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Communicating Risks, Risking (Mis)communication: Mass Media and the Science of Disasters

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ABSTRACT. The experience brought about by super typhoon Yolanda (internationally known as Haiyan) in November 2013 highlights the need to look into how we can improve ways of communicating risks and the science about natural hazards in national and local settings. This paper attempts to highlight the value of risk and science communication in national and local disaster mitigation and management. After analyzing the preparations done before super typhoon Yolanda's landfall using extant documents from the national government and different government agencies, weather forecast news published in newspapers and broadcasted on TV, and other several post-Haiyan scholarly literatures, we examine emergent communication-related issues to come up with recommendations toward mainstreaming risk and science communication in the country. This study found out that the government as well as the experts engaged in concerted efforts to prepare the citizens for the typhoon; and that the media did attempt to communicate risks and science before the typhoon's landfall. However, problems involving (1) psychological and social factors; (2) information dissemination through mass media; and (3) institutional mechanisms in disaster risk reduction provided by the government emerged, which have serious implications on how we shall mitigate disasters in the future.

KEYWORDS. science communication · risk communication · science and the media · Haiyan · public understanding of science

Introduction

One of the most daunting tasks of a communicator involved in disaster preparedness and management is to communicate hazards and its potential risks—including the science behind these—to vulnerable communities. Communicating risks is never a simple process. Several constraints always come into play when communicators inform the public about the chance of the hazard bringing serious harm to the community. Communicating science on the other hand—which is

needed in order to effectively communicate risks—has its own sets of constraints that affect how the public understands scientific concepts. Although scientific understanding is just one of the many variables that influence behavioral outcomes (Heath & O'Hair 2009), it is nevertheless deemed crucial in understanding risk-related behaviors among communities.

The Philippines is considered as one of the most disaster-prone countries in the world (Bankoff 1999). The United Nations Office for Disaster Risk Reduction analyzed 20-year data about hazard occurrences worldwide, and concluded that the Philippines ranked 4th in the list of countries most hit by natural hazards, next only to the US, China, and India (UNISDR 2015). In 2015, two years after super typhoon Yolanda (international name: Haiyan) hit the country, the United Nations Office for Disaster Risk Reduction reported that the Philippines still ranked 4th in the list of the most hazard-hit countries in the world (UNISDR 2016). In 2014, natural hazards, most of which were tropical cyclones, affected more than thirteen million people and cost more than PHP 54 billion of damaged properties (CDRC 2015). As the country constantly faces natural hazards due to its geographical location, we need to step up effective science and disaster risk communication.

The experience brought about by super typhoon Yolanda in November 2013 highlights the need to look into how we communicate risks and the science about natural hazards in local settings. Here, we shall attempt to underscore the value of risk and science communication in national and local disaster mitigation and management, and the need to "mainstream" science and risk communication efforts. Using post-disaster analyses reports of super typhoon Yolanda, we examine emergent communication-related issues to come up with recommendations on how risk and science communication can be mainstreamed into policy, education, and institution building.

Science Communication: Issues and Challenges in Communicating Science and Risks

"Science communication" is defined as any communication act that produces any of the following responses to science—awareness, enjoyment, interest, opinion-formation, and understanding (Burns, O'Connor, and Stocklmayer 2003). Although science communication also includes communication among scientists within and outside

their fields (Bucchi 1996), this paper focuses more on communicating science to the non-expert public.

Brossard and Lewenstein (2010) identified two general categories of how public understanding of science initiatives is done: one, privileges information delivery; the other, privileges public participation. The former seeks to find out ways on how scientific concepts can be translated into common terms for the non-expert public to promote understanding. The latter seeks to find ways on how all stakeholders—experts, non-experts, and everybody in between—participate, engage, negotiate, and work together to address issues and the associated science that concern them.

Many scholarly articles point out challenges in public understanding of science. The most common are the tensions between objective science and humanist media, including scientists-journalists interaction (e.g., Dudo 2015; Haynes 2003, 2016; Peters 1995, 2013; Maillé, Saint-Charles, and Lucotte 2010; Väliverronen 1993); scientists' engagements with non-expert public, including their (perceived) abilities to communicate effectively as well as the issues about gaps between scientists and the public (e.g., Poliakoff and Webb 2007; Dudo 2012; Bensaude-Vincent 2001; Besley and Nisbet 2011; Besley and Tanner 2011; Ruth et al. 2005); improving science literacy, attitudes, and public understanding of, and engagement in, science (e.g., Kawamoto, Nakayama, and Saijo 2013; Allum et al. 2013); and constraints in communicating science in developing countries (e.g., Hin and Subramaniam 2014). Local think pieces have also expressed concerns about communicating science in mainstream media (e.g., Lacanilao 2008).

Risk communication aims to build and maintain trust among the key players that can potentially be affected by a hazard, either natural or man-made, in order to cope with its possible effects. Three basic specific objectives of risk communication have been identified depending on the need or context: (1) "raise awareness . . . [to allow people vulnerable to hazards to] better respond to a risk"; (2) "disseminate information on actions to take before, during, or after a disaster or emergency"; and (3) "build consensus or engage people in a dialogue about appropriate behaviors and levels of concern" (Covello 2009, 143).

The advancement in our understanding about the nature of the audiences (passive or active), and the "sources" (experts or co-participants) gave rise to notable modifications on how risk (and science) can be

better communicated to concerned public (for discussions, see Lundgren and McMakin 2009). However, two decades worth of risk communication research has shown that despite the availability of different approaches in communicating risks, there are still a lot of constraints to effective risk communication that need to be recognized and addressed.

Covello (2009) identified similar challenges and grouped these into two: (1) challenges related to psychological, sociological, and cultural factors; and (2) problems with how the media report about risk. The first refers to misperceptions and misunderstandings about risks that may come from psychological (individual), sociological (collective), and cultural factors that can influence behavior of vulnerable communities about the hazard. The second pertains to misperceptions and misunderstandings about risks that may come from media, particularly the journalists who report information about risks.

Both science and risk communication are important in any disaster risk reduction and management (DRRM) initiative. Science communication methods can inform the public about the technical aspects of the hazards, while risk communication can address vulnerable communities in understanding and taking appropriate actions. One may seem to function independently from the other, but they are closely intertwined, especially with regards to science literacy (Ryan 2009).

As presented here, the problems encountered during super typhoon Yolanda will show that (1) the country needs to improve its efforts in communicating science through enhanced collaboration between experts and the media; and (2) risk communication strategies should be incorporated in any DRRM initiatives that involve collaboration among experts, the media, and the government.

AN OVERVIEW OF SUPER TYPHOON YOLANDA

Chronology and Tracking of the Typhoon

Super typhoon Yolanda is the twenty-fourth typhoon to enter the Philippine Area of Responsibility (PAR) in 2013. It started as a low-pressure area that developed in western Pacific, first noted by the Joint Typhoon Warning Center on 2 November (Soria et al. 2016). It became a tropical depression on 3 November, upgraded as a tropical storm on 4 November, and a typhoon by 5 November (Santos 2013).

Yolanda entered PAR at midnight of 6 November, already with a maximum sustained winds of 195 kph and gustiness of up to 230 kph (NDRRMC 2013). A day after, on 7 November, it intensified to 215 kph near the center, and continued to pack more strength that same day, reaching 275 kph before the day ended. This prompted the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA) to raise public storm warning signal no. 4 over Samar and Leyte, and in nearby provinces.

