

Development Divides, Shared Disasters: Explaining Divergent Risk Communication Outcomes During The 2011 Great East Japan Earthquake and The Philippines' 2013 Typhoon Yolanda

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ABSTRACT: Effective disaster risk communication plays a critical role in reducing disaster impacts by enabling timely dissemination and interpretation of hazard information. Despite experiencing similar exposure to natural hazards, countries often demonstrate varying communication outcomes because of differences in governance, institutional capacity, and socio-economic development. This study examines how development influenced disaster risk communication by comparing Japan's response to the 2011 Great East Japan Earthquake and Tsunami and the Philippines' response to Typhoon Yolanda (Haiyan). Using a qualitative comparative case study design based on the Most Different Systems Design (MDSD), the study analyzed secondary data from government reports, peer-reviewed literature, and publications of international organizations. The Pressure and Release (PAR) Model served as the analytical framework for examining root causes, dynamic pressures, unsafe conditions, and disaster risk communication outcomes.

The findings reveal that Japan's higher level of development supported sustained investments in disaster risk reduction, early warning technologies, institutional coordination, and disaster education, resulting in faster dissemination of warnings, stronger public understanding, and greater trust in official communication. In contrast, although the Philippines established formal disaster risk management policies, persistent socio-economic inequalities, uneven institutional capacity, communication barriers, and limited public understanding reduced the effectiveness of warning systems during Typhoon Yolanda. The comparative analysis demonstrates that disaster risk communication outcomes are shaped by the interaction of governance, institutional preparedness, and social vulnerability rather than hazard exposure alone. These findings reinforce the PAR Model by illustrating how structural conditions influence communication effectiveness and highlight the importance of strengthening institutional capacity, community preparedness, and inclusive governance to improve disaster resilience in hazard-prone countries.

KEYWORDS: Disaster Risk Communication; Pressure and Release Model; Disaster Governance; Japan; Philippines; Comparative Case Study

I. INTRODUCTION

Natural hazards continue to cause human, social, and economic losses all around the world despite advances in early warning systems and technologies. Effective disaster risk communication is a must, especially now when disasters become increasingly complex. Disaster risk communication refers to the process of generating, disseminating, and interpreting hazard information to encourage preparedness. International frameworks like the Sendai Framework for Disaster Risk Reduction highlight that reducing disaster losses requires people-centered warning systems that integrate scientific information, governance mechanisms, and community engagement (UNDRR, 2015).

Japan and the Philippines provide a compelling basis for examining disaster risk communication, as both countries are located within the vicinity of the Pacific Ring of Fire and are both frequently exposed to natural disasters and hazards. Despite their similar exposure to disaster risks, the countries produce different communication outcomes during times of disaster. For Japan, it is constantly recognized for its advanced warning technologies, institutional preparedness, and high levels of public compliance. In the Philippines, it has experienced recurring challenges in translating scientific warnings into timely and effective community responses, especially during large-scale disasters such as the Super Typhoon Yolanda (Haiyan) in 2013. These dissimilar outcomes suggest that hazard exposure alone cannot explain the differences in disaster response.

Despite existing literature about disaster risk reduction and communication, most of the studies only examined Japan and the Philippines independently, focusing on national preparedness programs, technological warning systems, and community resilience mechanisms. There exists a limited comparative study that explored how the variations in development levels, governance

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structures, institutional capacity, and social factors shape the efficacy of disaster risk communication between Japan and the Philippines. With this, there lacks a better understanding of why countries that are exposed to similar hazards experience a significant difference in communication outcomes and levels of public response (Aldrich & Meyer, 2015; UNDRR, 2015).

To address this gap, the study compares disaster risk communication outcomes during the 2011 Great East Japan Earthquake and Tsunami and the 2013 Typhoon Haiyan in the Philippines through the lens of Vulnerability Theory. Moreover, the Pressure and Release (PAR) Model will be utilized (Wisner et al., 2004). The theory views disaster outcomes as shaped by social, economic, and political conditions that influence vulnerability and resilience and are not limited to the magnitude of hazards. Applying this theory allows the study to examine how the variations in institutional capacity, governance effectiveness, technological infrastructure, and social trust contribute to the divergent outcomes related to risk communication between the two countries (Fukuyama, 2013; Aldrich & Meyer, 2015).

The study specifically asks: How do governance structures and institutional capacity influence disaster risk communication outcomes in Japan and the Philippines? How do social capital, community participation, and cultural factors affect the interpretation of and response to risk communication? And in what ways do differences in development and vulnerability contribute to divergent disaster communication outcomes?

This study contributes to comparative disaster governance and disaster risk reduction-related research. By examining the connection between development, vulnerability, and the effectiveness of communication, the study provides insight that may assist policymakers, disaster management agencies, scholars, and local governments in further strengthening disaster risk communication strategies.

Furthermore, this study argues that differences in vulnerability conditions—particularly governance capacity, institutional preparedness, technological infrastructure, and public trust—significantly shape disaster risk communication outcomes more than hazard exposure alone. As argued by Wisner et al. (2004), Aldrich and Meyer (2015), and Fukuyama (2013), the success of disaster communication greatly depends on the broader institutional conditions that shape both vulnerability and resilience.

A. Vulnerability Theory

This study will be grounded in the theory of vulnerability, with specific focus on the Pressure and Release (PAR) model by Wisner et al. Vulnerability theory argues that disasters are not only caused by natural hazards but largely depend on social, economic, and political processes that dictate the exposure and ability to cope among individuals (Wisner et al., 2004). The hazards, according to the PAR model, overlap with vulnerable conditions, which are brought about by root causes, including limited access to resources, poor governance systems, and socio-economic disparities. Such underlying factors create dynamic forces such as poor infrastructure, poor institutional readiness, and lack of social awareness that eventually lead to unsafe conditions in communities.

