Indigenous Knowledge in Disaster Risk Reduction: The Tales of Three Islands (San Miguel, Camotes and Alabat) in the Philippines

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Abstract

The importance of indigenous knowledge in reducing risk from disasters and natural calamities has been widely discussed in the social sciences by scholars arguing for integrative frameworks and participatory processes. This type of knowledge is vital for archipelagic developing countries, such as the Philippines, situated in a geographical area exposed to natural hazards. However, despite its potential contribution to disaster prevention, mitigation, response, rehabilitation and recovery, along with possible combination strategies with western scientific knowledge towards reducing vulnerability and disaster risk management, the literature on the integration of specific communities' indigenous knowledge-based disaster preparedness and adaptation is still limited. The novel contribution of this article is in the discussion of the unique indigenous knowledge identified in the cases of San Miguel Island, Camotes Island and Alabat Island, which is utilized even up to the present. Particularly, this study identifies substantial aspects of indigenous knowledge that contribute to disaster risk reduction in the three selected cases. Findings reveal myriad indigenous knowledge pertaining to intensity, height, direction and movement of ocean waves; intensity of winds; sudden surfacing of deep-sea creatures and unease of animals; different patterns of clouds, darkening of skies and foggy horizons, among others. In closely examining indigenous knowledge, this study sheds new light by providing meaningful insights for its contribution to disaster preparedness.

Keywords: *indigenous knowledge, disaster risk reduction, natural hazards, island communities, Philippines*

Introduction

Numerous natural disasters have occurred in the Philippines in recent years, many of which have left large numbers of its low-lying and coastal regions in extremely devastated conditions. The flash floods and mud-

flows that affected the provinces of Quezon and Aurora on November 2004, for instance, were caused by massive heavy rains that generated severe landslides and overflowing of rivers. The disaster displaced a million people, with a death toll of over 2,000, and affected more than 300,000 hectares of farmland in upland areas with massive landslides (Medina et al. 2009). Another event was the super-typhoon Yolanda (Haiyan), considered to be one of the most powerful storms to hit land in recorded history. The typhoon pummelled through the Visayas region in November 2013 and affected eight regions in total, causing the death of 6,300 citizens, injuring 28,689 (with 1,061 individuals unaccounted for) and costing Php 95,483,133,070 (US$ 1.87 billion) worth of damage (NDRRMC 2013).

Furthermore, due to the experience of the Philippines and the global humanitarian community in responding to the typhoon, the Post-Haiyan Tacloban Declaration was adopted. This document encourages cooperation and collaboration of the citizens in the Disaster Risk Reduction Management (DRRM) of one of the most devasted cities in the country (European Union 2014). Following this, seminars and training that could be vital for citizens' survival have been conducted as part of DRRM protocol. Additionally, the declaration encourages greater cooperation between the government and private sector, and protection of vulnerable groups (Quismundo 2014).

There are four categories of typhoon in the Philippines: tropical depressions, tropical storms, typhoons and super-typhoons. These typhoons that hit the country are classified as climate- and weather-related hazards. Other hazards under this classification also involve earthquakes, tsunamis, volcanic eruptions and droughts. These natural hazards are a normal process of Earth and may result in injuries, loss of life, destruction or loss of property, socio-economic crisis or environmental degradation (Manila Observatory 2005). These events are experienced in the Philippines throughout the year, with some having devastating impacts such as those of Yolanda. Yet these hazards have strengthened the disaster management system of the country. The Philippine Disaster Risk Reduction Management Act 2010 proved to be effective in the case of the province of Albay, where it achieved a zero-casualty count despite the severe typhoons that landed on the region from 2007 to 2012. This was a far better result compared to that of the disaster management plan in existence in 2006, where that province and the rest of Bicol region suffered under the wrath of another devastating typhoon, Reming (Salceda 2013).

Apart from Albay, the town of San Francisco in Camotes Island during typhoon Yolanda and Alabat island during typhoon Glenda are other examples of zero-casualty cases. These instances of disasters being casualty free have one common factor that is not widely known: indigenous knowledge. Defined as 'the local knowledge that is unique to a culture or society', indigenous knowledge is also called 'local knowledge, folk knowledge, people's knowledge, traditional wisdom or traditional science' (UNESCO 2010). It also refers to coping mechanisms and practices that communities have used in withstanding and enduring natural disasters and calamities over centuries (UNISDR 2008). This knowledge is usually passed down the generations through customs, discussions and rituals. It has also been the basis for society-sustaining activities such as agriculture production, food preparation and education (UNESCO 2010).

Research Questions

This study investigates how indigenous knowledge in selected island communities contributes to disaster risk reduction in times of disaster in the Philippines. In particular, it explores the following questions.

1. What are the different forms of indigenous knowledge applied to disaster risk reduction?
2. How can indigenous knowledge enhance disaster risk reduction?
3. What are the outcomes of using indigenous knowledge in disaster risk reduction?

Significance of the Study

As stated in Hyogo Framework for Action for 2005–2015 (HFA), indigenous knowledge is important when it comes to providing accessible and understandable disaster risks awareness and protection information, especially to local citizens. Bearing social and cultural factors, indigenous knowledge acts as a vital element in encouraging and enabling peoples and stakeholders to be resilient and in reducing risks by taking necessary action (UNISDR 2005).

Furthermore, within the Sendai Framework for Disaster Risk Reduction 2015–2030, indigenous knowledge provides an important contribution in terms of the development and implementation of mechanisms, plans, strategies and early warning systems. It complements scientific knowledge in disaster risk assessment and development, facilitating a

better understanding of disaster risk at both national and local levels (UN 2015). In addition, according to Jha and Jha (2011) indigenous knowledge is an essential national resource that can accommodate disaster prevention, disaster preparedness and disaster response in ways that are cost-effective, participatory and sustainable.

This study is therefore significant in promoting a better understanding of how disaster risk reduction (DRR) functions in local communities, as well as in recognizing indigenous knowledge in DRR. By understanding the different forms of indigenous knowledge present in the country, the government and the private sector in the field of development can further acknowledge and integrate this knowledge into DRR plans, which would help many regions in times of calamity.

Scope and Limitations of the Study

This study focuses on indigenous knowledge in selected local communities in the Philippines. It studied and analysed the different contributing factors in the four thematic areas of the Philippine Disaster Risk Reduction Management Plan (NDRRMC 2011). The study has considered the indigenous knowledge practices of San Miguel Island (Albay), Camotes Island (Cebu) and Alabat Island (Quezon Province) with regard to natural disasters. The research tackled these three cases from Luzon and Visayan, since the most common typhoon path lies between these two regions. Moreover, the locations were chosen due to available scholarly articles and research conducted that identified these areas as have existing indigenous knowledge with potential to contribute to the local DRR and resilience.

Disaster Risk Reduction

DRR is the idea and habit of reducing disaster risks systematically and through lessened exposure to threats, reduced vulnerability of property and people, management of the environment and enhanced preparedness (USAID 2011). It is done so as to manage and analyse the factors that cause disasters and aims to decrease the damage caused by natural hazards such as floods, earthquakes, cyclones and drought. The term 'disaster risk management' (DRM) is often used in the same context, referring to a systematic approach to identifying, assessing and reducing risks. DRM emphasizes more the practical implementation of initiatives to achieve DRR goals, but both terms

define a broad-based approach to the causes of and consequences of disasters (Twigg 2015).

Primarily, risk assessment, vulnerability, operational abilities and institutional capacities are all examples of disaster reduction strategies. The assessment of the vulnerability of critical facilities, economic and social infrastructure, usage of effective early warning systems and application of many different types of scientific, technical and other skills are among the essential features of DRR (USAID 2011).

The UN International Strategy for Disaster Reduction (UNISDR) examined the national HFA progress reports that could provide information regarding common challenges countries faced in implementing DRM policies and activities (UNISDR 2014). Since climate change leads to shifts in risk patterns, the next challenge refers to how issues pertaining to climate change are integrated into DRM. In some countries, consideration of DRM and climate change are combined, and so the adaptation policies establish a common platform in discussing how both aspects need to be mainstreamed into policies at national and local levels (UNISDR 2014).

Indigenous Knowledge

The relevant knowledge regarding changes in the local environment will have originated within the community, been maintained through non-formal means of dissemination, collectively owned, developed over several generations and subject to adaptation, and is deeply implanted in a community's way of life as part of a means of survival (Khetran, Khan and Chaudhry 2012). It develops and adapts continuously to gradually changing environments and is passed down through generations and closely interwoven with people's cultural values. Indigenous people and communities around the world have long used their traditional knowledge to prepare for, cope with and survive disasters. Several of their methods and practices have been passed down over generations, one of which includes observing animal behaviour to gain early warning of hazards such as earthquakes and tsunamis (Hasan 2015). In addition, according to (Hiwasaki et al. 2014a) the Intergovernmental Panel on Climate Change acknowledges indigenous knowledge as an invaluable basis for developing adaptation and natural resource management strategies in response to environmental and other forms of change.

On the other hand, as stated in an article by Mallapaty (2012), traditional knowledge does not always reduce communities' vulnerability

to natural disasters, as it may not quickly adapt to changing social and climatic dynamics. An example of this was with the volcanic eruption of Mount Merapi in Indonesia, where official evacuation orders based on detailed scientific monitoring contradicted the advice of the volcano's spiritual gatekeeper, Mbah Marijan. Since the gatekeeper had not received a premonition of volcanic eruption, the residents decided not to abandon their livestock and stayed in their residences. This resulted to the death of the gatekeeper. As Zimmermann and Issa (2009) also observed in Pakistan, relocating people from dangerous places can be a highly sensitive issue that often requires the support of clear and forceful government policies; and involvement of local communities is critical for the success of risk mitigation and disaster preparedness.

Research conducted by Hilhorst et al. (2015) in the villages of Ban Sai Ngam and Khek Koi in northern Thailand, where the Lisu and Hmong communities dwell, reveals that only a few respondents would mention similar forms of indigenous knowledge useful for coping methods during disasters, indicating that such knowledge is scarcely shared and spread through the communities. However, most of the indigenous knowledge evinced by the respondents can be identified into categories, such as respondents' observations relating to unusual animal activity vis-à-vis the upcoming weather, or having a shaman predict the future and revealing an upcoming crisis or disaster. In addition, ethnographic research has found that one of the coping methods employed during disasters connects to the community's high regard for community relationships, strong family links and mutual assistance in times of calamity. In the Philippines, *bayanihan* – a type of Filipino mechanism wherein clans, extended family and other organizations engage in voluntary collaborative action through extending assistance and aid emergencies occur – was observed to be most prevalent immediately after disasters (2015: 514–515).

Research on indigenous knowledge in Papua New Guinea by Sithole et al. (2015) conducted in three areas of the country (namely Kimbe, West New Britain; Bulolo, Morbe; and Popondetta, Oro) bore similarities with the present study in terms of its observations such as regarding changes in wind, sea waves, clouds and even celestial bodies. Furthermore, changes were noted in animal behaviour in the three cases, with the most common occurrence being the continuous barking of dogs prior to a cyclone or tsunami. Certain types of flora in these areas were also observed, with some flowers perceived to be blooming with a different colour than usual or at the wrong time. House-to-house dissemination of warnings, along with livelihood sustainability and coping practices

for food security – such as livelihood diversification before and after shocks – were also noted. The study also observed the use of the conch, a medium or large shell that produces sound employed as a warning device – a practice also found in Rapu-Rapu, Albay, Philippines in the 2014 study by Hiwasaki and colleagues.

In Mon district, Nagaland, India, the Konyak community acknowledges and integrates indigenous knowledge with the community's beliefs, behaviour and lifestyle (Paulraj and Andharia 2015). For instance, during the season when wildfires may occur, the Konyaks gather in front of the Angh's (head chief) home and hold a ceremony signifying the start of wildfire season. Another example is the observance of the Konyaks regarding the drying up of mountain springs accompanied by shortage of rainfall. This is an indicator for locals that there is the need to anticipate and prepare for drought and food shortage, serving as a sign for the need to start storing food grains in earthen pots (2015: 156–157).

Similarly, as observed by Iloka (2016) in Africa, indigenous knowledge has been evident not only in the field of DRR, but also in agriculture, traditional medicine, engineering and food production. Indigenous knowledge could provide knowledge and coping mechanisms to aid in disaster resilience in places such as Nigeria, where the locals in the Niger Delta region utilize indigenous plants to prevent erosion – as with bamboos and raffia palms planted near the riverbanks. Not only does this stop the bank from eroding but also serves as current breaks and later compacts the soil that makes up the riverbank, which prevents future landslides from occurring. Another instance of indigenous knowledge is the presence of a specific bird such as the Emahlokohloko bird (*Ploceus* spp.) in Swaziland that serves as an indicator for locals of the start of the rainy season. The species is also consulted to predict the height of an upcoming flood, as the birds start to build their nests in higher branches of the trees (2016: 3).

Research in Vanuatu found that indigenous knowledge appears to have played a significant role in the successful response by the people of Baie Martelli Village to the 1999 tsunami. Walshe and Nunn (2012: 192) report that this was the case largely through *kastom*, which is defined as 'cultural products derived from precolonial knowledge and practice' (2012: 188). In order to arrive at effective responses to disasters such as tsunamis, emphasis is placed on the importance of maintaining sources of indigenous knowledge in communities but at the same time, given its limitations, integrating it with nonindigenous scientific knowledge in ways that make it palatable to communities (2012: 192).

Policies Related to DRR in the Philippines

Due to the magnitude of catastrophe brought by Tropical Storm Ondoy (international name: Ketsana) in 2010, President Gloria Macapagal Arroyo implemented two Republic Acts that made a great change in the Disaster Management System of the Philippines. These two Republic Acts are: RA 9729 or the Climate Change Act of the Philippines; and RA 10121 or the Disaster Risk Reduction and Management Act of 2010 (Balgos 2016). RA 9729 was created to mainstream climate change into government policy formulations, as well as establish a framework, strategy and programme on climate change, which then led to the creation of Climate Change Commission. RA 10121 on the other hand, served as a replacement for the thirty-year-old Presidential Decree (PD) 1566 by President Ferdinand Marcos in 1978, which was created due to the series of massive flooding events in Metro Manila and nearby provinces between 1970 and 1978 (Balgos 2016).

PD 1566 represented a reactive approach, resulting in cities in the Metro Manila zone aligning their Disaster Management Plans mainly in terms of emergency and disaster response and anticipation. PD 1566 also had centralized management from the National Disaster Coordinating 7 Council (NDCC), thus being top down in nature and considering disaster as a form of physical hazard. RA 10121, therefore, addressed the deficiencies of PD 1566. NDCC became the Metro Manila Disaster Risk Reduction and Management Council. RA 10121 focuses on a bottom-up approach and considers participatory DRR. Instead of viewing disasters as physical hazards, it recognizes disasters as an aspect of the people's vulnerability, thus encouraging a more integrated approach in both sustainable development and DRR (Balgos 2016). In addition, RA 10121 ensures that both DRR and climate change measures acknowledge respect of human rights, are gender responsive and sensitive to indigenous knowledge systems.

As a fulfilment of RA 10121 of 2010, the National Disaster Risk Reduction and Management Council (NDRRMC) created the National Disaster Risk Reduction and Management Plan (NDRRMP) which provides legal basis for all plans, programmes, frameworks and policies that deal with disasters. The NDRRMP covers four thematic areas: disaster prevention and mitigation; disaster preparedness; disaster response; disaster rehabilitation and recovery. These four thematic areas are parallel to the National Disaster Risk Reduction and Management Framework in aiming at a vision of the country in having a 'safer,

adaptive and disaster resilient Filipino communities toward sustainable development'. Moreover, the NDRRMP taps into non-monetary resources available in achieving DRR. One of these non-monetary resources is the indigenous practices of DRRM (NDRRMC 2011).

Indigenous Knowledge in the Philippines

In the Philippines, local and indigenous people can be mostly found in coastal and small-island communities. Being highly vulnerable to disasters, indigenous knowledge that the local communities possess can aid them in being more resilient in the face of disasters. This local and indigenous knowledge is termed as an *endogenous system*, which refers to interchangeable mechanisms that are rooted internally, which include resources, capacities, values and practices that have been absorbed by the locals in their daily activities. This system is manifested collectively and seen as the community's resilience, which aids them in overcoming hazardous natural events (Hiwasaki et al. 2014a).

A study by Dalisay showed related cases of indigenous knowledge in Albay, where animal behaviour was observed – specifically, terrestrial animals such as rats, snakes and even crabs coming out of the ground and scampering to other areas before a typhoon arrived. Celestial bodies are also observed in the area, such as the position and colour of the moon and stars (fishermen from Albay even utilize such knowledge to their advantage for their fishing). Before a volcanic eruption, wild pigs and even chickens can be observed running away from Mayon volcano, an early warning sign for those living at the volcano's base (Dalisay 2017). Such early warning signs are also indicated in the 2008 study by UNISDR in Tiwi, Albay, where first-hand accounts of the experiences of farmers were recorded (UNISDR 2008).

The indigenous knowledge or endogenous system of *bayanihan* (camaraderie and support among community members) of the Filipinos sprang from indigenous principles. However, the practice of *bayanihan* is declining due to the following reasons: 1) There are other cultural practices being promoted due to migration and inter-marriage, and thus *bayanihan* is becoming replaced; 2) Filipinos are becoming independent from their neighbours; 3) *bayanihan* is now being replaced by modern values, causing the practice gradually to become outdated (Mangada and Su 2016).

An example of an ethnic group that practises *bayanihan* is the Agta people from Casiguran, Philippines. This component of their indigenous knowledge displays their social resourcefulness, as they are able to react

to vulnerabilities and risks that are known to threaten their survival (Molina and Neef 2016). The Agta commonly applied their indigenous knowledge in hazard prediction and early warning. Among the early warning indicators that the Agta identified were related to animal behaviour and changes in the atmosphere and the natural environment, which enabled them to prepare for heavy rains and approaching typhoons. With the help of their local resources, the indigenous knowledge of the Agta also involved the building of emergency shelters, constructing multipurpose structures and stockpiling foodstuffs and equipment (Molina and Neef 2016). By depending on their local practices, resources in their environment and their networks for preparedness, response and recovery when it comes to disasters, the Agta were one of the ethnic groups in the Philippines best able to endure powerful typhoons (Molina and Neef 2016).

Indigenous knowledge is often remarkably accurate in terms of disaster preparedness. Fisherfolks in Rizal use indigenous knowledge to ascertain if there is an approaching storm: the absence of fishes in shallow waters is an indicator of an incoming downpour of rain. In Romblon, Mangyans use the trees and the movement of birds as a sign of odd occurrences in the weather. When the leaves of the *ayutay* turn white and its branches are splintering, this is an indication of bad weather in the coming days. Having indigenous knowledge as another means of community preparedness is very useful in assisting DRR in mitigating disaster risks and it teaches people that traditional ways are also essential when it comes to DRR (Gonzalez 2015).

However, acknowledging that there is evidence that indigenous knowledge is accurate in disaster preparedness does not imply that there is a need to disregard science and modern DRR (Gonzalez 2015). There is also a need for further research to be able to understand the limitations and potentials of indigenous knowledge, as with the *bayanihan* system of the Filipinos, apropos their contribution and significance in DRR (Manganda and Su 2016).

Moreover, of course not all indigenous knowledge has a scientific basis or is acceptable or adequate in every situation (Hiwasaki et al. 2014b: 23). In the Typhoon Haiyan disaster of 2013, among the most vulnerable people during and after the calamity were indigenous communities. For instance, despite their indigenous knowledge the Tagbanua people were not prepared to cope with the typhoon's onslaught. Due to the geographical factors, the location of some of their communities and circumstances where income, transport and communication

were either scarce or cut off, and access to even basic needs was very limited, it was difficult for the people to deal with the calamity and its aftermath (Tebtebba 2013).

To potentially address such shortcomings, Hiwasaki et al. prescribe a community-led 'process for integrating local and indigenous knowledge related to hydro-meteorological hazards and climate change with science' based on research conducted among coastal and small-island communities in Indonesia, the Philippines and Timor-Leste (2014b: 15). Such a process would entail: identification, documentation and validation of local and indigenous knowledge; integration of such knowledge with science; and corresponding phases of 'preparation, data gathering, analysis and validation, science integration, and popularization and utilization of local and indigenous knowledge' (2014b: 19–23).

Four Thematic Areas of the NDRRMP

Disaster Prevention and Mitigation

Prevention and mitigation activities aim to eliminate or at least minimize the possibility of a calamity from occurring, as well as lessening the possible negative effects of unavoidable disasters; this includes enhancing the capacities of communities. The overall responsible agency in this area is the Department of Science and Technology (DOST). It oversees measures related to building codes, zoning, land-use plans, regulation and safety codes for buildings, preventive healthcare (Warfield 2016), evaluation of hazards, vulnerability analyses updates, identification of areas prone to hazards and mainstreaming DRRM into development plans (NDRRMC 2011).

Disaster Preparedness

Achieving an adequate level of readiness is the primary goal of disaster preparedness; this is necessary in order to respond to any disaster. It is practised by enhancing the capacities of government and nongovernment organizations, as well as communities, in light of possible negative impacts of disasters. This thematic area is headed by the Department of the Interior and Local Government, which is responsible for matters regarding emergency exercises or trainings, early warning systems, emergency communications systems, evacuation plans, public education (Warfield 2016), local drills, development of a national disaster response plan and capacity exercises, among others (NDRRMC 2011).

On a local level, household measures include the building of disaster-proof houses and preparing emergency kits that contain rice or other foods, gas or any type of fuel, candles, bandages and other first-aid items which might be needed. At the institutional level, disaster preparedness includes reducing the risks and vulnerabilities of the area through the policies and programmes of governmental and nongovernmental institutions. An example of this is the organization of a Barangay Disaster Risk Reduction Management Council (BDRRMC), an entity under the level of the smallest unit of government in the Philippines (Barangay). The BDRRMC is equipped with skills in first aid trainings, rescue operations, weather monitoring, damage reporting and communications. This entity is also responsible for forming calamity guidelines, management of early warning systems, capacity and awareness trainings, purchasing equipment such as stretchers, shovels, communication radios and power generators, among other things (Leeftink 2014).

Disaster Response

The main objective in disaster response is to provide immediate assistance in the aftermath of a calamity – meeting the most urgent necessities of the affected population until more permanent and sustainable solutions are available. The overall responsible agency for this thematic area is the Department of Social Welfare and Development. Rescue and retrieval operations, clearing of roads, relief goods and aid distribution (Leeftink 2014), needs assessment and early recovery activities are examples of activities that must take place during this phase (NDRRMC 2011).

Disaster response also includes the measures people carry out in coping with the aftermath of a disaster, such as the places they go to for refuge and how they organize themselves. In addition, immediate assistance can be delivered in many forms, such as emergency response in life or death situations, improving health conditions and increasing the affected population's morale. Usually, the most common type of assistance is pioneered by humanitarian actions such as emergency aid. Aid comes in various forms such as food, medical assistance, temporary shelter, initial repairs to damaged infrastructure as well as provision of communications in order for the affected population to contact their close relatives. This kind of assistance is usually brought by humanitarian agencies, who are often called upon and voluntarily operate in order to provide immediate assistance. These agencies possess experienced leaders, trained personnel and guidelines to follow while working in emergency situations (Warfield 2016).

Disaster Rehabilitation and Recovery

When an emergency situation stabilizes, this entails a shift from response to rehabilitation and recovery. This fourth thematic area is now more focused on the rebuilding of damaged infrastructure, public information lifeline facilities such as access to water supply, electricity and communication systems as well as livelihood recovery and caring for the mental well-being of the affected population (Leeftink 2014). The overall responsible agency for this thematic area is the National Economic and Development Authority, which covers concerns that are related to employment and livelihood once outside the evacuation centres (NDRRMC 2011).

Narrative Discussion of the Framework

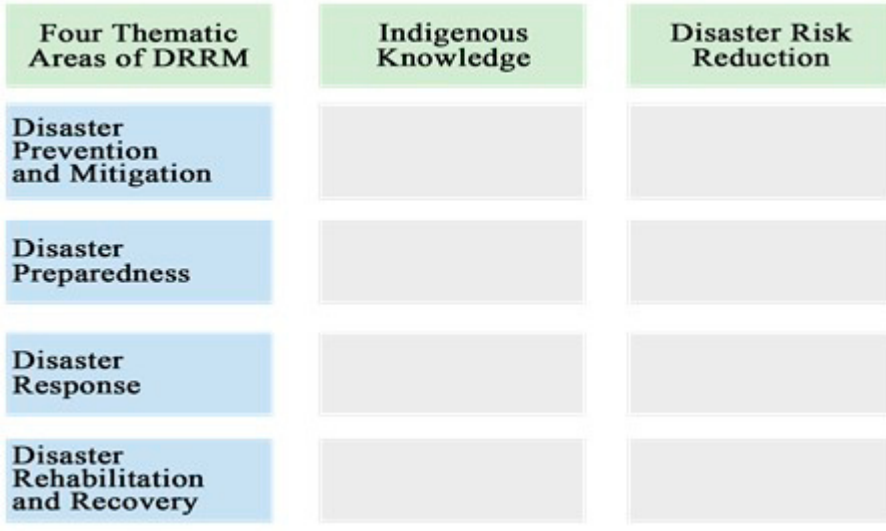
This research utilized the thematic areas of the Philippine Disaster Risk Reduction Management system, adapted as variable categories for the identification of indigenous knowledge or practices in DRR. Identifying the prevalence of indigenous knowledge in these four thematic areas of disaster management is essential to determine the contribution of indigenous knowledge in overall DRR management in their respective locations.

Figure 1 depicts the framework that the study used in assessing similar factors in the four thematic areas of DRRM in the related literature in terms of the methods discussed apropos their indigenous knowledge counterpart. The identified factors in disaster prevention and mitigation, preparedness, response, and rehabilitation and recovery signify the contribution to DRR in the three cases.

Data and Methods

This study utilized a qualitative design in obtaining relevant data in order to answer the research question: How can indigenous knowledge contribute to DRR in times of disaster in the Philippines? The data for this research comprised accounts of events where indigenous knowledge/practices are involved, specifically data regarding indigenous coping mechanisms in the four thematic areas of disaster. Records of disastrous events were also needed in identifying the indigenous methods used in each case. Data pertaining to the locations' DRRM also helped identify the factors that aid in DRR. The different factors that contributed to DRR in the three areas were also gathered.

FIGURE 1. Conceptual framework for the study



Source: Adapted from the four thematic areas of the NDRRMP (NDRRMC 2011)

Data Collection Procedure

The researchers first identified locations that held similar contexts and cases. Afterwards, researchers contacted local (barangay) officials, DRRM heads and residents for interview. Semi-structured interviews were then conducted. To garner more residents as key informant interviews, snowball sampling was utilized since not all residents are familiar with indigenous knowledge. Snowball sampling is a research technique wherein the research participants suggests and recommend other suitable and potential research participants in the location (Oregon State University 2010).

Due to the use of semi-structured interviews, the study utilized a question guide in the interviews with the head of the DRRM offices in each area. This was also the case for interviews with residents. The research investigative questions enable participants to convey their ideas, insights and opinions, which are essential in gathering data.

Analytical Techniques Procedure

The gathered data are classified into two categories: according to their location and according to their roles in the community. The method of illustrative case studies was then employed in analysing and interpreting the data. This method uses cases which display one or more instances of an event to rundown a situation (Mann 2006). Table 1 presents the

full methodology matrix, describing how each investigative question for the paper has been pursued utilizing the corresponding types of data, data sources, data gathering techniques and details of included items in the questionnaires. Responses are then analysed within corresponding thematic areas of the Philippine Disaster Risk Reduction Management system as well as respective categories of indigenous knowledge or practices in DRR.

TABLE 1. Methodology matrix

Investigative Question	**Data**	**Data Source**	**Data Gathering Technique**	**Details of Questionnaire** (Questions were also translated during data collection into Filipino and local languages/dialects)
What are the different forms of indigenous knowledge applied to disaster risk reduction?	Methods practised by the population that address disaster risk reduction in their area.	Local government unit (LGU) Offices	Interview	• What are the different kinds of indigenous knowledge utilized in your community? • What indigenous knowledge has been passed on to you by your family, relatives and community? • In your community, how does indigenous knowledge contribute to disaster risk reduction? • Is indigenous knowledge important for disaster risk reduction in your community? For society? If yes, how so?
		Residents	Interview	• What are the different kinds of indigenous knowledge utilized in your community? • What indigenous knowledge has been passed on to you by your family, relatives and community? • In your community, how does indigenous knowledge contribute to disaster risk reduction? • Is indigenous knowledge important for disaster risk reduction in your community? For society? If yes, how so?

How can Indigenous knowledge enhance disaster risk reduction in the Philippines?	Possible effects of indigenous knowledge in the disaster risk reduction management systems.	LGU Offices	Interview	• In your opinion, how can indigenous knowledge enhance the current disaster risk reduction system? • What are the shortcomings or gaps of the current disaster risk reduction management system and of indigenous knowledge?
		Residents	Interview	• In your opinion, how can indigenous knowledge enhance the current disaster risk reduction system? • What are the shortcomings or gaps of the current disaster risk reduction management system and of indigenous knowledge?
What are the outcomes of using indigenous knowledge in disaster risk reduction?	Result of indigenous knowledge in disaster risk reduction.	LGU Offices	Interview	• What are the possible outcomes brought by the incorporation of indigenous knowledge in the disaster risk reduction management system? • In your opinion, what are the effects of indigenous knowledge to the disaster risk reduction management system?
		Residents	Interview	• What are the possible outcomes brought by the incorporation of indigenous knowledge in the disaster risk reduction management system? • In your opinion, what are the effects of indigenous knowledge to the disaster risk reduction management system?

Source: Compiled by the authors, adapted from Mann (2006).

Results

This section describes identified indigenous knowledge that plays a major role in the disaster management system of the three cases and applies the analytical framework for categorization. It was found that indigenous knowledge can become complementary and positively affect disaster management plans, thus highlighting the need for incorporating indigenous knowledge in designing future disaster plans for the Philippines.

Table 2 shows the frequency distribution of insights categorized under indigenous knowledge, which were all gathered from the three islands. The total number of indigenous knowledge insights gathered is 37. The thematic area with the highest frequency is Disaster Preparedness, with a total of 35 out of 37, comprising 95 per cent of the total data insights gathered; this is followed by Disaster Response, with a total of 2 out of 37, comprising 5 per cent of the data insights; and then comes Disaster Prevention and Mitigation and Disaster Rehabilitation and Recovery, both with a total of 0 out 37 data insights, and both comprising 0 per cent of the data. The cumulative frequencies verify that all computations made are correct and that all the data have been included.

TABLE 2. Frequency distribution of indigenous knowledge data based on the local DRRM office heads and residents of the islands

Indigenous Knowledge	**Frequency**	**Percent Frequency**	**<CF**	**>CF**
Disaster Prevention and Mitigation	0	0%	0	37
Disaster Preparedness	35	95%	35	37
Disaster Response	2	5%	37	2
Disaster Rehabilitation and Recovery	0	0%	37	0
Total	37	100%		

Source: Compiled by the authors.

Table 3 shows the frequency distribution of the insights categorized under DRR, which were all gathered from the three islands. This table shows that the total number of DRR insights gathered is 55. The thematic area with the highest frequency is Disaster Preparedness, with a total of 25 out of 55, comprising 49 per cent of the total insights gathered from the interview data; this is followed by Disaster Prevention and Mitigation, with a total of 12 out of 55, comprising 22 per cent of the interview data; and then by Disaster Response and Disaster Rehabilitation and Recovery, both with a total of 8 out of 55, and both comprising 15 per cent of the interview data. The cumulative frequencies verify that all computations made are correct and that all the data have been included.

TABLE 3. Frequency distribution table of DRR data based on the local DRRM office heads and residents of the islands

DRR	Frequency	Per cent Frequency	<CF	>CF
Disaster Prevention and Mitigation	12	22%	8	51
Disaster Preparedness	27	49%	35	39
Disaster Response	8	15%	43	12
Disaster Rehabilitation and Recovery	8	15%	51	4
Total	55	100%		

Source: Compiled by the authors.

Table 4 shows that in all the localities, indigenous knowledge can be found in the thematic area of Disaster Preparedness. There was no indigenous knowledge observed in the rest of the thematic areas for San Miguel Island and Alabat Island, while there is the presence of indigenous knowledge under the category of Disaster Response for Camotes Island.

TABLE 4. Tabulation of indigenous knowledge and DRR data according to the local DRRM office heads of each location

Four Thematic Areas of DRRM	Indigenous Knowledge	Disaster Risk Reduction
Case of Barangay Rawis, Tabaco City, Albay		
Disaster Prevention and Mitigation	N/A	• Barangay LGU is alerted of emergencies and is briefed regarding incoming typhoons
Disaster Preparedness	• Sudden direction changes of sea waves to clockwise • High waves and strong winds as compared to normal days, 3 days before a typhoon • Sudden surfacing of deep-sea creatures in abundance (e.g. sea snake, tongue-fish, rabbit-fish) 2–4 days before the typhoon • Abundance of sea urchins and starfish by the shoreline 2–4 days before the typhoon • Animal unease, domesticated ducks fly to other areas • Rainbows only appear to form halfway 2–4 days before a typhoon • Clouds appear shaped similar to ground scratches by a rooster 2–4 days before • The summit of Mayon Volcano is fully covered with clouds 3–4 days before a typhoon	• Information dissemination • Early warning systems • Trainings • Identified evacuation areas (schools and concrete houses)
Disaster Response	N/A	• Benefits allotted to residents who evacuate (e.g. 2 kilograms of rice)
Disaster Rehabilitation and Recovery	N/A	• Search and rescue • Physical aid in rebuilding of damaged/destroyed houses
Case of Barangay Tulang Diyot, San Francisco, Camotes Island		
Disaster Prevention and Mitigation	N/A	• Hyogo and Sendai Framework are posted on big signage in *purok* halls and translated in Cebuano • The municipal LGU is alerted of emergencies and briefed regarding incoming typhoons and will relay information to the Barangay LGUs and the Barangay LGUs will relay to the community

Disaster Preparedness	• Utilization of *batingaws* (warning bells), locally called *karatung* • Fishermen look at the leaves of star apple trees (*caimito*); if seen inverted from the trees there will be a natural hazard approaching (e.g. typhoons) • If frogs are submerged in the waters, the weather for the next few days will be fine. If the frogs emerge from the waters, it is a sign that there will be a typhoon or storm incoming • *Timos* (crickets) appear in numbers in houses and if the Timos are seen flying outside, there is a natural hazard on the way • If the seaweed is seen in an upright position, there will be either an approaching drought or typhoon; if the seaweed lies flat, there will be good weather	• Information dissemination through the *purok* system • Early warning systems • Monthly trainings and capacity buildings • Monthly drills (earthquake, fire, tsunami response) • Identified evacuation areas (schools and concrete houses; Consideration of options such as the *Adopt a family* system to decongest evacuation centres • Mandated for each household to have a 72-hour kit (composed of important documents, handy radio, flashlights, batteries, clothes, canned goods, potable water etc.)
Disaster Response	*Bayanihan* system	• Search and rescue operations
Disaster Rehabilitation and Recovery	N/A	• Reconstruction of damaged facilities and houses
Case of Alabat Municipality, Quezon		
Disaster Prevention and Mitigation	N/A	• Identification of areas prone to hazards • Zoning • Land-use plans • Evaluation of hazards • Mainstreaming DRRM into development plans
Disaster Preparedness	• Position of the stars and the moon (for navigation) • Unusual appearances of oar-fish (for earthquakes) surfacing in great numbers	• Early warning systems • Emergency communications systems • Evacuations plans • Development of a national disaster response plan • Capacity exercises
Disaster Response	N/A	• Rescue and retrieval operations • Relief goods and aid distribution
Disaster Rehabilitation and Recovery	N/A	• Lifeline facilities

Source: Compiled by the authors.

Table 5 shows that in all localities, indigenous knowledge can be found in the thematic area of Disaster Preparedness. Furthermore, there was no indigenous knowledge observed in the rest of the thematic areas for Albay and Quezon, while there is the presence of indigenous knowledge under the category of Disaster Response for Camotes Island.

TABLE 5. Tabulation of indigenous knowledge and DRR data according to the residents of each location

Four Thematic Areas of DRRM	Indigenous Knowledge	DRR
Case of Barangay Rawis, San Miguel, Albay		
Disaster Prevention and Mitigation	N/A	• Barangay LGU is alerted of emergencies and is briefed regarding incoming typhoons
Disaster Preparedness	• Sudden direction changes of sea waves to clockwise • High waves and strong winds as compared to normal days, 3 days before a typhoon • Sudden surfacing of deep-sea creatures in abundance (e.g. sea snake, tongue-fish, rabbit-fish) 2–4 days before a typhoon • Abundance of sea urchins and starfish by the shoreline 2–4 days before the typhoon • Animal unease, domesticated ducks fly to other areas • Rainbows only appear to form halfway 2–4 days before a typhoon • Clouds appear shaped similar to ground scratches by a rooster 2–4 days before • The summit of Mayon Volcano is fully covered with clouds 3–4 days before a typhoon	• Information dissemination • Early warning systems • Trainings • Identified evacuation areas (schools and concrete houses)
Disaster Response	N/A	• Benefits to residents who evacuate (e.g. 2 kilograms of rice)

Disaster Rehabilitation and Recovery	N/A	• Search and rescue • Physical aid in rebuilding of damaged/destroyed houses
Case of Barangay Tulang Diyot, San Francisco, Camotes Island		
Disaster Prevention and Mitigation	N/A	• Hyogo and Sendai Framework are posted on big signage in *purok* halls and translated in Cebuano • The municipal LGU is alerted of emergencies and is briefed regarding incoming typhoons and will rely the Barangay LGUs and the Barangay LGUs will rely to the *purok* leaders
Disaster Preparedness	• Utilization of *batingaws*, aka *karatung* • If the leaves of the trees are still, there is a bad weather approaching	• Information dissemination through the *purok* system • Early warning systems • Monthly trainings and capacity building • Monthly drills (earthquake, fire, tsunami response) • Identified evacuation areas (schools and concrete houses; *Adopt a family*) • Mandated each household to have a 72-hour kit (composed of important documents, handy radio, flashlights, batteries, clothes, canned goods, potable water etc.)

Disaster Response	• *Bayanihan* system	• Search and rescue operations
Disaster Rehabilitation and Recovery	N/A	• Reconstruction of damaged facilities and houses
Case of Barangay Villanorte, Alabat, Quezon		
Disaster Prevention and Mitigation	N/A	• Identification of areas prone to hazards
Disaster Preparedness	• Strong ocean waves coming from Polillo island • Darkening of the sky and appearance of *abu-abu* (cloudlike fog) on the horizon indicate the arrival of a typhoon in the area • 2–3 days of rain • Unusual appearance of *walowalo* (sea snake) in the surface of the ocean • Unusual appearance of *mabait na pating* (tame shark) on the surface of the ocean • Unusual appearance of *talangka* (crab) on the surface of the ocean • Strong winds	• Early warning systems • Emergency communications systems (radio) • Evacuation plans
Disaster Response	N/A	• Rescue and retrieval operations • Relief goods and aid distribution
Disaster Rehabilitation and Recovery	N/A	• Lifeline facilities

Source: Compiled by the authors

Collected indigenous knowledge and DRR data in regard to interviews conducted in the case studies sites of the three islands are shown in Table 6.

TABLE 6. Indigenous knowledge and DRR data according to respondents from each location

	Indigenous Knowledge	Disaster Risk Reduction	*Total*
San Miguel	2	1	3
Camotes	2	1	3
Alabat	1	4	5
Total	5	6	11

Source: Compiled by the authors.

Analysis

Indigenous knowledge in all the communities studied has been found to coexist with the local DRRM system. In relation to the scope of the DRRM in the four thematic areas, most indigenous knowledge fell under Disaster Preparedness. There was only one indigenous practice that was identified in Disaster Response, which is the *bayanihan* in the case of Camotes, while there are none for Prevention and Mitigation and Rehabilitation and Recovery.

Most indigenous knowledge in the second thematic area of Disaster Preparedness involves observance of the upper atmosphere as well as bodies of water. Animal behaviour was also observed, such as the sudden surfacing of considerable numbers of deep-sea creatures, the unease of domestic ducks and other animals, sudden appearances of frogs and the sheer abundance of starfish and sea urchins along the shorelines. Signs read in bodies of water involve the sudden change of direction of waves in clockwise direction, abrupt strong winds and high waves. Observances on the upper atmosphere involve split rainbows and unusual cloud formations. All these events are seen to happen two to four days before a typhoon is experienced. Thus, these results are comparable to findings of other studies in that indigenous/traditional knowledge, methods and practices that relate to animal behaviour have been utilized by communities as a means of disaster preparedness (Hasan 2015; Dalisay 2017).

The indigenous knowledge present in the communities was identified to have been passed on from generation to generation through word of mouth as well as common practice, especially among the fisherfolk. This indigenous knowledge that the communities possess has been demonstrated to be a remarkably effective form of disaster prepared-

ness in many instances, as part of the DRRM system of their respective communities. However, in the case of Camotes Island, the indigenous knowledge in the communities was overlooked by local DRRM, though these were integrated in their *purok* system, the island's existing indigenous social organization.

There are, however, inaccuracies in the DRRM system according to some interviewees. They stated that there are instances where reports on the news and those of government agencies do not match up, and that the path predictions of typhoons are inaccurate. These inaccuracies resulted in some residents becoming sceptical of the system, which mostly results in them disobeying the orders from local government pertaining to evacuation. The members of the fishing community, specifically, experience an economic disadvantage when an announcement of a typhoon hitting their area turns out to be inaccurate. Despite the adequate amount of fish in the waters, they end up with no catch due to the warnings that hinder going to sea. Those travelling on sea craft are also affected by these warnings, since boats are not able to leave port due to typhoon warnings.

On the other hand, indigenous knowledge is strongly considered to be able to provide reliable indicators of typhoons. With the Philippines' typhoon season ranging from July to December, such observations occur most frequently over these months. However, climate change has affected these annual meteorological patterns, with strong typhoons making landfall even in the month of March, just before summer. Despite these changes, indigenous knowledge is still relevant, as the occurrence of observable patterns proved to be an invaluable and effective method for disaster preparedness, especially for the fisherfolk.

In the case of Barangay Villanorte in Alabat Island, those who do not believe the local government's announcements and warnings feel more convinced when the elderly in the locale have stated the imminent arrival of a typhoon upon noticing the emerging signs and indicators in the surroundings. Those who were resistant to evacuating at first are then encouraged to comply because of their belief in indigenous knowledge. However, scientific knowledge in certain instances can be contradictory to local understanding of disasters, which results in the rejection of science by the communities. As noted above with the poignant example of the volcanic eruption of Mount Merapi in Indonesia, fatalities have occurred as an outcome of such ignoring of warnings from scientists and by depending only on spirits and cultural stories (Mercer et al. 2010).

In the case of Barangay Tulang Diyot on Camotes Island, indigenous knowledge is carried through the establishment of the *purok* system. At Barangay Rawis in San Miguel Island, both indigenous knowledge and the local DRRM is relied upon. The fishermen depend on the LGU's warnings as well as their own observations. Even if the LGU announces an incoming typhoon that will hit a specific location, if the fishermen do not see any signs of an incoming typhoon they choose not to follow the LGU. On the other hand, when the fishermen have observed a sudden change in their environment, they send a warning to their fellow fishermen and families to not go to sea despite an absence of warnings from the LGU.

As such, indigenous knowledge does not suffice as a sole method for total DRR. Rather, it can complement but also in certain instances hinder the local DRRM system, depending on the community's local cultural context and perceived DRRM system performance.

Moreover, considering the findings obtained by Hilhorst et al. (2015) in their research on indigenous communities in Thailand and the Philippines, it is purported that indigenous knowledge in both countries among communities is neither completely local, nor homogenous, nor shared. As a result, this paper shares the sentiment of caution being recommended against an interpretation that indigenous knowledge is always grounded in a long tradition of coping with disasters. Coping should be viewed as embedded in social practice and as responsive to change. At the same time, positive labelling of indigenous practices and a more comprehensive approach to indigenous knowledge and practices can help communities to be more resilient.

Conclusion

In times of calamity in the Philippines, indigenous knowledge contributes to DRR in terms of disaster preparedness. This particular thematic area is positively affected by the indigenous knowledge that a certain location possesses, as this knowledge enables people to become aware of when a typhoon may occur in that specific site. This would in turn help give people ample time to prepare to avoid an impending disaster. Similar to previous research by other scholars vis-à-vis engaging local knowledge (Hilhorst et al. 2015; Molina and Neef 2016; Dalisay 2017) in defence against natural calamities, this paper stresses the 'significance of indigenous knowledge and its value for peripheral communities in disaster risk management, which is also increasingly acknowledged as

central to development agendas in developing countries' (Mercer et al. 2010; Walshe and Nunn 2012: 192).

In the cases of San Miguel Island, Camotes Island and Alabat Island, there are different forms of indigenous knowledge applied to DRR. The positive effect of indigenous knowledge is that it enables people to anticipate the occurrence and course of typhoons. It is also argued that even though the Philippines possesses necessary policies to reduce detrimental effects of natural hazards, there have still been several cases in the country that have led to severe damage and significant loss of life – and it is in this aspect that indigenous knowledge may contribute to securing zero casualties for the three cases outlined above, despite severe typhoon conditions. However, it must also be noted that in certain cases indigenous knowledge can cause worry and anxiety for people, or may override LGU instructions and DRM systems when people are sceptical of meteorological forecasts and more inclined to heed observations based on traditional knowledge and practice. This may be further exacerbated as climate change affects annual meteorological patterns and seasonal indicators for some communities.

Overall, indigenous knowledge can enhance DRR in the Philippines by contributing to disaster preparedness, as it allows greater awareness and a sense of caution regarding the occurrence of disasters, therefore helping people in preparing for the arrival of calamities. As such, although indigenous knowledge is not touted as a standalone prediction mechanism, it does contribute to an attitude of precaution and preparedness for minimizing the risk and effects of adverse natural phenomena.

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