On 8 November, at 4:40 a.m., super typhoon Yolanda made its first landfall in Guiuan, Eastern Samar; less than three hours later, it made its second landfall in Tolosa, Leyte. Yolanda made several other landfalls over the Visayan islands, and finally on Busuanga, Northern Palawan by 8:00 p.m. that same day. The typhoon exited PAR in the afternoon of 9 November.

To date, super typhoon Yolanda is regarded as the strongest typhoon to hit the Philippines. It left more than 6,000 people dead, 28,000 injured, and PHP 93 billion worth of infrastructure damage, most of these in Eastern Visayas (NDRRMC 2013).

Government Preparations Done

The National Disaster Risk Reduction and Management Council (2013) reported that at least a day before Yolanda entered PAR, the council had started its preparations with the Local Disaster Risk Reduction and Management Councils. An emergency meeting, presided by the then Executive Secretary Paquito Ochoa Jr., was held on 6 November, laying out the massive preparations of all member agencies to plan for super typhoon Yolanda's entry. The *Official Gazette* (2016) reported that during this meeting, the local government units (LGUs) to be affected by the typhoon activated their 24-hour disaster monitoring system. Possible evacuation centers had already been identified, repacking operations for relief goods had started, LGUs conducted pre-emptive evacuations, and medical supplies had been prepositioned before Yolanda's landfall.

Most LGUs in Southern Luzon, Bicol, Central and Eastern Visayas were reported to have initiated their own preparations, some of them as early as 4 November, by conducting local meetings with all stakeholders, doing massive information campaigns, packing relief goods, maintaining the "red alert" status of all public services related to disaster risk reduction, and spearheading pre-emptive evacuation activities (NDRRMC 2013).

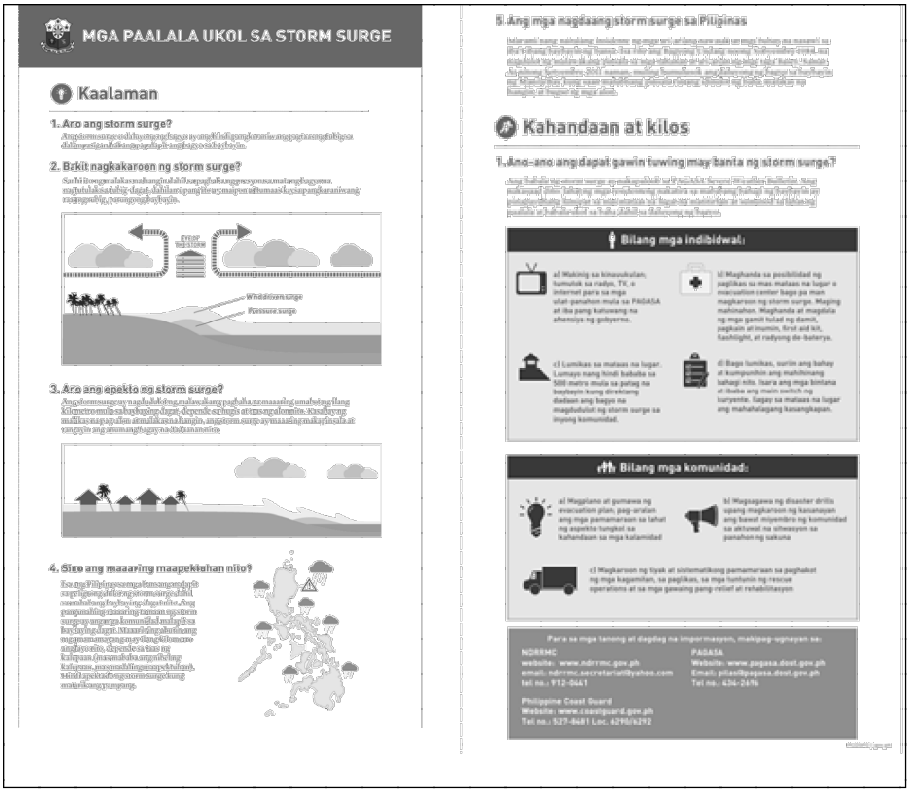

Figure 1. Infographic on storm surge published by the *Official Gazette* (n.d.).

Furthermore, the day before Yolanda's landfall, about 4,500 troops of the Armed Forces of the Philippines and 6,500 police and support units in Eastern Visayas were placed on red alert. Fire trucks, ambulances, rescue choppers, military trucks, and watercrafts had been put on standby (*Official Gazette* 2016). Then National Defense Secretary Voltaire Gazmin and then Department of Interior and Local Government Secretary Manuel "Mar" Roxas also flew to Tacloban to meet with local officials.

COMMUNICATING THE COMING NATURAL HAZARD: INFORMATION DISSEMINATION IN GOVERNMENT AND MEDIA

Actual reports from official documents—NDRRMC's Final Report on the effects of Typhoon Yolanda (Haiyan), as well as the government's *Official Gazette* website[1]—were used to identify efforts made by the government in communicating information about the typhoon.

For different media organizations' efforts, a content analysis of two broadsheets—*Philippine Daily Inquirer* (PDI) and *The Philippine Star* (*PhilStar*)—was done on their news articles about super typhoon Yolanda starting from the first time the news appeared in 4 November 2013, up to the day the typhoon made its first landfall, on 8 November. Also, nine random clips of weather forecast reports aired in different TV news programs between 4 November and 8 November —*State of the Nation* (GMA News); *TV Patrol* (ABS-CBN News); *NewsLife* and *News@1* (PTV 4)—were accessed through YouTube and were content analyzed. The aim was not to provide generalized conclusions about the general picture of how super typhoon Yolanda was reported in the media, but to search for evidence of science and risk communication efforts by media organizations while the country was preparing for the typhoon's landfall. A summary of the findings based on the timeline of events before and during the typhoon's landfall is shown in the appendix.

Government's (and Experts') Efforts to Communicate Information before the Typhoon

Several government agencies spearheaded by experts from PAGASA started to disseminate information as early as 3 November when Yolanda was not yet a typhoon. Since then, PAGASA had issued regular public warning advisories through their website and by holding regular press conferences. The *Official Gazette* (2016) reported that on

5 November, PAGASA had already identified the strength of the typhoon. That same day, Department of Science and Technology Secretary Mario Montejo issued a public warning about the possible effects of the typhoon. This particular warning was not contained in the *Gazette* report; however a blog site reported that:

> Typhoon Haiyan, with gusts of up to 185km/h, was moving over the sea at 30km/h and may make landfall at mid-day on Friday in the central islands of Samar and Leyte, said Science and Technology Secretary Mario Montejo. (Medic Mike 2013)

On 6 November, the day Yolanda entered PAR, regional and provincial government had started to issue disaster warnings over local radio stations. The Philippine Information Agency had also assisted in disseminating information about the typhoon to local authorities through tri-media (NDRRMC 2013). Several other agencies, such as DOST-led Project Nationwide Operational Assessment of Hazards (NOAH), had issued warnings about the storm surge (Lagmay et al. 2015). Likewise, the *Official Gazette* reported to have published several information materials in their website, which aimed to communicate the potential risks of the typhoon, including a relatively comprehensive infographic, written in English and Filipino, about the nature and effects of a storm surge. That infographic was uploaded in the *Official Gazette*'s (n.d.) website (see figure 1 in page 44).

Storm Surge

On 7 November, one day before Yolanda made its landfall, the Provincial Disaster Risk Reduction and Management Council of Samar and Leyte had disseminated public advisories about the typhoon. Respondents in on-site interviews done by Lagmay et al. (2015) claimed that the local government in Tacloban went around the vulnerable areas the night before Yolanda's landfall, asking people to evacuate immediately. Moreover, then President Benigno S. Aquino III made a televised public statement regarding the potential serious effects of the typhoon, as well as the initiatives being undertaken by the government to prepare for Yolanda.

In his statement (*Official Gazette* 2013a, 2013b; RTVMalacanang 2013), President Aquino explained the coming natural hazard using comparisons with past typhoons such as typhoon Pablo:

> *Umabot na, at aabot pa, sa storm signal number 4 ang lakas ng hangin sa ilang mga lugar dulot ng bagyong ito. Sa kasalukuyang datos, mukha pong mas matindi ang hagupit ni Yolanda kaysa kay Pablo.* (*Official Gazette* 2013a, third paragraph)
>
> (Storm signal number 4 has been—and will be—raised over some areas because of this typhoon. Current data indicates that Yolanda will be stronger than Pablo.) (*Official Gazette* 2013b, third paragraph)

described the characteristics of the typhoon:

> *Nasa 600 kilometro po ang diameter ng bagyong ito. Inaasahan pong tatama si Yolanda sa mga probinsya ng Samar at Leyte simula mamayang hatinggabi.* (*Official Gazette* 2013a, third paragraph)
>
> (The typhoon has a 600-kilometer diameter. We expect it to make landfall on Samar and Leyte by midnight.) (*Official Gazette* 2013b, third paragraph)

and the possible effects the typhoon might bring:

> *Bukod sa inaasahang bugso ng hangin, ulan, pag-apaw ng mga ilog, pati ang posibilidad ng pagdagsa ng lahar sa mga pook malapit sa bulkan ng Mayon at Bulusan, mino-monitor din po natin ang banta ng mga storm surge sa mahigit isandaang mga pook. Matindi ang panganib ng storm surge sa Ormoc, Ginayangan Ragay Gulf sa Albay, at Lamon Bay sa Atimonan. Maaaring umabot ng lima hanggang anim na metro ang taas ng alon sa mga lugar na ito.* (*Official Gazette* 2013a, third paragraph)
>
> (Aside from strong winds, rain, the overflowing of our rivers, and the possibility of lahar in areas near the Mayon and Bulusan volcanoes, we are likewise monitoring the threat of storm surges in more than a hundred areas: Storm surges are expected in Ormoc, Ginayangan Ragay Gulf in Albay, and Lamon Bay in Atimonan. Waves in these areas may reach five to six meters.) (*Official Gazette* 2013b, third paragraph)

In the statement above, the President had warned the public about the storm surge, saying that the "wave" might reach the height of up to six meters.

Media: Broadsheets

The *PDI* first reported Yolanda on 4 November as part of its news story about two low-pressure areas that then threatened the Visayas-Mindanao

area. One of these LPAs became tropical depression Wilma that made a landfall in Northern Mindanao on 4 November, but eventually weakened after; the other one became super typhoon Yolanda the day after. Like any other pre-typhoon news reports, the article was plain and straightforward, mentioning the location of the first LPA, and its forecasted effects. The article devoted one paragraph (out of seven) in discussing the second LPA, and just mentioned that it "looks like it will intensify . . . before it enters the PAR (Philippine Area of Responsibility)."

Physical Characteristics of Typhoons

In the following days, both *PDI* and *PhilStar* had published an article about the "second" low-pressure area—now a tropical storm bearing the international name "Haiyan." Both broadsheets published stories that focused on either the characteristics of the typhoon (i.e., its wind strength, gustiness, speed, and forecasted track) or the national and local government's efforts to prepare its citizens for the typhoon. News about the typhoon landed on *PDI*'s front page starting on 6 November, and *PhilStar*, on 7 November, both as banner stories. The day before Yolanda's landfall, both broadsheets included photographs (mostly satellite images) on the front page, showing the forecasted track of the typhoon.

Forecasts as Probability, Public's Readiness, and Attempts to Laymanize Technical Information

Some risk messages did appear in several news stories. For example, a *PDI* article published on 5 November hinted that the typhoon might cause a serious threat to the Visayas and Mindanao area, but clarified, by citing the forecaster, that "it was too early to tell if Yolanda would become a supertyphoon." The report cited the forecaster explaining the "cone of uncertainty," clarifying that more accurate predictions can be made when the typhoon enters PAR. The article implicitly corrected "unreliable" reports circulating on the Internet that time, claiming that the "supertyphoon" will make "land fall in Leyte . . . by Friday." The report ended by citing the forecaster advising the "public to always be prepared"(Andrade 2013, A6).

Analogies and survival tips as laymanization were also found in news articles. A day before Yolanda's landfall, both *PDI*'s and *PhilStar*'s stories had provided some "risk" messages by explaining very briefly the

effects of a Signal No. 4 typhoon, providing concrete examples such as "large trees uprooted" and "power and communication services severely disrupted" to help readers visualize its possible effects. One *PDI* story attempted to laymanize the expected amount of rainfall during the passing of the typhoon, explaining "7.5 to 20 ml (of rainfall) per hour" means "that a square meter container will have collected 7.5 to 20 liters of water after an hour of rain" (Yap 2013, A14).

Interestingly, on the same page of this issue (page A14), *PDI* published survival tips during typhoons given by the Philippine Red Cross, instructing readers on what to do before, during, and after a typhoon. Moreover, *PDI* also published a brief article about PAGASA's public storm signals. But aside from just reiterating the "book definition" of each warning, the article did not provide additional information that might help readers understand the extent of damage each typhoon warning might bring. Nevertheless, these attempts to give additional practical information to encourage people to prepare for the typhoon are noteworthy.

By 8 November, *PDI* published two stories about Yolanda on the front page (albeit not a banner story), again showing a satellite image of the typhoon, highlighting its strength and scope. After briefly discussing the characteristics of the typhoon, one of the two stories picked up the President's message broadcasted in major media networks the day before. The story quoted the President's statement about the forecasted height of the storm surge, thus making this the first time the term "storm surge" was cited in all *PDI*'s stories about super typhoon Yolanda. After citing the President, however, no other explanations were included in the article to clarify what it meant, and how dangerous six-meter storm surges were (the term was quoted thrice in the entire article). The news story also cited a PAGASA forecaster explaining that Yolanda's strong winds "can generate waves of up to 7 meters in coastal waters along its path" but no other attempts were made to allow readers to visualize how dangerous a seven-meter wave can be (Andrade and Ubac 2013, A19).

Nevertheless, the story made several attempts to seriously warn the public, citing different sources repeatedly and reporting the possible adverse effects of the typhoon to emphasize the need to be prepared and follow the directions from authorities. Another noteworthy attempt to diversify the information about the typhoon is the publication of a "Weather Glossary" that appeared on the same page of Andrade and Ubac's story (2013, A19). Seventeen jargons, which included terms

such as "low-pressure area," "intertropical convergence zone," "tropical cyclone," and "tropical depression"—terms that are usually used in news stories about typhoons—were defined. However, "storm surge" was not in the list.

The *PhilStar*'s 8 November issue framed its lone news story about the typhoon to focus on the preparations being made in Bohol, the province that experienced a 7.2 magnitude earthquake in mid-October. The news story also reported on the preparations being made by the government. It was noted that although the story did include some points from the broadcasted message of the President the night before, the term "storm surge" did not appear anywhere in the story.

Media: Television

Weather forecast segments did incorporate science popularization initiatives and risk messages, even days before the typhoon entered PAR. The common "pattern" of reporting was observed, i.e., (1) discuss the characteristics of the typhoon; (2) provide the other pertinent information that may help the viewers prepare for the effects of the typhoon (e.g., place under storm signal warnings; gale warnings); and (3) talk about some scientific concepts related to typhoons, the effects that the typhoon would bring, and the appropriate preparations that all possible victims of the hazards related to the typhoon should do.

Popularizing Technical Terms

As early as 4 November, *GMA News* resident meteorologist Nathaniel Cruz already included a noteworthy explanation of the concept of "cone of uncertainty" during his weather forecast aired over Jessica Soho's *State of the Nation* news program. In fact, he explained this concept from time to time (until 8 November) to warn the people residing in areas where the "cone of uncertainty" passed to prepare for any effect that the typhoon might cause.

The selected weather forecasts also showed efforts to popularize scientific concepts related to the typhoon. For example, the forecaster explained how a typhoon gains its strength in warm waters and how the typhoon can "recharge" its strength as it passes over the waters between the islands in the Visayas (*State of the Nation* 2013a). Also, he made

remarks about the jargon "landfall" and how storm surge happens (*State of the Nation* 2013d).

When the anchor asked about storm surge, the forecaster explained:

> *Ano yung storm surge? Yung napakalakas na hangin na nanggagaling sa karagatan, tinutulak niyan yung tubig na nasa dalampasigan papasok inland. At kung iyan ay sasabayan pa ng high tide, Jessica, yung dating taas ng tubig, ipagpalagay na isang metro lamang, pero dahil sa lakas ng hangin, yung isang metro mo na pangkaraniwan ay hindi problema, nagiging lima o anim na metro. O kung sa piye, yan ay mga 10–15 feet. Yung unti-unting pagtaas ay hindi biglaan iyan Jessica, hindi katulad ng tsunami na talagang biglang darating. Ito ay unti-unti yung pagtaas kaya puwede nating maiwasan iyan . . . Lagi pong isipin natin basta signal number 2 hanggang signal number 4, ang isa sa mga panganib na idudulot ng bagyo . . . [ay] storm surge, o yung pagtaas ng tubig-dagat sanhi ng malalakas na alon, malakas na hangin, at yung low-pressure area na dala ng isang papalapit na bagyo.*
>
> (What is a storm surge? It happens when very strong winds from the ocean push the water in the seaside inland. And if that coincides with a high tide, Jessica, the former water level, let's say only a meter, because of the strong winds, the common one-meter water level that is not problem reaches five or six meters. Or in feet, that's ten to fifteen feet. That gradual increase in water level does not happen suddenly, Jessica, unlike a tsunami. Water level gradually increases so we can avoid that. Let's always remember that a signal number 2 to signal number 4 storm may bring the threat of a storm surge, or the increase in sea level due to strong waves, strong winds, and low pressure area due to an incoming storm.) (*State of the Nation* 2013d; translation supplied)

There were also some explanations about the Fujiwhara effect (*NewsLife* 2013a) and how the northeast monsoon and high-pressure area affect the track of the typhoon (*NewsLife* 2013b). For example, after the anchor asked if the low-pressure area (referring to then-dissolved tropical depression Wilma) and the incoming super typhoon Yolanda would have a chance to interact with each other, the forecaster explained:

> Based from their distance or positions, more than 2,500 kilometers, there is no chance for these two to have some interaction with one another. There should be at least a distance of less than 1,000 kilometers for these to have an interaction, or what we know as the Fujiwhara effect. (*NewsLife* 2013a)

Another report explained the nature of the eye of the typhoon and what can be experienced when the typhoon's eye wall hit an area (*TV Patrol* 2013a). Two forecasters explained how typhoon signal warnings should be understood in reply to those who wondered why their areas received a typhoon signal but were still experiencing relatively fair weather (*TV Patrol* 2013b, *State of the Nation* 2013b). For example, *TV Patrol*'s Kim Atienza remarked before concluding his weather report in 7 November:

> *Gusto lang nating idagdag ano, dahil napakaraming nagsasabi na mataas na ang storm signal sa kanilang mga lugar pero wala pa ring ulan, maganda pa ang panahon doon. Ang PAGASA storm signals ay merong saklaw na 24 hours. Kung maganda man ang panahon ngayon, ay bukas siguradong susungit iyan, kaya't ipatuloy natin ang pag-iingat.*
>
> (We just want to add, because a lot of people were saying that their areas are already under a high storm signal but there's still no rain, the weather in these areas are still good. PAGASA storm signals are in place for 24 hours. If the weather is good today, it will surely be bad tomorrow, so let's continue being cautious.) (*TV Patrol* 2013b; translation supplied)

One report provided a piece of trivia about the origin of the name "Haiyan," and clarified that technically, PAGASA only uses three classifications of weather disturbances—tropical depression, tropical storm, and typhoon; the term "supertyphoon" is not one of them (*News@1* 2013).

The different weather forecast segments also provided repeated warnings about the potential effects of the typhoon and enhanced viewers' understanding of the possible risks that people in the would-be affected areas may experience. For example, there were some discussions on how the typhoon might become a disaster once it hits a densely populated area (*State of the Nation* 2013a); the different hazards that people in the affected areas might be exposed to as a result of strong winds and heavy rainfall, including a possibility of "tornadoes" developing near the typhoon's eye wall (*State of the Nation* 2013b); and the possible effects of a typhoon with a 225 kph wind strength (*State of the Nation* 2013c). Cruz explained:

> *Hindi lamang mga maliliit na puno; malalaking puno puwedeng hugutin nitong napakalakas na hangin. At ito kasing pinag-uusapan nating hangin, Jessica, hindi ito yung isang oras [lang na mararanasan]; puwedeng dalawa hanggang tatlong oras na babayuhin yung isang lugar at sasabayan pa iyan nung bugso na umaabot ng 260 [kph]… Malawakan na pinsala—agrikultura, komunikasyon,*

> *imprastraktura . . . Hindi lamang yung mga bahay na gawa sa light materials ang kaya[ng itumba] kung hindi pag signal number 4, kahit na yung mga kongkreto, yung bubong nun ay kayang tangayin.*
>
> (Not just small trees, these strong winds can uproot big trees. And these strong winds we're talking about, Jessica, do not just last for an hour. They may strike an area for two to three hours and they will come with sudden gush of winds at 260 [kph] . . . Extensive damages–agriculture, communication, infrastructure . . . A signal number 4 storm can take down not only houses made of light materials but also roofs of houses made of concrete.) (*State of the Nation* 2013c; translation supplied)

As pointed out earlier, storm surges were included in some reports (translated as *alon* or wave in *TV Patrol* 2013b) and its adverse effects (*State of the Nation* 2013d). All weather forecast segments included gale warnings issued by PAGASA and urged the viewers to prepare for the typhoon, reiterating that even those residing in areas that will not be directly hit should make the necessary preparations.

Weather Maps as Technical Information

There were also attempts to help the viewers "read" the weather maps being flashed on the screen. Cruz explained what the short and long lines of the wind map meant, saying:

> *Eto yung wind map ng Weather Central. Yung nakikita nating mga arrow na iyan, mas mahaba yung arrow, mas malakas yung hangin, Jessica. So nakikita mo yan, mayroong isang arrow diyan na halos ang haba e doble o triple nitong mas malalakas na hangin. So eto yung gitna ng bagyo bago lumapit sa kalupaan.*
>
> (This is the wind map of Weather Central. Those arrows we see, the longer the arrows the stronger the winds can get, Jessica. So can you see that, that arrow is almost twice or thrice longer than stronger winds. So this is the center of the storm before it makes landfall.) (*State of the Nation* 2013a; translation supplied)

Atienza explained the color codes being used in the weather map; for example, areas where a red-colored band of clouds hover will experience very heavy rainfall (*TV Patrol* 2013a); red-colored areas in gale warning map will experience very high waves (*TV Patrol* 2013b).

Based on the discussions above, it can be surmised that the government and the mainstream media did not lack efforts in communicating information about the incoming typhoon. In the

survey done by SWS (2014), 45 percent of Filipinos claimed to have received warning about Yolanda one to two days before, and 24 percent received the warning three to four days before. Interestingly, 39 percent of the respondents from Visayas claimed to have received the warning three to four days before, and 25 percent one to two days before. Just before Yolanda struck, 98 percent of Visayans claimed to have been warned.

The Disastrous Aftermath: Problems in Communicating Hazards and Risks

But despite these efforts, why was the aftermath a disaster? Careful analysis made by various institutions after the typhoon revealed several science and risk communication-related problems that may help us find ways to improve the way we communicate information before disasters happen.

The Problems Encountered during Super Typhoon Yolanda

Several scholarly studies on the post-Yolanda experience have implied that accurate and human-centered risk and science communication initiatives would have played very important roles in mitigating the effects of the disaster (e.g., Jibiki et al. 2016; Lagmay et al. 2015; Yi et al. 2015; Esteban et al. 2015; Leelawat et al. 2014; SWS 2014). Eleven scholarly articles that highlighted post-Yolanda analysis were content analyzed. Results showed that the problems encountered in super typhoon Yolanda can be grouped into three themes: problems with (1) the psychological and social factors; (2) information dissemination through mass media; and (3) institutional mechanisms in disaster risk reduction provided by the government. This section discusses the three themes culled out from extant literature with the aim to synthesize their findings and come up with recommendations to move forward.

"We're Used to Storms . . . We Men Will Stay Behind": Previous Experiences as Both Boon and Bane of Disaster Risk Mitigation

Encouraging people to evacuate to safer places is one of the most important messages—and most challenging in many cases—that risk communicators usually make.

One striking result of several post-Yolanda analyses is the admission that many had underestimated the strength of the typhoon (Mas et al.

2014; SWS 2014; Ching et al. 2015; Esteban et al. 2015; Jibiki et al. 2015; Jibiki et al. 2016). Because of this, many were found to downplay the safety warnings, and this affected their evacuation behavior. Jibiki et al. (2015) found that 55.6 percent of their respondents in Leyte (n=637) underestimated the severity of the typhoon. They found that 64.8 percent of their respondents believed that "the wave should not be that large" and that 31.8 percent believed that their "house was strong enough" for the typhoon and so, they (mostly men) stayed (this finding was also supported by other researchers, such as Esteban et al. 2015). Interestingly, in another study, Jibiki et al. (2016) found that people who did not underestimate the magnitude of the typhoon were more likely to evacuate.

Experiences in surviving other severe typhoons in the past might have also played a role in the decision to evacuate or not (Mas et al. 2014; Lagmay et al. 2015; Yi et al. 2015). In one of the *PDI* news articles about super typhoon Yolanda discussed earlier, the authors quoted two interviewees, both from Palo, Leyte, regarding their plans for evacuation. One of them, a tricycle driver said, "We're used to storms . . . We men will stay behind" as they plan to secure their belongings and livestock. Another interviewee, a gardener, was quoted saying "I have encountered many storms in my life and I've always survived. If this storm will take me, then I'll leave it to God" (Yap et al. 2013, A8). Lagmay et al. (2015, 10) also pointed out that "there is a local belief that they know their sea better than anyone else" and that influenced the evacuation behavior of most people, especially in the coastal area.

It was not the first time Leyte had experienced a strong typhoon. In 1897 a typhoon left about 6,500 dead; another in 1912, with 15,000 casualties. Reports suggest that there were people in the area who claimed to have heard these stories before (Lagmay et al. 2015; Jibiki et al. 2016; Mas et al. 2014; Mas et al. 2015; Yi et al. 2015). Soria et al. (2016) had reconstructed the storm surge of the 1897 typhoon, compared it to super typhoon Yolanda, and found that Yolanda's storm surge was twice the height of the 1897 typhoon. Needless to say, most, if not all, victims of super typhoon Yolanda were not yet alive during these two previous typhoons. In a way, this made them experience a very strong typhoon's fury "for the first time." This supports Esteban et al.'s (2015, 40) study where they found out that 56 percent (n=172) of their respondents said "they had not experienced any type of damage due to coastal hazards so far in their lives," which

in turn might be the reason why many had underestimated the typhoon and were unaware of the potential effects of strong storm surges.

Other reasons for (non)evacuation were also pointed out by Esteban et al. (2015). In their study in Leyte and eastern Samar, they found that many of their respondents did not know how and where to evacuate; they believed that their place was safe enough; and they thought they could run away easily if ever the typhoon turned out to be really strong. Some wanted to secure their personal belongings (see also Leelawat et al. 2014). These were reported despite having clear indications that prior to the typhoon, they had received evacuation training from the local government (Esteban et al. 2015, 40).

Technical Information Dissemination through Mass Media

Another recurring problem reported in the articles is related to the public's (mis)understanding of the term "storm surge" (Mas et al. 2014; Ching et al. 2015; Esteban et al. 2015; Jibiki et al. 2015; Kure and Quimpo 2015; Jibiki et al. 2016). The argument was that (1) people were not familiar with the term "storm surge," maybe due to a lack of exposure to such term (Jibiki et al. 2015), or failure to translate it into local language (Ching et al. 2015); (2) the media as a whole failed to accurately report what it was and its possible effects (CMFR 2013); and (3) if authorities, including the media, used the term "tsunami," the non-expert public might have understood it more clearly and thus might have acted accordingly due to the severity of the warning (Mas et al. 2014; Lagmay et al. 2015).

Storm Surge: Finding a Local Emphatic Term

Jibiki et al. (2015) reported that out of the three technical terms in early warning messages used by authorities and experts, the term "storm surge" was the least recognized among their survey respondents in the Leyte and Samar areas (n=642). In another survey, Esteban et al. (2015) noted that 62 percent of their respondents strongly agreed that "storm surge was a real danger to them" (n=172). However, after three separate focus group discussions in different locations were done, results showed that people did not really understand its nature and thought that it was "just strong waves from the sea" (ibid., 42). Ching et al. (2015) found that 89 percent of their respondents (n=100) said that

they received warnings against the storm surge but they did not really understand what it meant.

Aside from the public's lack of exposure to the jargon, the lack of a local term was pointed out as another reason why authorities found it challenging to communicate the concept. Even the president's address once used *alon* (wave) to describe the surge, which might have explained why the media also used the same translation. This might have created confusion about the nature of storm surges. Esteban et al. (2015, 43) found that even local government officials "did not expect it [storm surge] to be as big as stated . . . [because] their knowledge of what could happen was limited to strong waves, which were a usual occurrence during typhoons in the past." This made it difficult for local officials to effectively persuade local residents to evacuate and deterred local residents from heeding the warnings way before the typhoon arrived.

Right after the typhoon, discussions started among linguists to find an appropriate Filipino translation of the term, suggesting that "storm surge" should be translated as *daluyong*, *humbak*, or *silakbo*; while others, in an attempt to be more hip and popular, proposed *tsu-balod* or *tsu-alon*, from the word "tsunami" (Rodolfo 2013a, 2013b). Later, PAGASA translated storm surge as *daluyong bagyo* in their Filipino dictionary of weather forecasting terms (PAGASA and KWF 2015).

There were also claims that the media failed to give "storm surge" enough publicity, as well as to communicate its potential risks. As previously noted, the government actually issued storm surge warnings before the typhoon's landfall. In fact, PAGASA had warned against the height of storm surges eighteen hours before its landfall (see Jibiki et al. 2015). CMFR (2013) claimed that although the media in general picked-up the term after the President had used it in his emergency address, their stories lacked emphasis about its potential danger. CMFR called this a "major media lapse" (under Clarifying Terms, third paragraph), as most media outfits failed to use, explain, and laymanize with accuracy in their stories the storm surge information provided by the government and experts. As a result, even journalists assigned to cover the typhoon on the ground were shocked, as they did not expect the magnitude of the storm.

Tsunami vs. Storm Surge: Experts and the Issue of Accuracy

Due to the unfamiliarity with the term, the non-expert public claimed that had they received a "tsunami" warning instead of "storm surge," they might have understood it better and thus treated the warning more seriously. Several news stories had published this concern (e.g., see Gutierrez's 2013 report in Rappler.com), as well as the scholarly literature (e.g., Mas et al. 2014; Esteban et al. 2015; Kure and Quimpo 2015; Lagmay et al. 2015). Using "tsunami" to mean "storm surge" makes sense: since more people are familiar with the intensity and potential destruction that tsunamis bring. This may be attributed to the extensive media coverage of tsunamis in Indonesia and Thailand in 2004, and Japan in 2011.

However, experts thought otherwise because risking miscommunication by using an inaccurate metaphor is unacceptable in science and is believed to lead to another, probably more serious, semantic problems later on. Ranada's (2013) report quoted a scientist who argued that people will be more confused if authorities used the term "tsunami" as a warning because they might think that an earthquake is involved; if they do not experience an earthquake, people might not evacuate all the more. What could have been done was to communicate the concept in a more visual manner, using local terms, the report said.

Others have suggested that communicators should have used the term "tsunami-like waves" to communicate its risks, and at the same time avoid directly substituting the term "tsunami" for "storm surge," which are technically different forms of natural hazards. As what has been evident in the preceding presentation, pre-landfall Yolanda media stories, as well as reports from experts and government officials, failed to adequately illustrate the effects of severe storm surges. Bernal's (2013, third paragraph) report quoted a PAGASA official admitting that they could have emphasized the effects of storm surge more, saying "We [PAGASA] weren't able to tackle [the storm surge]. It's more on the signals and in delivering the forecasts and warning distributed to the public. But the storm surge wasn't explained there."

Aside from the limited efforts to popularize the concept, perhaps one of the reasons the science and risk of storm surges did not receive enough publicity was the timing of the event relative to the "bigger" and more controversial socio-political issues at the time (Lagmay et al. 2015). Stories to warn the public about the incoming typhoon had to

compete with news regarding the dominant political issues, which included the coverage of the disbursement acceleration program and the first of the series of Senate hearings about the "pork barrel" scam.

Institutional Mechanisms in Disaster Risk Reduction

As discussed, both local and national government had done preparations to inform, respond to, and mitigate the effects of the disaster before Yolanda's landfall, and these efforts are praiseworthy. However, government efforts had fallen short, which caused serious consequences that might have been avoided had there been more systematic and efficient planning and execution on their part. Three major pitfalls had been identified that highlight the need to improve risk communication and planning efforts nationwide: (1) poor disaster education given to local citizens; (2) some loopholes in the current local disaster risk management system; and (3) lack of safe evacuation facilities.

Jibiki et al. (2015) reported that 63 percent of their respondents (n=640) rated "Low" and "Very Low" when asked about the opportunities to learn the hazards before super typhoon Yolanda happened. Esteban et al. (2015) pointed out that local residents had not participated in any evacuation drills or disaster preparedness trainings prior to the typhoon. This is the reason why, in the same study, the survey revealed that many did not evacuate because they did not know what to do. Disaster preparedness training might be the least priority, as people were busy meeting day-to-day needs (Lagmay et al. 2015). However, this does not say that no efforts were done to mitigate its effects prior to the disaster.

As Lagmay et al. (2015) had also pointed out, Republic Act 10121 or the Philippine Disaster Risk Reduction Management Act of 2010 had instructed LGUs to spearhead initiatives to reduce disaster risks, including information dissemination about hazards, risks, effects, and countermeasures.[2] Although wide-scale implementation of the Republic Act 10121 has been not as effective, a report claimed that there were serious efforts of the Leyte government to implement the law as they did extensive planning several months before the typhoon came. Esteban et al. (2015) interviewed local officials in Tacloban and found that three months before Yolanda, disaster risk management preparations, including the plan to incorporate trainings in their policies, were under way.

Another source of the problem is the existence of some loopholes in the current local disaster risk management system. One of these loopholes is that the focus of the disaster risk management plan is on flooding and not on coastal hazards, although there are indeed some flood hazard maps and flood markers available (Esteban et al. 2015). More interestingly, Lagmay et al. (2015) argued that a storm surge hazard map for Tacloban had been released prior to the typhoon. Although the map's forecasted storm surge heights were considered as an "underestimation," the local government could have incorporated this information during their planning.

Another loophole is the lack of an efficient system in disseminating hazard and risk-related information. A survey done by Leelawat et al. (2014) showed that 27 percent of their respondents claimed to have difficulty in accessing information about disaster. Another study found that many local residents were not aware that a storm surge map in their area existed; the maps were not displayed in their barangay halls (Yi et al. 2015). Ching et al.'s (2015) study found out that 76 percent of their respondents were not aware that disaster plans actually existed in their community.

Interestingly, Jibiki et al. (2016) noted that in 2007, PAGASA had issued information materials about storm surges in the Yolanda-affected areas, explaining its nature and potential effects. However, information was not effectively disseminated way before the typhoon, which could have refreshed their knowledge about it.

Lastly, the lack of safe evacuation facilities in the area had been found to affect people's behavior towards evacuation. Jibiki et al. (2015) found that 42 percent of the surveyed local barangay captains believed that evacuation areas should not be flooded, and a little over 32 percent said that it should withstand strong winds. However, a little more than 30 percent of them said that they encouraged people to evacuate to schools, "because that was the most appropriate place they could choose under the circumstances" (Jibiki et al. 2015, 68), even though the school facilities may not be fully safe to be used as evacuation centers. Leelawat et al. (2014, 23) found that some of their respondents did not evacuate before and during the typhoon because "evacuation centers are poorly maintained," and they experience inconvenience due to "over-packed evacuation centers" (ibid.). The study surmised that people might be more likely to evacuate if they perceive that the evacuation centers are safe and secured. Unfortunately, as Kure and Quimpo (2015) mentioned people in the affected areas did

feel that some evacuation centers were unsafe. For example, the Tacloban City Convention Center and Leyte Convention Center were both used as evacuation centers during the typhoon, but the storm surge inundated the former, while the latter collapsed due to strong winds during the typhoon's onslaught (see also Mas et al. 2014). The issue on the safety of evacuation facilities is also highlighted in Esteban et al.'s (2015) study.

MOVING FORWARD: RECOMMENDATIONS FROM A COMMUNICATIVE PERSPECTIVE

To mitigate the effects of such disasters, more active efforts to improve science and risk communication should be done. To "mainstream" these efforts, it is important to incorporate these initiatives in policy, education, and institution building.

DRRM is primarily a responsibility of the government and, as expected, there were serious efforts on their part to build the capacity of LGUs to understand the science of risks, access DRR-related information, and make sense of relevant information about disaster risks. Efforts have to continue and more must be done to adequately capacitate all personnel working for DRRM, supplying them with relevant skills and understanding in performing their tasks efficiently—from properly detecting hazards to responding to community needs during a disaster. The government, both local and national, should closely monitor the proper and effective implementation of Republic Act 10121, particularly in the planning and execution of the so-called people-centered early warning system in local communities. Standard operating procedures in all levels to warn and alert communities should be subjected to continuous assessment. Conducting trainings for LGUs on how to properly communicate science and risks can have a big role in realizing this objective.

Although Republic Act 10121 is directed mostly to government, the public should also be adequately aware about this law, as well as other existing laws related to DRRM. This would widen the scope of the public's understanding about disaster prevention, which may help in making them appreciate their responsibilities to mitigate the hazard's potential effects. If science and risk can (and should) be popularized, then laymanizing contents of executive laws should also be done.

Capacitating the public before disasters happen are also important. LGUs and technical experts can continue to initiate evacuation drills, flood and storm surge drills, and other safety drills to educate the public about what to do in case of emergencies. Initiatives had been started by PAGASA and other government agencies (e.g., see PAGASA 2014, a report on flood and safety drill in Manila) through different projects, and these initiatives are laudable. What can be done is to continuously improve wide-scale drills in local communities especially those that are regarded as high-risk areas.

The education sector has much to do with regards to "mainstreaming" science and risk communication. There is a lack of training and mentors in science journalism. Panela[3] (personal correspondence) had already expressed this serious concern, as science and risk communication normally require specialized training for journalists in order to obtain and maintain a high level of scientific and journalistic accuracy in reporting. Scientific and numeric literacy for journalists are needed in educating their audiences. Journalists should also learn to face head-on the challenges of making science topics relevant to the public in order to "sell" science news. However, what "sells" is most of the time defined and decided by their editors. It was thus argued that journalists are just part of the whole media system that should learn to value science and risk communication—the other parties include editors and publishers themselves. There is therefore a need to beef up science journalism training in the country, and one way to do that is to incorporate more science and technical subjects in the curriculum of communication-related undergraduate courses, particularly the disciplines that train for the mainstream media.

Another way to increase the effectiveness of science and risk communication is to conduct trainings for existing media practitioners on how to frame news about weather forecasts. PAGASA currently runs regular media trainings for local and mainstream media practitioners, which include topics such as basic meteorology, NOAH as a tool in DRRM, PAGASA's flood and weather forecasting and warning system, and general discussions on global warming and climate change (see PAGASA 2013, a brief report on Seminar-Workshop for Southern Mindanao Mediamen). What is needed is for other science and technology agencies to adopt the same initiative; or better yet, conduct a streamlined initiative to conduct refresher courses and trainings for media practitioners, both local and national, regarding science and risk communication.

Schools, colleges, and universities can also push for the institution of courses in risk and science communication. As argued, risk is best communicated to particular audience segments where a thorough needs analysis is done before actually commencing communication. In this way, the messages become more relevant to them, with the hope that they act accordingly. The key is to look at the problem in a more interdisciplinary manner, factoring in the potential contributions of other disciplines in science and risk communication. De Leon-Bolinao[4] argued that experts from other social science disciplines, such as anthropologists, historians, sociologists, and psychologists, should be included in any concerted effort in managing and reducing risks, as they can render special contributions to the long-standing efforts in reducing disaster risks. Disasters and how people react to and cope with them are both social and cultural issues, and so the initiatives should not solely be the responsibility of technical experts and communicators alone.

Both the community media and the mainstream media have a big responsibility in communicating risks and science before a disaster happens. As previously noted, the media has played a major role in disseminating information about the impending disaster and communicating risk and science concepts that may help the public understand the risky situation more clearly. It is hoped that the media would allocate more airtime and space to talk about the science of hazards and its risks even when no imminent disaster is coming. The key is to give the topic enough salience and depth, and frame news reports that are more relevant to an identified, specific audience. It will also be beneficial if commercial networks spend time for regular discussions about science, hazards, and risk reduction.

Scientists and technical experts should also be more proactive with public engagements. Experts' visibility in the media can also help in communicating risks and science to the non-expert public. At present, technical experts appear in the media only to explain disasters and risks; they are regarded mostly as guest-experts in news and current affairs programs and they usually function as an interpreter of the event who gives reliable expert opinions. The challenge still remains when it comes to strategies on how to effectively communicate weather forecasts and climate risks to non-technical audiences, who constitute the bulk of the media consumers. This may require them to undergo capacity building to familiarize themselves about the newsroom culture (or culture in the media in general) as well as some training on science communication.

Also part of the problem is the available avenues where popularization of science concepts can be done. For example, Cruz[5] argued that weather forecasters who want to "make sense" in front of the viewing non-expert public need to wrestle with the limited airtime given to them to explain numbers and scientific jargon in a more meaningful way. Finding ways to improve the current weather forecasts reporting system, he said, will contribute to the ongoing efforts in educating the public about risks. Making some efforts to localize weather forecast reporting by using the vernacular and limiting the geographical scope of the forecast, as well as explaining forecasts using culturally sensitive visual signs and symbols, might also help.

Effective communication entails the congruent understanding among stakeholders of the risks brought by natural hazards. It is also imperative to engage the public on the nature of technical forecasts regarding typhoons and other natural hazards: that these may or may not happen. What is important is for the public to be prepared; it is best to err on the side of safety.

However, we cannot merely put the burden of communication on media per se because multiple actors are involved to make communication effective. It requires strong linkage and collaboration among stakeholders: media, the science community (both bench and social sciences), and the public.

It is imperative to engage the public on the nature of scientific information, particularly information on natural hazards. The issue of accuracy and exactness is anticipated by the public when forecasts are made. But these are forecasts, expectations based on assumptions and calculations that predict events that are yet to happen. Public engagement should also enable communities to appreciate and understand the nature of forecasts and that the best action is preparedness. Public engagement entails understanding the phenomenon from both ends of the communication and information continuum, i.e., from the technical side, via media and on the ground (community). This calls for stronger collaboration and interaction among science and technical persons (e.g., DOST, PAGASA), the media, and communities. Stakeholders must help each other popularize understandable and actionable terminologies useful in risk communication and weather forecasting.

The call to build a science culture in the Philippines and improve science and risk communication initiatives in the country is not at all

new (e.g., Velasco 1998; Valdez and Fernandez, 1999; Tecson-Mendoza 2007). The lessons learned after Yolanda's wrath enabled us to reflect on our own roles as communicators, government authorities, and technical experts. What is needed now is to translate these learnings into actual practice. Hazards will inevitably get more disastrous and, in the advent of climate change, science and risk communication will become more and more valuable. Mitigating disaster risks is not a job for a few. Collaboration among involved stakeholders is the key.❁

NOTES

1. Link to the website is http://www.gov.ph/laginghanda/updates-typhoon-yolanda/.
2. Section 12c no. 10 of Republic Act 10121 or the Philippine Disaster Risk Reduction and Management Act of 2010.
3. Shaira Panela, personal communication with the authors, 3 September 2014 during the 2014 University of the Philippines Third World Studies Center Public Lecture Series on Natural Disasters, Lecture 1—Communicating Risks, Risking Miscommunication: Mass Media and the Science of Natural Disasters, Pulungang Claro M. Recto, Bulwagang Rizal (Faculty Center), University of the Philippines, Diliman, Quezon City.
4. Maria Luisa De Leon-Bolinao, personal communication with the author, 3 September 2014 during the 2014 University of the Philippines Third World Studies Center Public Lecture Series on Natural Disasters, Lecture 1—Communicating Risks, Risking Miscommunication: Mass Media and the Science of Natural Disasters, Pulungang Claro M. Recto, Bulwagang Rizal (Faculty Center), University of the Philippines, Diliman, Quezon City.
5. Nathaniel Cruz, personal communication with the authors, 3 September 2014 during the 2014 2014 University of the Philippines Third World Studies Center Public Lecture Series on Natural Disasters, Lecture 1—Communicating Risks, Risking Miscommunication: Mass Media and the Science of Natural Disasters, Pulungang Claro M. Recto, Bulwagang Rizal (Faculty Center), University of the Philippines, Diliman, Quezon City.

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APPENDIX

Table 1. Timeline of Yolanda advisories and reports from government agencies and media

Category	Description
Date	2 November 2013
Typhoon development	Low-pressure area that developed in western Pacific
Date	3 November 2013
Typhoon development	Tropical depression
Date	4 November 2013
Typhoon development	Tropical storm
Government	LGUs conduct local meetings with all stakeholders; massive information campaigns
Media[a]	First reports appear on broadsheets *Philippine Daily Inquirer* (PDI) and *Philippine Star* (PhilStar); and on TV news and public affairs programs *State of the Nation* (GMA News); *TV Patrol* (ABS-CBN News); *NewsLife* and *News@1* (PTV 4) GMA News weather forecast with Nathaniel Cruz in State of the Nation NewsLife
Content	Government: Tropical storm Broadsheet: looks like it will intensify . . . before it enters the PAR Broadcast: "Cone of ucertainty" Typhoon can "recharge" its strength as it passes over the waters between the islands in the Visayas; Landfall Storm surge Fujiwhara effect and how northeast monsoon and high-pressure area affect the track of the typhoon Weather map symbols explained (lines and color)
Date	5 November 2013
Typhoon development	Typhoon
Government	PAGASA identifies typhoon strength NDRRMC (2013) reported that at least a day before Yolanda entered PAR, NDRRMC had started its preparations with the Local Disaster Risk Reduction and Management Councils DOST Secretary issues public warning: "Typhoon Haiyan, with gusts of up to 185km/h, was moving over the sea at 30km/h and may make landfall at mid-day on Friday in the central islands of Samar and Leyte, said Science and Technology Secretary Mario Montejo."

Media	*PDI* article on typhoon: Typhoon might cause a serious threat to the Visayas and Mindanao area; "it was too early to tell if Yolanda would become a super typhoon" "Cone of uncertainty" clarifying that more accurate predictions can be made when the typhoon enters PAR
Content	Government: Typhoon, gust strength Broadsheet: Wind strength, gustiness, speed, and forecasted track Serious threat but "it was too early to tell if Yolanda would become a super typhoon" "Cone of uncertainty"
Date	6 November 2013
Typhoon development	Yolanda entered PAR at midnight, already with a maximum sustained winds of 195 kph and gustiness of up to 230 kph; reaching 275 kph before the day ended
Government	PAGASA raises storm signal no. 4 over Leyte and Samar Emergency meeting of the NDRRMC headed by then Sec. Paquito Ochoa Jr. Regional and provincial governments issue disaster warnings over local radio stations Philippine Information Agency had also assisted in disseminating information about the typhoon to local authorities through tri-media DOST-led Project NOAH had issued warnings about the storm surge *Official Gazette* releases infographic (figure 1)[b]
Media	Forecasts and short features on: *TV Patrol* *State of the Nation* *News@1*
Content	Government: Storm surge Broadcast: Two forecasters explained how typhoon signal warnings should be understood as a reply to those who wonder why their areas received a typhoon signal but were still experiencing relatively fair weather Trivia about the origin of the name "Haiyan", and clarified that technically, PAGASA only uses three classifications of weather disturbances, and the term "super typhoon" is not one of them
Date	7 November 2013
Government	Army and police troops placed on red alert Pres. Benigno S. Aquino III makes televised public statement

Media	Yolanda on *PDI* and *PhilStar* banner headlines *PDI* publishes survival tips during typhoons given by the Philippine Red Cross, instructing readers on what to do before, during, and after a typhoon. *PDI* also publishes a brief article about PAGASA's public storm signals TV Patrol forecasts
Content	Government:[c] "Umabot na, at aabot pa, sa *storm signal number 4* ang lakas ng hangin sa ilang mga lugar dulot ng bagyong ito . . . *mas matindi ang hagupit* ni Yolanda kaysa kay Pablo." "*Nasa 600 kilometro po ang diameter* ng bagyong ito. Inaasahan pong *tatama si Yolanda sa mga probinsya ng Samar at Leyte simula mamayang hatinggabi.*" "Bukod sa inaasahang *bugso ng hangin, ulan, pag-apaw ng mga ilog, pati ang posibilidad ng pagdagsa ng lahar* sa mga pook malapit sa bulkan ng Mayon at Bulusan, mino-monitor din po natin ang banta ng mga *storm surge* sa mahigit isandaang mga pook. Matindi ang panganib ng storm surge sa Ormoc, Ginayangan Ragay Gulf sa Albay, at Lamon Bay sa Atimonan. Maaaring *umabot ng lima hanggang anim na metro ang taas ng alon sa mga lugar na ito.*" Broadsheet: Risk: effects of a Signal No. 4 typhoon, providing concrete examples such as "large trees uprooted" and "power and communication services severely disrupted" "7.5 to 20 ml (of rainfall) per hour" means "that a square meter container will have collected 7.5 to 20 liters of water after an hour of rain" Broadcast: Alon, gale warnings
Date	8 November 2013
Typhoon development	First landfall at 4:40 a.m. on Guiuan, Eastern Samar; final landfall on Busuanga, Northern Palawan by 8:00 p.m.
Government	PAGASA forecaster explaining that Yolanda's strong winds "can generate waves of up to 7 meters in coastal waters along its path"
Media	*PDI* published two stories about Yolanda on the front page President's message broadcasted in major media networks the day before (see previous discussion). The story quoted the President in informing the forecasted height of the storm surge, thus making this the first time the word "storm surge" was cited in all PDI's stories about typhoon Yolanda *PhilStar* story on preparations/preparedness

Content	Government: Strong winds "can generate waves of up to 7 meters in coastal waters along its path" Broadsheet: Satellite image of the typhoon, highlighting its strength and scope Storm surge
Date	9 November 2013
Typhoon development	Yolanda exits PAR

[a] Broadsheet/broadcast.

[b] See page 44 for the infographic.

[c] Emphasis added; see pages 46–47 for the English translation.