The previous literature has used vulnerability theory to evaluate the disaster risk in various settings. For example, Aminuddin et al. (2017) utilized the PAR model to assess disaster vulnerability within Brunei and found that governance limitations, low community awareness and absence of institutional gaps played a key role in risk without taking into consideration available mitigation strategies. Similarly, Davis (2016) used the framework on rural communities in El Salvador and showed that structural vulnerability and weakness of coping mechanisms increased exposure to hazards. These studies support the argument that it is more a structural situation that defines the outcomes of disasters as opposed to hazards. With regard to the present study, the vulnerability theory will provide a sound framework to study how disparities in development, infrastructure and institutional capacity in Japan and the Philippines affect the efficacy of disaster risk communication.

Vulnerability theory is an important analytical tool in the context of this research in that it provides a critical framework on which to research the international inequalities between Japan and the Philippines. Although similar natural hazards are experienced in both states, differences in their vulnerability profiles can be explained by the divergences in economic development, infrastructure, and institutional capability. The existing literature on comparative disasters shows that more developed economies are generally characterized by lower vulnerability due to strong institutional risk systems, better infrastructure, and more effective risk governance (Pelling, 2003; UNDP, 2014). In particular, it has been proposed that Japan has high resilience to disasters due to long-term investments in disaster-risk mitigation, the incorporation of disaster education, and the institutionalized form of early warning systems to support information dissemination and high levels of public compliance (Shaw, 2014; World Bank, 2013).

Scholars in the Philippines, on the contrary, argue that socio-economic inequality, unbalanced spatial development, and local governance restrictions shape structural vulnerability (Kelman, 2010; Porio, 2011). These structural determinants hinder access to communication infrastructure, create differences in the flow of information, and lack the ability by communities to decipher and act on disaster alerts. An example of this can be given in research on urban vulnerability in Metro Manila, where it was found that the marginalized and informal settlements have high barriers to access to timely and intelligible risk information due to infrastructural inadequacies and socio-economic limitations (Porio, 2011). Also, global disaster-risk surveys show that developing nations often fail to make early warning systems effective for community responses through institutional fragmentation and lack

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of local capacities (UNDRR, 2015; World Bank, 2020). Therefore, vulnerability theory not only explains the dissimilar consequences of disasters, but it also provides an interpretative model to understand how structural factors affect accessibility of disaster-risk communication systems, their interpretation, and their effectiveness.

B. Disaster Risk Communication

Disaster risk communication has also evolved over the years, and it's a growing challenge in a more people-centered approach. However, despite the widespread emphasis on disaster planning and foresight, risk communication remains frequently a knot at the tail end of that process rather than being threaded throughout (Fakhruddin et al., 2020). The UNDRR, as the focal point of the UN system for disaster risk reduction, emphasizes that communication must not only inform but also inspire protective actions among individuals. In such cases, communication becomes more effective when it involves dialogues that interact with the community rather than technical transmissions where warnings are often disregarded.

C. Governance Structures and Institutional Capacity

Governance significantly influences disaster risk communication, particularly through its capacity to formulate and implement policies effectively during crises. Integrated governance structures lead to more consistent communication outcomes, as seen in Japan's centralized approach, contrasting with the decentralized system in the Philippines, which, while responsive to local needs, can create inconsistencies and hinder national capacity. This comparison demonstrates how different governance structures impact the effectiveness of disaster communication and responses at the community level.

D. Technology vs Human Response: Beyond the Alarm

Foreign studies emphasize the role of advanced technology in improving disaster communication. According to Basher (2006), effective early warning systems should not only be technologically advanced but must also be people-centered and understandable to the public. Likewise, Mileti and Sorensen (1990) argue that warning effectiveness depends on how well messages align with human behavior and decision-making processes.

However, local studies in the Philippines reveal that technological systems alone do not automatically result in effective public response. Studies following Haiyan found that warning dissemination was relatively successful, but message comprehension remained a challenge, particularly among communities unfamiliar with technical hazard terminology (Lagmay et al., 2015). This demonstrates the distinction between receiving a warning and understanding its implications.

The literature suggests that the effectiveness of disaster communication depends not only on technological capacity but also on how warning messages are understood, trusted, and acted upon. This highlights the importance of examining how vulnerability conditions influence the relationship between warning dissemination and public response.

E. Social Capital and Community-Based Communication

The social capital theory provides a useful perspective for understanding how communities process and act on risk information. Foreign literature, particularly that of Aldrich (2012), highlights the importance of social networks, trust, and shared norms in disaster response. Communities with stronger social capital are better able to disseminate information quickly and coordinate collective action.

In the Philippines, social capital exhibited a dual role during Typhoon Haiyan, facilitating community support but also causing delays in evacuation due to reliance on local information over official warnings. This highlights the predominance of bonding social capital, which, while helpful, can hinder effective risk communication. Conversely, Japan demonstrates a more effective use of linking social capital through regular disaster drills and strong community governance, enhancing the credibility and efficacy of official risk communications.

F. Trust, Culture, and Risk Perception: Belief and Behavior

Trust and cultural context are critical factors that shape how people perceive and respond to catastrophic occurrences. Slovic (2000) and Wachinger et al. (2013) show that people's decision to respond to disasters is greatly shaped by their level of trust in institutions. High levels of trust increase how people adhere to and follow evacuation orders and preparedness measures, while low trust leads to uncertainty, which eventually results in delayed response.

In the Philippines, cultural practices, including reliance on past experiences and informal communication, also influenced risk perception. Evidence from Typhoon Haiyan suggests that previous disaster experiences also influenced risk perception. In several affected communities, residents underestimated the threat posed by storm surges because they interpreted warnings through the lens of previous typhoon experiences, many of which had not produced similar levels of destruction (Lagmay et al., 2015). This highlights how prior experiences and local understandings of risk can influence the interpretation of official warnings. The literature suggests that risk perception is not purely based on objective information but is socially constructed through cultural norms, previous experiences, and levels of institutional trust. As a result, people exposed to similar hazards may respond differently depending on how they perceive the credibility of warnings and the institutions delivering them.

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II. METHODOLOGY

This study adopts MDSD, or Most Different Systems Design, within the framework of a qualitative comparative case study. MDSD is appropriate because Japan and the Philippines significantly differ when it comes to economic development, governance structures, institutional capacity, and technological advancements. However, despite having these differences, both countries remain highly vulnerable to natural hazards due to their geographic location within the Pacific Ring of Fire. By comparing the two cases, MDSD will aid in identifying the factors responsible for the variations in outcomes (Przeworski & Teune, 1970).

Moreover, a qualitative comparative case study design will facilitate an in-depth examination of disaster risk communication within real-world contexts (Mills, Durepos and Wiebe, 2010). With this, the study examines how the differences in governance, institutional capacity, vulnerability, and communication systems shape the outcomes of disaster risk communication in Japan and the Philippines.

The study will focus on two major disasters. The 2011 Great East Japan Earthquake and Tsunami and the 2013 Typhoon Yolanda, a.k.a. Haiyan, in the Philippines. These two events were selected as they resulted in extensive documentation and studies and tested the effectiveness of modern disaster risk communication systems.

Ultimately, the findings of the study will be analyzed through the lens of the Vulnerability Theory: Pressure and Release (PAR) Model by Wisner et al. (2004). The PAR Model explains disaster outcomes as the interaction between natural hazards and socially produced vulnerabilities. By emphasizing how root causes, dynamic pressures, and unsafe conditions shape a society's capacity to prepare, interpret, and respond to the risks brought by disasters (Wisner et al., 2004).

A. Case Selection Justification

The cases were selected because Japan and the Philippines significantly differ in their respective country profiles, but both countries experience frequent natural hazards and have established disaster risk reduction systems. With these factors, MDSD significantly fits the study.

In Japan, the 2011 Earthquake and Tsunami represent a case where advanced technological warning systems, institutional preparedness, and public compliance played a huge role in disaster response. In the Philippines, the 2013 Typhoon Yolanda highlights challenges in risk communication, specifically about the interpretation of storm surge warnings, local government capacity, and public understanding of hazard information. By utilizing these events as the basis of the study, an examination of how the different structural and institutional contexts influence disaster risk communication outcomes will commence.

B. Data Sources

The study will rely entirely on secondary sources. The data needed will be collected from official government documents, international organization reports, peer-reviewed journal articles, and disaster assessment reports related to the selected cases. Verified secondary sources are selected as they provide reliable information regarding disaster preparedness, communication systems, governance structures, and disaster response outcomes.

C. Operationalization Through the Pressure and Release (PAR) Model

The study operationalizes vulnerability with the three dimensions of the PAR Model (Wisner et al., 2004):

1. **Root Causes**—This identifies the underlying pressures that contribute to disaster risk, such as social, economic, and political structures.
2. **Dynamic Pressures**—This pertains to the immediate and direct triggers of disaster, which ultimately translate root causes into specific vulnerabilities.
3. **Unsafe Conditions**—These are the vulnerabilities that make people and communities susceptible to disaster.
4. **Disaster Risk Communication Outcomes** - The effectiveness of disaster risk communication will be assessed through: the speed and reach of warning systems, clarity of risk messages, public understanding of warnings, trust in institutions, and community response and preparedness.

D. Limitations

The study acknowledges several limitations, including the complete reliance on secondary data, which may constrain the availability of specific indicators. Also, the study focuses on two disaster events only, which may limit the generalizability of the findings to other disaster contexts. Moreover, while the comparative design allows the interpretation of patterns and explanations, it still cannot establish definitive causal relationships between vulnerability factors and disaster risk communication outcomes

III. RESULTS & DISCUSSIONS

A. Japan: 2011 Great East Japan Earthquake and Tsunami

The Great East Japan Earthquake & Tsunami occurred when a magnitude 9.0 earthquake struck off the Pacific coast of the Tōhoku region of Japan on 11 March 2011, followed by a massive tsunami. It was one of the most severe disasters in Japanese history, with over 19,000 confirmed dead and missing persons, severe damage to infrastructure, and the accident at Fukushima

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Daiichi Nuclear Power Plant (Cabinet Office of Japan, 2012; National Police Agency of Japan, 2012).

The Basic Act on Disaster Management serves as a guide to the disaster risk management system of Japan, which sets out a coordinating governance framework with the Cabinet Office, the Central Disaster Management Council, Japan Meteorological Agency (JMA), prefectural governments, and municipal authorities (Cabinet Office of Japan, 2015). The JMA is responsible for the monitoring and warning function for hazards using cutting-edge technologies such as the nationwide Earthquake Early Warning (EEW) system and the tsunami warning system. In case of emergency, official warnings are issued via several means, including TV, radio, mobile phone notification, the J-Alert system, and local PA systems, and sent out promptly to disseminate hazard information as rapidly as possible (Japan Meteorological Agency, 2021).

Disaster preparedness is further strengthened by regular evacuation drills, disaster education and community-based preparedness programs, which are one of the long-term efforts of the country in disaster risk reduction (Shaw, 2014). However, the earthquake and tsunami in 2011 were far greater than envisaged in current hazard assumptions, causing widespread devastation and highlighting the issues in the disaster management of complex and cascading disasters in extreme environments (Funabashi & Kitazawa, 2012).

i) Root Causes

In the Pressure and Release (PAR) Model, root causes are the general political, economic, and institutional contexts under which a society is vulnerable, prior to the occurrence of a hazard (Wisner et al., 2004). The results show that the country's high level of economic development and governance substantially mitigated structural vulnerability, as it allowed continuous investment in DRR, scientific research, and institutional preparedness in the case of Japan. These chronic conditions created a context where disaster risk communication became part of the nation's governance processes and not just emergency response tools that are deployed only during disasters. The continued economic growth of Japan enabled the fiscal means to establish disaster preparedness on various levels of government. After the Great Hanshin-Awaji Earthquake in 1995, the national government launched a number of measures to reinforce disaster management institutions, amend disaster management laws, and increase investments in seismic monitoring and communication technology (Cabinet Office of Japan, 2015). These reforms were based on a change in approach to disaster governance, which now embraces a proactive approach, acknowledging that effective communication and shared decision-making must occur at the right time to minimize disaster losses. The modernization of the observation network of the Japan Meteorological Agency (JMA) by continuous public investment has led to the transmission of earthquake detection and warning information within seconds of detection (Japan Meteorological Agency, 2021).

Japan also has a well-developed disaster communication capability, with institutional coordination. The roles and responsibilities in disaster management are well defined between the Cabinet Office, the Japan Meteorological Agency, prefectural governments, municipalities, and emergency response agencies. While local governments make evacuation decisions, there are national institutions that offer standardized monitoring of hazards, technical guidance and communication procedures that promote speedy information exchange between various levels of government (Cabinet Office of Japan, 2015). These institutional arrangements lowered uncertainty in the dissemination of warning messages as agencies were pre-structured in legal terms and had pre-established operational procedures before the disaster.

The results further indicate that governance capability was not confined within formal structures, but existed in the process of incorporating disaster education into social life. Preparations for disasters have been an ingrained part of the Japanese educational system, at work and in the community. An annual nationwide exercise on Disaster Prevention Day (DP Day), which took place on September 1, introduces citizens to the evacuation and emergency warning methods (Shaw, 2014). Frequent contact with disaster education raised awareness among the public regarding the channels of official communication and lowered their risk of ignoring or misunderstanding disaster warnings in the event of an actual hazard. Public confidence in scientific institutions and government agencies in charge of hazard monitoring was also a structural condition that lowered vulnerability. Previous studies suggest that when in an emergency, compliance with protective measures is enhanced and the strength of official warnings is bolstered by institutional trust (Aldrich & Meyer, 2015). The Japan Meteorological Agency (JMA) has long been trusted, and the country has continually invested in disaster science, leading to high trust in official hazard information in Japan. This institutional legitimacy increased the effectiveness of DR communication as warning messages were perceived as more credible sources of information than questioned by the public.

In this light, Japan's underlying causes were identified by conditions that lowered, not raised, its structural vulnerability, as seen from the PAR Model. The disaster risk communication environment was favorable prior to the Great East Japan Earthquake and Tsunami in 2011, as a result of stable governance, sustained investment in economic development, continuity of institutions, and high public confidence in them. While these factors were not enough to remove the physical hazard, they contributed to the country's ability to efficiently produce, distribute, and process risk information. The situation in Japan is therefore relatively less communication vulnerable, compared to other countries with relatively weak institutional capacity and governance.

ii) Dynamic Pressures

Consistent with the Pressure and Release (PAR) Model, the dynamic pressures are the institutional and social processes that

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transform structural conditions into the immediate vulnerabilities prior to a disaster (Wisner et al., 2004). The results show that in Japan, these pressures were significantly reduced through long-term investments in disaster risk reduction, communication systems and ongoing public awareness campaigns. Such actions helped to communicate hazard information quickly and helped the public identify and act on official warnings. The nationwide implementation of the Earthquake Early Warning (EEW) system by Japan Meteorological Agency (JMA) was one of the contributing factors that reinforced the disaster communication system in Japan. The EEW was officially opened for operation in 2007 and is constantly monitoring seismic activity via a wide network of observation stations across the country and automatically triggering warnings when an earthquake is detected. The system has been broadcasting alerts to television and radio broadcasting stations, mobile phones, transportation companies, schools, and emergency management organizations within seconds of the arrival of the first earthquake waves during the great East Japan earthquake on 11 March 2011 (Hoshiba & Iwakiri, 2011; Japan Meteorological Agency, 2021). While the warning time for communities depended on the distance from the epicenter of the earthquake, the system proved useful in giving precious seconds to communities and institutions that could take immediate protective measures before the arrival of the stronger ground shaking. Institutional preparedness also helped in communication, providing clearly defined procedures for disaster response agencies before the earthquake. The Basic Act on Disaster Management explicitly tasks national ministries, prefectural governments, municipalities and disaster management response organizations with specific duties, and enables the transfer of hazard information between various administrative levels to flow smoothly (Cabinet Office of Japan, 2015). Agencies were not burdened with institutional uncertainty with regard to the roles and responsibilities for communicating evacuation advisories, emergency response, and public information, as these were already established by law and in disaster planning. The coordination helped to minimise decision-making delays and enabled official warnings to be rapidly disseminated across the affected areas. Communication-related vulnerabilities were also mitigated by public preparedness. For a long time, disaster education has been included in the school curriculum, on-the-job safety training, and community-based disaster management activities in Japan. Citizens knew what to do and how to respond when disaster struck, and were well informed on emergency warning signals, evacuation routes, and recommended protection measures through regular earthquake drills (Shaw, 2014). This 24-hour exposure to preparedness activities helped many residents identify warnings by the authorities and act accordingly with little delay. Repeated disaster education has been found to enhance hazard awareness and adherence to evacuation information in the past, as people get familiar with the content and trustworthiness of official information, including both what is being said and how it is being said (Paton, 2013).

However, the Great East Japan Earthquake highlighted a number of dynamic pressures which tested disaster communication. The earthquake was so large that it caused an unprecedented tsunami that was greater than many hazard assumptions, which meant that there was less time for evacuation in several coastal communities. In a few locations, the tsunami inundation exceeded the previously defined hazard zones, so that the evacuation decisions were based on the earlier defined hazard zones rather than the actual tsunami inundation (Suppasri et al., 2013). The situation has shown that even if the warning systems are technologically advanced, the communication systems are still limited when the characteristics of the hazards are above the planned scenarios. This is especially noticeable in the case of communication problems during the Fukushima Daiichi Nuclear Power Plant accident. Conflicting information from official announcements and changing scientific evaluations created a lack of confidence in the communities affected by the nuclear disaster on evacuation procedures and radiation risks (Funabashi & Kitazawa, 2012). While the warnings from earthquakes and tsunamis were transmitted quickly, risk communication for the nuclear emergency was complicated by the need to deal with an unfolding technological disaster and uncertainty in scientific information. This experience confirms that preparedness of institutions can vary by hazard type and that preparing for effective disaster communication requires the capacity to deliver timely, clear, and credible information in fast-changing situations.

Strong institutional readiness, cohesive government, and programmatic public education notably softened the dynamic pressures in Japan as seen through the PAR Model. These circumstances allowed for widespread, rapid dissemination of hazard information to the public and allowed the possibility of an accurate interpretation of official warnings. However, the tsunami's unprecedented scale and the complexity of the Fukushima nuclear accident demonstrated that even sophisticated disaster communication systems are fragile when faced with circumstances that fall outside of historic planning scenarios and expectations or when there is a need to communicate uncertainty in the face of quickly changing circumstances.

iii) Unsafe Conditions

Japan's disaster risk reduction systems were well developed prior to the 2011 Great East Japan Earthquake and Tsunami, but the findings show that there were still some vulnerabilities. The conditions show how well institutions are prepared can significantly lower disaster risk, but with hazards that are more intense than planners have assumed, institutional preparedness cannot fully remove people's exposure to disaster risks. The world's most dangerous situation was the clustering of settlements and critical infrastructure along the northeastern coast of Japan. The economic reliance on fishing, maritime commerce, and port-related industries led to the development of many municipalities around the coastal areas of the Tōhoku region. Coastal development has contributed to the livelihoods of the local people, but has also raised their risk to tsunamis. In many places, the

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tsunami waves caused by the magnitude 9.0 earthquake exceeded 10 meters in height, and in some coastal communities, more than 30 meters in height; entire residential areas, transportation networks, and public facilities were rapidly inundated (Mori et al., 2011). In spite of timely warning of the Tsunami, these physical conditions restricted the evacuation opportunities.

The disaster also highlighted the weaknesses of present hazard assessments. Coastal protection works such as seawalls and breakwaters had been planned based on past tsunami magnitude and frequency estimates. Many engineering assumptions about the tsunami were surpassed by the events of 2011, which overtopped or even destroyed coastal defenses that communities long believed to be protective (Suppasri et al., 2013). In some municipalities, the hydro zones and flood hazard maps underestimated the flood inundations, and evacuation routes and shelters were inundated. The results indicate that warning propagation speed is not the only factor influencing the effectiveness of the communication, but also that the accuracy of hazard assessment influencing public evacuation planning is important. Such vulnerability during the disaster was also due to Japan's demographic profile. The relatively high proportion of elderly (aged 65+) in many of the communities worst hit by the tsunami was in keeping with the overall demographic situation in rural Japan. Individuals aged 65 and over sometimes needed more time and support to evacuate due to limited mobility and physical needs. Older people were more likely to be among the victims in the tsunami, and the analysis of post-disaster mortality showed that demographic factors played a role in the effectiveness of evacuation even in areas where the warnings were received (National Police Agency of Japan, 2012; Aldrich, 2012). The results show that successful evacuation is not possible when an individual's ability to respond is restricted by their physical capacity, and that effective communication is insufficient.

The disaster was cascading, creating another unsafe condition. The Fukushima Daiichi Nuclear Power Plant accident was a result of the tsunami and was a more complicated emergency than just the earthquake and tsunami. In some areas, it was difficult to carry out the emergency response due to damage to the critical infrastructure such as transportation systems, electricity networks, and communication facilities, which hindered information dissemination (Funabashi & Kitazawa, 2012). The residents had to respond to changing information on tsunami hazards and radiation risks, causing additional confusion in the evacuation and recovery process. Multiple hazards occurring at the same time illustrate how complex disasters can be in terms of how much strain is placed on the communications systems.

As seen in the PAR Model, these unsafe situations were more related to the physical exposure, the demographic characteristics, and the unprecedented scale of the disaster rather than institutional weakness. Rapid dissemination of hazard information was attributed to the structure of Japan's government, and the vast scale of the earthquake and tsunami put even highly developed disaster management systems to the test. The results suggest that communication vulnerability reduction needs to be continuously reassessed in terms of hazard assumptions, adjustment to demographic changes, and planning for complex disasters that are beyond the traditional emergency disaster scenarios.

iv) Disaster Risk Communication Outcomes

The results show that Japan has relatively achieved good disaster risk communication outcomes in the Great East Japan Earthquake and Tsunami in 2011 due to its strong institutional capacity and preparedness for integration of warning systems into disaster risk management systems and long-term investment in disaster preparedness. The synergy of these factors allowed for the speedy dissemination of official hazard information, "decoding" by the public, and implementation of protective action in numerous affected communities. However, this unprecedented disaster also highlighted some weaknesses that affected the effectiveness of communications in certain situations. The disaster communication system in Japan was very efficient in terms of speed and extent of warnings disseminated. Railway companies, mobile phone companies, local governments, emergency management agencies, television and radio broadcasters were able to receive and disseminate an Earthquake Early Warning (EEW) almost instantaneously after the initial seismic waves were detected by the Japan Meteorological Agency (JMA) (Japan Meteorological Agency, 2021). The second stage involved the dissemination of warnings via a variety of media sources, such as television, municipal loudspeakers, satellite communication systems, and the nationwide warning system, J-Alert, so that even if some communication channels were affected, the residents received official warning messages. The second stage was the dissemination of warnings via a variety of communication media - the television, the municipality's loudspeaker, satellite communication networks and the nationwide warning system, J-Alert - so that even if some communication channels were disrupted, the residents received official warning messages. The multiple dissemination pathways enhanced the robustness of the communication network, because in case of emergency it would not be so vulnerable to a single source of information.

Effectiveness of the communications was also aided by the clarity and consistency of official warning messages. The following alert categories and communication protocols are used throughout Japan by the Japan Meteorological Agency (JMA) to ensure that the hazard information is delivered in a format that is familiar to both emergency responders and the general public (Japan Meteorological Agency, 2021). The use of a uniform and consistent terminology eliminated confusion and enabled a coordinated response among government agencies. But the scale of the Tsunami was unprecedented too, and it was also seen that the clarity of the message is related to the accuracy of the information available to the science community. In several coastal regions, initial estimates of the tsunami hazard are based on limited seismic data immediately following the earthquake, so initial tsunami

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forecasts underestimated the wave heights in these areas (Suppasri et al., 2013). As other forecasts were updated, some residents were already making evacuation decisions based on earlier warnings. The results indicate that, despite being well developed, communication systems are limited when hazards evolve quickly and beyond the initial scientific assessments.

Japan's long history of disaster education helped to build public awareness of disaster warnings. Preparations for earthquakes are integrated into school curricula and workplace safety preparations and are part of community-based disaster management initiatives; residents are informed on official alert and emergency signals and procedures through regular evacuation drills before disasters happen (Shaw, 2014). These ongoing preparedness activities helped to raise awareness of earthquake and tsunami warnings in the 2011 disaster. However, knowledge of sheltering did not always lead to availability of shelter to evacuate. Some residents' risk perception was affected by their previous experiences of smaller tsunami events and their confidence in tools for coastal protection, which resulted in delays in evacuation even after official warnings were issued (Suppasri et al., 2013). This illustrates that, while the successful transmission of the information is important for the communication outcome, the interpretation of risk plays a role as well in the individuals' experience and their local situation.

Institutional trust also contributed to facilitating disaster risk communication. The Japan Meteorological Agency (JMA) has gained a significant scientific trust rating, and this helped increase public trust in the earthquake and tsunami warnings at the outset of the disaster (Aldrich & Meyer, 2015). The scale of institutional trust led many to view official warnings as trustworthy information for taking protective measures. But public confidence has become more complicated in the case of the Fukushima Daiichi Nuclear Power Plant accident. Information on evacuation plans and health risks, as determined by scientific evaluations of radiation exposure, varied over time, resulting in uncertainty in the affected communities (Funabashi & Kitazawa, 2012). The nuclear incident has taught that institutions' credibility should be upheld by transparent and timely communication, especially in the case of uncertainty when events change quickly.

In general, the disaster risk communication outcomes in Japan can be attributed to the combined effects of robust governance, institutional readiness, and ongoing public education efforts. Conditions that allowed for the rapid dissemination of warning messages, relatively high public understanding of the message, and the translation of a warning to protective action in many communities. Concurrently, the effectiveness of communication has been shown to be vulnerable in the face of unprecedented hazards, characteristics of the population, and cascading disasters that bring additional modes of uncertainty. In a Pressure and Release Model perspective, the results show that the outcome of DRM is not only affected by technological capacity but also by how the properties of the hazard change over time and interact with the capacity of the institution.

B. Philippines: 2013 Typhoon Yolanda (Haiyan)

The Philippines is one of the countries most prone to natural disasters and the adverse impact of climate change. The country relies on robust institutional frameworks for disaster management. The foundational legal instrument governing this sector is the Philippine Disaster Risk Reduction and Management Act of 2010, a.k.a. R.A. 10121. This agency aims to uphold the people's constitutional rights to life and property by addressing the vulnerabilities and strengthening institutional capacity for DRRM (Official Gazette of the Republic of the Philippines, 2010).

The year 2013 significantly marked Philippine history when it comes to disasters. Super Typhoon Yolanda—one of the strongest typhoons ever recorded in history—struck the country, leaving over 35.528 billion pesos in damage and 3.6 million people displaced (Ilagan, 2019).

Because communication and connectivity are critical lifelines during calamities, Cisco's Tactical Operations (TacOps) team came in. The team's mission is to provide secure, IP-based, deployable networking and communications solutions during crises in which normal infrastructure has been destroyed. The team's deployment and expertise in mobile networking technology during Typhoon Yolanda were deemed instrumental in connecting disaster zones to the outside world, ensuring that food, water, and medical care reached the affected communities as quickly as possible (Cherney, 2015).

i) Root Causes

In the lens of the PAR Model, communication-related challenges observed during Yolanda were caused by several structural vulnerabilities. Despite having an institutionalized disaster risk reduction and management agency, entrenched socioeconomic inequalities and uneven regional development significantly shape access to resources, information, and communication systems. In Eastern Visayas, a region known for most of its communities being located in coastal and low-income areas, which was the center of the typhoon, it faced huge barriers in accessing timely information and preparedness resources compared to the other regions in the Philippines, making it increasingly vulnerable to disaster impacts.

Studies suggest that the degree of vulnerability is produced through unequal access to communication systems and public infrastructure. Moreover, it was argued that disaster communication is experienced in various ways and not in a uniform manner. It is shaped by access to the media, relationships with local government institutions, and infrastructural inequalities (Guyton, 2021). In the post-Yolanda era, these inequalities became much more evident as many residents only relied on limited communication channels and experienced difficulties in accessing factual and timely information. Under these conditions,

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vulnerability was reinforced by differences in access to communication and institutional support.

The humanitarian response after Yolanda showed how communication played a crucial role and how it became a form of aid. According to the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), the destruction from Yolanda displaced and disrupted the communities' access to information—information that would help them survive during that time. The disruption of communication systems showed the weaknesses of vulnerable communities in accessing, interpreting, understanding, and acting upon critical information during crises.

Moreover, even though RA 10121 provided a mechanism for disaster preparedness and response, its implementation varied, as government capacity is different across local government units. Main differences revolved around access to resources, technical expertise, organizational capacity, and manpower. These factors significantly influenced the efficacy of the implementation and preparation of disaster risk reduction programs (UNDP, 2015). Consequently, the root causes of vulnerability experienced during Typhoon Yolanda were mostly embedded within the socioeconomic, infrastructural, and institutional conditions that shaped disaster risk communication outcomes.

ii) Dynamic Pressures

During Typhoon Yolanda, dynamic pressures were evident in the limitations of information dissemination and disaster education, communication, and preparedness. One of these is the public's limited understanding of hazard information. This was noted in the study made by Guyton (2021), wherein the residents of San Jose, Tacloban City, stated, "We did not know we would be swimming." This demonstrates citizens' limited understanding of the risk that was about to come.

Before the devastating landfall of Typhoon Yolanda, government agencies such as the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) and the National Disaster Risk Reduction and Management Council (NDRRMC) significantly issued weather advisories and storm surge warnings to the communities deemed vulnerable to the impact of the typhoon. However, even though these warnings exist here and there, many residents saw "storm surge" as a stranger (Lagmay et al., 2015). They were unfamiliar with it, resulting in the underestimation of the risks and delayed evacuation plans. This suggests that the challenge was not just about the absence of information but was about the inability to understand and interpret risk warning messages.

These challenges in communication show that there is a broader issue in disaster preparedness and public risk education. The effectiveness of disaster communication greatly depends on the communities' ability to understand, interpret, and act upon warning messages. It only becomes effective when information is disseminated through meaningful narratives—ones that can be easily understood by the locals (Lejano et al., 2022). Usage and reliance on technical terms without an understandable explanation hinders the public's ability to interpret warnings and translate them into protective actions.

Additionally, disparities in local preparedness and institutional capacity shape the efficacy of disaster communication. Because communities differ in terms of accessibility to preparedness programs, risk education, and communication systems, some communities are better equipped to understand and respond to risk warnings compared to others. It was further emphasized by Fakhruddin et al. (2020) that risk communication should be seen as a continuous process integrating scientific information with the public's understanding and trust. If this process becomes stagnant or weak, the spread of warning messages may fail to achieve its intended purpose.

Furthermore, the accessibility of information is also seen as a significant dynamic pressure during and after the disaster. According to the research (Guyton, 2021), it was noted that communication systems are shaped by social and infrastructural inequalities that affect how information is disseminated and interpreted. After Typhoon Yolanda, disruptions in communication systems further complicated the flow of information between the affected communities, government agencies, and humanitarian organizations. These challenges further supported the vulnerabilities already faced by the citizens—the inability to interpret and respond to warning messages.

Ultimately, Typhoon Yolanda revealed that these dynamic pressures in disaster risk communication were shaped not just by institutional and technological deficiencies but by the inability of the public to understand, prepare, and access information.

iii) Unsafe Conditions

Intense disaster impacts were mostly caused by socioeconomic vulnerabilities. In Eastern Visayas, many households rely on fishing and agriculture for their livelihoods, which are both sensitive to environmental disruptions. Widespread destruction brought by the typhoon significantly affected income-generating activities and weakened community resilience. Most studies about Yolanda found that the restoration of livelihoods, access to basic services, and constrained efforts for poverty alleviation remained a huge challenge even years after the disaster. This shows how the entrenched socioeconomic conditions shape every recovery outcome (Eadie et al., 2020).

Because of the long-standing poverty incidence in the Philippines, most of the Filipinos settle for poorly constructed houses, increasing their vulnerabilities to typhoons and other disasters. More than a decade after the typhoon, housing reconstruction programs continued emphasizing the importance of having a resilient house plan for a stronger foundation that can withstand disasters, which reflects the extent to which inadequate housing conditions amplified Yolanda's impact (Gabieta, 2025). In a

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similar sense, it was noted by Ahmed and Guyton (2024) that housing recovery remained a long-term challenge for the survivors, emphasizing the continuing importance of safe and resilient housing to reduce impact vulnerabilities.

Moreover, unsafe conditions were further emphasized by communication-related vulnerabilities. The destruction of telecommunication towers and infrastructure also disrupted the flow of messages from one point to another, from the affected communities to the government agencies and to other humanitarian organizations. Most of the residents in the affected areas relied only on limited communication channels, which affected their ability to receive updates and assistance and make informed decisions. These hindrances reduced the effectiveness of risk communication, which further led to increased community vulnerability during and after the typhoon.

Collectively, these unsafe conditions show that the impacts brought by Yolanda were not only limited to the degree of hazard exposure but were instead shaped by the interaction of physical exposure, vulnerable housing conditions, scarcity of livelihood, and communication barriers that resulted in the inability of the communities to prepare, withstand, and recover from the impacts of the disaster (Ahmed & Guyton, 2024; Eadie, et. al., 2020).

iv) Disaster Risk Communication Outcomes

The disaster risk communication outcomes brought by Typhoon Yolanda showed both the strengths and weaknesses of the Philippine disaster communication systems. Even before the landfall, government agencies such as PAGASA and NDRRMC already released warning messages, especially to the communities deemed vulnerable. With this, it shows that government agencies already utilized formal communication systems to disseminate hazard information, making it already available to the public before the disaster occurred (Lagmay et al., 2015).

But it did not necessarily mean that the government agencies' warning messages were immediately absorbed by the people, it is still up to them to take an effective public response. One of the most notable challenges faced was the people's limited understanding of the term "storm surge." Even though warnings were issued days before the landfall, many residents were unfamiliar with the concept, which resulted in the underestimation of the dangers brought by the disaster. This resulted in delayed evacuations and increased casualties (Lagmay et al., 2015).

Furthermore, the ability to interpret warning messages measures the effectiveness of disaster communication. Noting Lejano et al. (2022) again, risk communication only becomes effective when it is framed in locally meaningful narratives that the intended audience can easily understand and relate to. Heavy reliance on technical terminologies was prominent during Yolanda, which limited the public's ability to comprehend and contextualize warning messages. This shows that the efficacy of communication is not just solely about the dissemination of information but also about the public's ability to understand it and translate it into protective actions.

Another factor that shapes the condition of communication outcomes is trust and social networks, wherein social capital influences how warning messages are shared, trusted, and acted upon within the communities (Aldrich and Meyer, 2015). Residents initially relied on family members, neighbors, and informal community networks when making decisions about evacuation and preparedness in most cases. Although these sources of information or networks provide support and guidance, they can also generate existing perceptions of risks that contrast with the official advisories and warnings.

Challenges in communication are not only experienced during or immediately after the disaster but are still being felt long after that. As previously stated, the destruction of communication systems also destroyed communication flows from one point to another. According to the United Nations Office for the Coordination of Humanitarian Affairs (2014), access to timely and reliable information became critical, as it is one of the things needed for the victims to survive during the response and recovery phases. This disruption of communication further limited the communities' access to assistance and communication of urgent needs.

Looking through the PAR Model, the outcomes of the disaster risk communication during Typhoon Yolanda were largely shaped by the interaction of the root causes, dynamic pressures, and unsafe conditions, which eventually influence how the information is disseminated, comprehended, trusted, and acted upon. The case of Typhoon Yolanda's devastating landfall in the Philippines suggests that in order for effective disaster communication to occur, it requires not just technological and institutional capacity but also public understanding, trust, and accessible communication systems that would help the communities translate risk warning messages into protective actions.

C. Comparative Matrix

Country	Root Causes	Dynamic Pressures	Unsafe Conditions	Disaster Risk Communication Outcomes
Japan	Strong economy, effective governance, continuous investment in disaster preparedness, and widespread disaster	Advanced early warning systems (EEW), regular evacuation drills, hazard mapping, and coordinated emergency	Coastal communities exposed to tsunamis, aging population, underestimated tsunami height, and	Warnings were disseminated quickly and widely. High public awareness and trust in government supported

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	education.	response.	the Fukushima nuclear accident.	timely evacuation, although the scale of the disaster created communication challenges.
Philippines	Uneven economic development, limited resources, regional inequalities, and varying local government capacity despite Republic Act No. 10121.	Early warnings from PAGASA and NDRRMC were issued, but limited disaster education and misunderstanding of "storm surge" reduced their effectiveness.	Poverty, vulnerable housing, dependence on climate-sensitive livelihoods, and damaged communication infrastructure after Typhoon Yolanda.	Warnings reached many communities, but limited public understanding, damaged communication systems, and unequal access to information delayed evacuation and reduced the effectiveness of disaster communication.

The comparison between Japan and the Philippines was predicated with the Most Different Systems Design (MDSD) that looks at cases that are significantly different in terms of socio-economic and institutional characteristics but are similar in terms of phenomenon. While both countries have different degrees of economic development, governance frameworks, technological capabilities and institutional preparedness, they are highly vulnerable to natural disasters due to their location in the Pacific Ring of Fire, and have both suffered major disasters that demanded a significant amount of DR communication. The study contrasts these two cases to isolate the impact of development on disaster risk communication outcomes (while controlling for the common context of high disaster exposure). The Pressure and Release (PAR) Model offers a further comparison by presenting the elements of root causes, dynamic pressures and unsafe conditions that affected communication outcomes in each country.

The driving force of Japan's ability to develop financially can be linked to the success of funding projects for disaster risk reduction, scientific inquiries, and the widespread use of the latest technologies used for early warning of disasters, as well as the customs associated with instruction of the population at issue. Seismic activity monitoring systems, along with the network of emergency communication, were significantly upgraded after natural disasters like the Great Hanshin earthquake in 1995 (Cabinet Office of Japan, 2015). In contrast, the experience of the Philippines demonstrates that although the country established a legal basis for disaster management through the Republic Act No. 10121, not a single local government unit is able to develop the required communication capacity. Factors that determine the difference in regions of the Philippines include differences in economic potential, including financial means, technical resources, and communication infrastructure; social well-being of the population of particular areas, and constant unequal social development of regions (UNDP, 2015; Guyton, 2021). The results of the research prove that there is a contradiction in the ecological policies of the countries mentioned above, as both have the capacity for the application of disaster risk reduction, but their development levels differ.

The comparison indicates the significant disparity in the dynamic pressures. Japan's disaster communication strategy has been improved through meticulous public education, timely evacuation drills, hazard mapping, and the employment of the Earthquake Early Warning (EEW) by the Japan Meteorological Agency. This ensures efficient timing for the delivery of warnings and public understanding of disaster processes to cope with such threats. On the other hand, Philippine entities like PAGASA and NDRRMC have also released announcements concerning the weather conditions and storm surge warnings before Typhoon Yolanda arrived (Lagmay et al., 2015). Nevertheless, the impact of warnings was lessened as many of the residents were not informed about the term storm surge, which caused misunderstanding of the threat and delay in evacuation. This comparison demonstrates that the dissemination of warnings per se cannot ensure successful disaster communication; information must be understandable, relevant to the local population, and supported by organized disaster education.

The differences can also be seen in terms of unsafe conditions. While Japan had advanced disaster preparedness mechanisms, there were vulnerabilities because the tsunami went beyond the scope of many engineering assumptions and affected vulnerable coastal populations, including regions occupied by older populations, which further complicated evacuation efforts. In contrast, unsafe conditions in the Philippines were determined by long-standing socio-economic issues such as high poverty rates, poor housing, reliance on climate-dependent livelihoods like fishing and farming, destruction of telecommunications infrastructure, etc. The massive destruction of telecommunications facilities led to communication problems among affected communities, the government, and aid organizations, which restricted access to life-saving information needed during planning and recovery.

These structural disparities ultimately influenced the effectiveness of disaster risk communication. For instance, in Japan, disaster communication was effective owing to not only the advanced technological backup but also strong institutional coordination, public disaster awareness, and trust in the authorities. As a result, the official warnings were understood and processed into timely actions, despite the fact that the unprecedented tsunami caused massive casualties and destruction. However, in the case of the Philippines, even formal warning systems did not guarantee a successful public response. In particular, though the official warnings were received in a timely manner, poor public knowledge of the risk information, different levels of access to the means

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of communication, damaged infrastructure, and reliance on informal local networks affected the understanding of the message (Lagmay et al., 2015; