities were already present in the community, which can be available during disasters for the community people. But more importantly, it also showed that natural resources underpin the livelihoods of many households in Barangay Patitinan. Most of them are highly dependent on tiger grass fields, forests, and fishing grounds, often open access in nature. These resources are important sources of income, food, fuel, building materials, medicines, etc.

However, based on interviews, the ecological landscape of the Barangay was different before. The Barangay, according to a key informant used to be forested and more biodiverse. The forest was abundant in root crops, fruit-bearing trees, and towering trees with hardened dark brown bark. Inhabitants gathered firewood in the deep forest. Also found in this forested area were Patitinan trees. They were towering trees with shapely stand, spreading branches where birds of various species made their habitat. Hornbill and owl were among those birds that lived in the forest. These Patitinan trees were used as building materials for the inhabitants' houses because, just like the Narra tree, they too were durable. They were also used as flooring material because of their brilliance, which is equal to Mangachapoy and Amoguis.

Deforestation and the consequent loss of biodiversity can be attributed to several factors. Household interviews reveal that the common perception is that deforestation has been mainly due to *kaingin* system or slash and burn farming. There have also been practices of indiscriminate planting of tiger grass instead of trees or deep-rooted trees in mountainous terrain. Aside from these, road widening development in the area also affected the environment. The road widening involved blasting the site, cutting a portion of land hills, and excavating landmass, rendering the craggy mountain sensitive to natural perturbations. These all contributed to vast eroded landmass in the area, which disrupted both flora and fauna. The eroded landmass, including flora and fauna, the limited number of crops grown and species of animals, the abundance and dominance of tiger grass in the area all indicate a loss of biodiversity.

A potential solution to both the massive erosion and the loss of biodiversity is the use of a bioengineering approach to stabilize the soil surface. This approach can be both a soil erosion mitigating measure and, at the same time, a biodiversity-increasing intervention. Bioengineering uses shrubs and grasses to hold the soil and keep the surface soil eroded by surface run-off. Aside from this, it increases the absorptive capacity of soil and filter sediments. These shrubs and grasses must be combined with deep-rooted trees to penetrate deep into the soil and make the bioengineering techniques stronger and more effective (Raut and Gudmestad 2017, Singh 2010). It improves the slope stability, prevents land degradation and loss of vegetation. Furthermore, this approach is cost-effective and environmentally friendly, proven to help reinforce and improve slope stability and maintain ecological balance. Although it is a mitigation measure, the bioengineering approach may also enhance the adaptive

capacities in the area of natural capital, resulting in improved agricultural productivity and income.

Learnings and Knowledge in Disasters and Risks

This section pertains to the perceived DRR-related concepts, laws, causes, and its impacts on human activities and the environment of Barangay Patitinan's community members. It also identified their sources of information for disaster and described the local practices on disaster preparedness, response, and rehabilitation and recovery of the community members. Table 5 below summarizes the identified likely social adaptive indicators of Barangay Patitinan communities for this category.

Table 5. Summary of the likely social adaptive indicators on Learnings and Knowledge in Disasters and Risks of Barangay Patitinan, Sagñay, Camarines Sur

Social Adaptive Capacity Indicator	Indicator Component/ Descriptor
Knowledge of DRR-related concepts and laws	Individual perceptions on typhoons and causes and impacts of landslide Limited knowledge of the DRRM laws and other related laws
Sources of information on natural hazards	Television Radio Barangay and municipal officials
Activities before, during, and after a disaster	<i>Disaster preparedness</i> Stockpiling food, water, medicine, and securing their essential documents Secure their houses to withstand the impact of disaster (modern and indigenous practices) Communicate with the Barangay officials and neighbors to be familiar with the designated evacuation centers and refuge areas Participated in developing hazards and risks map <i>Disaster response</i> Keep themselves informed and updated Provide shelter, food, and clothing to evacuees Help in the search and rescue team to bring corpses to the covered court Share food and provide medicines to sick community members <i>Disaster rehabilitation and recovery</i> Assist in cleaning the surrounding and fixing damaged houses Share food and provide medicines to sick community members Plant backyard plants and trees in the mountains along the road and the mountain cliffs.

Knowledge of DRR-related Concepts and Laws

Aside from landslides, Barangay Patitinan is also faced with multiple hazards such as typhoons, rockslides, storm surges, and floods. Since they were strongly hit by Typhoon Usman, which triggered their massive landslide, respondents were asked about their perception of typhoon hazards (see Figure 3). Results revealed that most of the respondents (30%) associated typhoons with strong winds and rain, while others viewed it as bad weather (27%). Respondents also stated that they perceived the typhoon as a weather system formed at sea, bringing strong winds and heavy rains (24%).

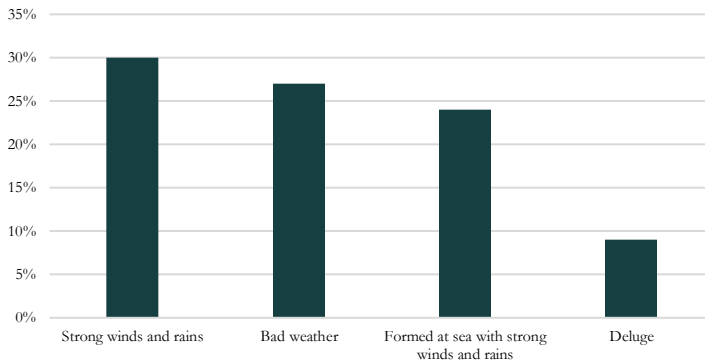


Figure 3. Perception on typhoon associated hazards

In terms of the respondents’ perception of the causes of landslide (see Figure 4), the survey revealed that 42% of the respondents believed that frequent landslides were caused by deforestation, including *kaingin* system or the consistent slash and burn activities, while 17% claimed it was due to the high volume of rainwater. Some of the respondents (17%) pointed out poverty since it forced them to engage in *kaingin* as their source of livelihood.

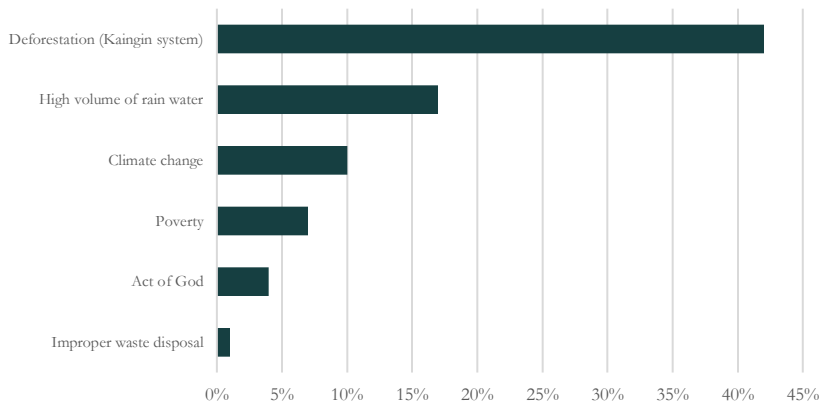


Figure 4. Perception on the causes of landslides

These perceived causes of landslides were consistent with the community’s observed changes that worsen Typhoon Usman's impacts. The majority of the respondents (59%) referred to deforestation as the most undesired observable change in Barangay Patitinan. Other observed changes include worsening poverty incidence in their community, increasing population resulting in increased housing, quarrying, cutting of mangroves, increasing waste and improper waste disposal, lack of knowledge on climate change, and negligence of the government. However, it is worth noting that the community was unable to consider the road widening project of the 36.69 kilometer Pili-Tigaon-Albay boundary road as one of the possible causes of the landslide. The road widening project involved blasting the site, cutting a portion of land hills, and excavating landmass, rendering the craggy mountain sensitive to natural perturbations. The indiscriminate planting of tiger grass, as earlier mentioned, is also a contributing cause of landslides.

Survey results revealed that 17% of the respondents were knowledgeable on DRRM-related concepts while 17% on climate change-related ones. In terms DRRM-related laws, 7% were knowledgeable on the Philippine Disaster Risk Reduction and Management (PDRRM) Act of 2010 while 9% on Climate Change Act.

The respondents also have limited knowledge on identifying vulnerable groups in disasters. They only identified children (48%) and elderly (21%) as the vulnerable sectors during disasters as these sectors were perceived as physically weak and needed immediate assistance during a disaster. The respondents also perceived women and mothers as less vulnerable due to their social roles in the community, such as fishing, farming, gathering firewood, and fixing the roof by placing sandbags in preparation for typhoons. Some elders of the IPs also consider their women as physically strong because of their well-exercised bodies (*ebersisyo ang hawak*). This is apparent during the implementation of Kapit-Bisig Laban sa Kahirapan-Comprehensive and Integrated Delivery of Social Services (KALAHI-CIDSS) projects implemented in the community. Women were involved in construction-related activities such as mixing cement, hauling mixed cement, and shoveling. Electing a lady chieftain among the IPs is also an indication of recognizing the power of women's leadership in their community.

Sources of Information on Natural Hazards

Regarding the community members' sources of information on natural hazards and disasters, the survey revealed that 36% of the respondents relied on television while 33% on radio as their primary sources of information on disasters. Since the mobile signal is weak in the area, only 5% of the respondents receive information through their mobile phones. Other sources of their information include the municipal (14%) and barangay officers (10%).

For the IPs', their lady chieftain revealed that they still follow their traditional practice of using a hollowed tree trunk as a wooden gong (*Balalong*) or a native trumpet (*Hamudyong*) made from an empty conch shell that produces sound to relay a warning signal to the community members. Some of them observe nature and animal behavior as their basis for any impending danger or disaster. Flock of birds nesting on branches of trees, the unusual soaring elevation of ducks, and continuous falling of leaves from trees, for instance, are considered signs of coming disasters. Aside from these, a relatively fast movement of clouds and the formation of a big halo (*sayap*) of light around the moon are also believed to be precursors of danger or disasters. They believe that the bigger the halo, the stronger the impact of the disaster.

Activities Before, During, and After a Disaster

Disaster Preparedness

Disaster preparedness is a crucial aspect in DRRM for the community's resilience. Community residents of Barangay Patitinan prepare prior to the disaster by stockpiling food, water, medicine, and securing their essential documents. To secure the roof of their houses against strong winds, community members place sandbags, old rubber tires and tying their houses with strong rope to a big tree. They also nail down their house doors and windows and store new batteries for their flashlights. They also communicate with the Barangay officials and neighbors to know the designated evacuation center and be more familiar with other safe places or houses.

Part of the disaster preparedness of a community is anticipating, coping, and recovering from disaster impacts. Understanding and being aware of the community hazards and risks is an integral part of disaster preparedness. The community members of Barangay Patitinan, guided by facilitators, developed their own hazard and risk map (see Figure 5), where they identified and mapped the risk areas by hazards (landslide and storm surge) in their locality. This document allowed the community to be aware of the areas they have to avoid to reduce risks. Figure 5 shows that there is a high risk of landslides in the mountain area of Barangay Patitinan, while flood is a low to medium risk hazard along the coastal area of the community.

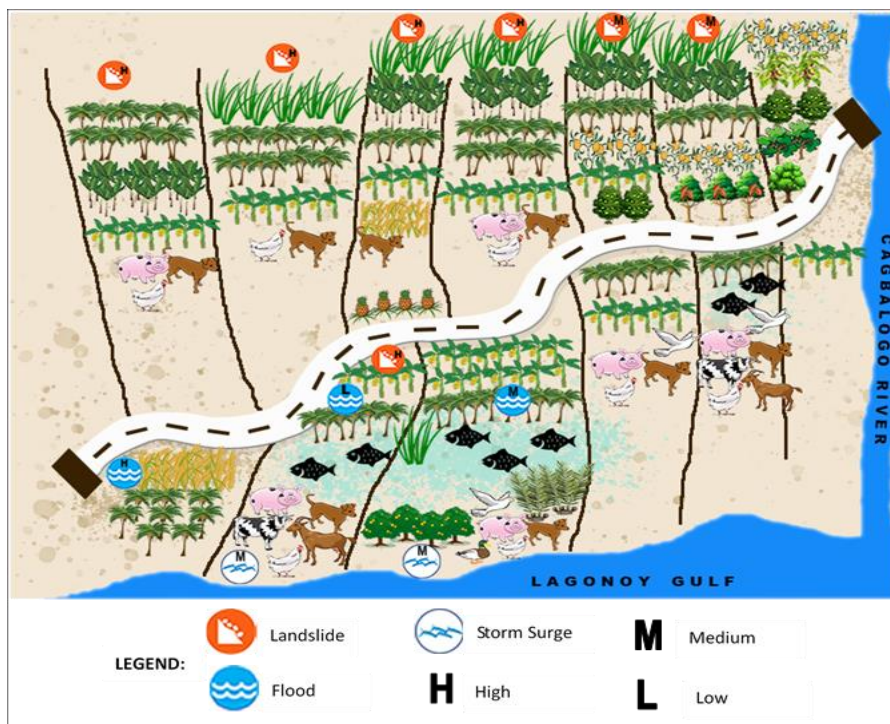


Figure 5. Hazards and risks map of Barangay Patitinan, Sagñay, Camarines Sur

For the IPs, they employ their traditional practices to prepare and recover from the disaster. Noteworthy is the use of the traditional *kurob*, a *kubo*-like house structure made of bamboos, *nipa*, cogon, and coconuts. Instead of four posts to hold the roofs, the lower ends of the roofs are buried approximately about a meter in the ground. These serve as the shelter's foundation. The bamboo flooring, which is a common space, is elevated approximately about a foot. Some IPs are still practicing this kind of structure to secure their house from being blown away by a strong typhoon. Another indigenous practice is using a hole that is dug at least two meters below the ground to serve as an emergency shelter. With a width that varies depending on the number of people to be accommodated and a cover made from cogon grass, this hole protects the IPs from strong and cold wind and rain. The IPs stay in the hole with their food and essential household items until the typhoon subsides. Although, indigenous knowledge systems and practices (IKSP) have helped the IPs cope with natural hazards and disasters in the past, these knowledge systems are slowly disappearing with the assimilation of "modern" survival strategies and continuing loss of interest among the younger generation.

Disaster Response

Throughout the onslaught of a typhoon, some would keep themselves on guard by intently listening to the news or being awake most of the time praying for their safety. The children have similar observations during the imaging workshop conducted. According to them, during Typhoon Usman, some took refuge in one's relatives' or neighbors' houses. They shared food, provided medicines, and prayed with them.

Disaster Rehabilitation and Recovery

After the typhoon, it is customary for the people to help clean the surroundings, fix damaged houses, share food with those greatly affected, and provide medicines to sick people. The community members also plant backyard plants and trees in mountains and along the road and mount cliff.

Governance and Institutions

This section pertains to the trust level of the community's key informants towards their leader, engagement of the community members in capacity building activities, and the status of their local environmental institution. Table 6 presents the likely social adaptive capacities of Barangay Patitinan in this category.

Table 6. Summary of the likely social adaptive indicators on Governance and Institutions of Barangay Patitinan, Sagñay, Camarines Sur

Social Adaptive Capacity Indicator	Indicator Component/ Descriptor
Trust in leadership	High level of trust or assistance to the community, linkages, and other assumed roles
Community engagement	KALAHI-CIDSS and DRR-related activities
Local environmental institution	Barangay environment committee Barangay Disaster Risk Reduction and Management Committee (BDRRMC)

Trust in Leadership

The study attempted to look into the trust level of the community residents towards their leader by using a Likert rating scale from 1 to 5 (with one being the lowest and five being the highest). This rating, though, was only limited to key informants. All the key informants gave a rating of 5 to their village head. They have identified that their village leader provided substantial assistance regardless of political affiliation, such as access to water system and provision of toilet facilities, financial aid (i.e., scholarship), infrastructure development such as the construction of a chapel for the community's worship, temporary shelter during calamity and disaster, referral to decent jobs, and other livelihood assistance. The community leader also has strong international linkages with international organizations such as the BNAA and some influential politicians, securing community assistance. The village head's profession, desire to help the community and the assumed role as an emotional anchor for family-related affairs have also been oft-mentioned reasons for admiring her leadership.

Community Engagement

The community members' participation is crucial in the success of community leadership, especially in managing disasters. However, community members' participation in the local development planning is still not recognized by the community. In the case of Barangay Patitinan, participation among community members is usually project-based initiated. Active participation among community members was actuated during the implementation of the KALAHI-CIDSS projects with appropriate guidance from the facilitators. The Partido State University (PSU) initiated and facilitated community activities joined by community volunteers and different sectors in the community where they identified hazard-prone areas, estimated damage cost, and identified mechanisms and strategies to reduce risks.

Local Environmental Institution

For the local environmental institution in the community, there are only two environmental institutions that key informants could recall, namely: the Barangay Environment Committee (BEC) and Barangay Disaster Risk Reduction and Management Council (BDRRMC). Presently, the BEC's programs are limited to advocating and implementing backyard gardening using the seeds provided by the DA and waste disposal program. Aside from its primary function indicated in the Implementing Rules and Regulations of the RA 10121, the BDRRMC also participated in disaster-related activities such as crafting of the community's Barangay Disaster Risk Reduction Management plan. The plan was initiated by PSU and participated in by various stakeholders in the community. However,

since its formation, no ordinance has yet been passed to legitimize the BDRRMC formation and functions.

With its limited focus, environmental institutions have also overlooked potential sources of environmental problems, especially in the aspect of managing common property resources. Anyone can plant crops anywhere since they have public and unutilized land which is still open access. Tiger grass, for example, is still found in steep mountain slopes or flat expanse of land since there is no crop zoning developed.

Summary and Conclusion

Typhoon Usman in 2018 severely impacted the municipality of Sagñay and triggered landslides in Barangay Patitinan that resulted in the loss of lives, properties, and natural resources. Although measures to mitigate the impacts of disaster and climate change are being done at the village level, these are insufficient. There is also a need to understand the social adaptive capacity and finding ways to build it for a resilient or sustainable community. Identification and assessment of social adaptive capacity lead to potential resilience-building policies. This assessment, however, must be community-specific as different communities would likely have different capacities. Such an assessment has not been done in landslide and poverty-stricken communities such as Barangay Patitinan. Thus, the motivation for this study is to understand the social adaptive capacity of communities in Barangay Patitinan based on its likely indicators. These likely indicators include: availability of livelihood and income diversity, economic opportunities, access to markets, occupational mobility, natural capital, over dependency on declining resources, knowledge of DRR-related concepts and laws, sources of information on natural hazards, activities before, during, and after a disaster, trust in leadership, community engagement, and local environmental institutions. These indicators were adapted and modified from Whitney *et al.*'s (2017) categories of social adaptive capacity. Descriptive or qualitative analysis was done to assess these social adaptive capacity indicators. Analysis was informed by the results of the PRA and survey conducted for the drafting of a DRRM plan for Barangay Patitinan. The relevant results of this descriptive analysis are as follows:

Access to Assets

Access to assets is characterized by the presence of basic but limited community infrastructures necessary to stimulate economic growth. Survey results also showed that human capital was low, as evidenced by the low level of education among respondents. Household assets were also limited. In particular, houses were made of light, low-quality materials, and only a handful of owned durable assets like boats and other vehicles. There is a high level of social capital within the communities, but external social networks and interactions with other agencies and organizations were limited. Perhaps this is due to the inaccessibility of the community.

Diversity and Flexibility

Communities in Barangay Patitinan have less diverse sources of income and limited availability of livelihood. Barangay Patitinan's economy is mainly agriculture-based, with most of its households engaged in farming and planting banana, corn, cassava, taro, coconuts, sweet potato pineapple, abaca, tiger grass and *palay*, fishing (i.e., yellowfin tuna, sardines, bullet tuna, spanish mackerel, dolphin fish, grouper, and anchovies), and livestock raising. Abaca handicrafts and soft broom made from tiger grass are produced on a very small scale. There is high dependency on natural resources, which was observed to have been prone to degradation and loss of biodiversity.

Marketing the community members' harvested goods and produced products (i.e., soft brooms) has been limited to the community. Since the majority of their products are raw,

the community seemed to have limited value-added products. Though the area has diverse economic opportunities, the community members are unable to participate since the majority are into agricultural livelihood. This also leads to the observed restrained occupational mobility, which is further exacerbated by the barangay's geographical remoteness and limited transportation services. Alternative work was mostly for male residents and is limited to off-farm jobs, notably in construction-related work in Sagñay, Tiwi, Naga City, and Metro Manila.

Learning and Knowledge on Disasters and Risks

The community's learnings and knowledge on hazards or DRRM shows limited understanding of basic national laws and related concepts but adopts disaster preparedness strategies acquired from the training given by the Municipal Disaster Risk Reduction and Management Office (MDRRMO). Information on natural hazards mostly came from television and radio. The community's limited understanding of the causes of landslides is also indicative of their limited understanding and inability to see the interconnectedness of the ecosystems.

On the other hand, IPs mainly relied on IKSPs that helped them cope with natural hazards and disasters in the past. However, these IKSPs are slowly disappearing with the assimilation of "modern" survival strategies and continuing loss of interest among the younger generation.

Governance and Institutions

The high level of trust bestowed upon the community's leadership seems to be defined by one's good standing in the community indicated by profession, social relation, and contribution to the community's wellbeing. However, community engagement is weak. The community mainly acts as the recipient of information and doers of programs and projects rather than partners in development involved from planning to the implementation process. Community involvement in the implementation of KALAHI-CIDDS and the drafting of the DRRM plan that were participatory and developmental revealed an immense yet hidden potential of the community in the decision-making process. This character could be tapped to increase the social adaptive capacity of communities in Barangay Patitinan. Local environmental institutions are limited and need to be strengthened.

Recommendations

The Barangay Patitinan communities have observed likely indicators of social adaptive capacities. However, the social adaptive capacities can still be further improved. The following are recommended to further enhance its observed and identified indicators:

Adopting Bioengineering as an Approach to Increasing Biodiversity and Preventing Landslides

Biodiversity is vital to humans because of the ecosystem services it provides. In the past, Barangay Patitinan is known for its abundant natural resources. However, observed declining resources brought about by deforestation and subsequent erosion of huge landmass and rocks calls for a community action plan to moderate the utilization of its natural resources. This may mean proper selection of plant species to be planted, particularly in mountainous terrain, for natural ecosystem stability and planting high-value crops in appropriate areas to increase agricultural production. This also includes selective cutting of trees to support the soil and lessen the risk of landslide in the community. A bioengineering approach to improve slope stability, prevent land degradation and loss of vegetation, and improve natural capital is also a viable approach. Bioengineering approach to slope stabilization, as discussed earlier, is both a landslide mitigating and biodiversity increasing intervention.

Diversifying Income Opportunities through Product Diversification and Differentiation

Since the community is also abundant in abaca, the community may consider reviving abaca fiber weaving by producing products (i.e., garments, bags, slippers, and decorations) for commercial purposes instead of just selling them as fiber or raw material. The community members of Barangay Patitinan can redesign the shawl or *hunlungan*. Bananas can also be processed into high value products such as chips, dried, puree, pastillas, feeds, fibers, and fertilizers. The broom from tiger grass can be sold in bulk and available alternative markets to minimize transaction costs. The community can also engage in aquaculture to increase and ensure the continuous supply of their fish. The fish hatchery could be utilized for local communities' economic benefit. However, these value-adding activities would also need support in terms of capital and processing facilities. Participation among sectoral organizations is needed to engage in entrepreneurial and capacity building activities (production and marketing). Local products can be displayed in a showroom designed following the *Kurob*, an IPs' cultural identity. Since the Barangay Patitinan is quite inaccessible, marketing of the products can be done through digital marketing. The latter will entail the engagement and capacity enhancement of the younger generation to manage an online market. These diversification strategies may stimulate Barangay Patitinan's economic growth, improve households' access to material assets, and promote diversity and flexibility that could enhance their adaptive capacity for a resilient community.

Strengthening Community's Engagement in Local Development Planning

Participation of the local community in the decision-making process is critical for community empowerment, promoting a sense of ownership, and building mutual responsibility and accountability for the local officials and constituents. Active community participation can also minimize the risks and vulnerabilities of the community. The successful implementation of the KALAHI-CIDDS project and the DRRM plan development indicate the community's potential ability to set its developmental direction. The community-based organizations actively engaged in KALAHI-CIDDS projects should be strengthened by involving them in local development planning. Support from external organizations, such as non-government organizations or academe, to mentor and guide them in this aspect may be needed during the early phase of self-determination by the community.

Strengthening BDRRMC in Collaboration with the Barangay's Committee on Environment

Strengthening the existing local environment institutions such as the BEC and the BDRRMC is necessary for enhancing adaptive capacity. Both must coordinate and collaborate in advocating and developing environment and DRRM-related activities for the community members. These activities may include consciousness-raising and skills enhancement activities to better equip the community in responding and adapting to DRR and climate change impacts. Particular activities could be lectures and trainings on concepts and laws related to DRR and climate change, identification of the vulnerable groups, disaster preparedness (i.e., setting up the system for early warning, evacuation and emergency operations management, disaster and evacuation drills, stockpiling), and emergency response (i.e., search and rescue, repair and restoration of critical facilities and utilities, medical assistance, the conduct of damage needs and capacity assessment). They can also tap different community organizations in the roll-out of these activities.

Developing Participatory and Comprehensive Long-term Rehabilitation Plan

The proposed strategic interventions raised above must be considered and encapsulated in a program for a more cohesive, pragmatic, and integrated approach. The development of this rehabilitation plan must be participatory and multi-dimensional or

transdisciplinary. Implementation of this plan necessitates the activation of local sectoral organizations. Provision of organizational development trainings in partnership with outside entities (i.e., academe, NGOs, government agencies, and private sectors) and other skill capacitation efforts are also needed.

Institutionalizing DRR-Related IKSP

The continued adoption of IPs of their IKSPs in disaster preparedness, response, and recovery, and rehabilitation implies the importance and effectiveness of IPs knowledge in preparing and coping with the risks from disasters and natural hazards. It is recommended that IKSPs, especially those that are slowly disappearing, be disseminated among the community members of Barangay Patitinan.

Developing Activities that Promote Community Cooperation and Cohesion

It was observed that there was a high level of cooperation and cohesion within the community. Community sharing of food and houses as refuge during disasters served to fill in the government's gaps in disaster relief and response in Barangay Patitinan. It facilitated the saving of lives and helped many community members recover from disasters. This is already an innate Filipino trait which is the *Bayanihan* spirit. Community activities can be designed to sustain this indigenous Filipino trait and promote a culture of collaboration, teamwork, empowerment, and action.

Conducting Further Research Studies

Further studies related to assessing the social adaptive capacity, particularly in the ecological aspect, are needed. Other supporting studies may include a geological study on assessing the slope's stability, including the soil slope's water retention capacity, soil analysis, biodiversity assessment, and economic feasibility of possible strategic interventions. The results of these studies hoped to serve as inputs for the development of the community's holistic rehabilitation plan. Furthermore, measurement of indicators and relating it to levels of resilience against impacts of landslides can also serve as an additional input for this rehabilitation plan.

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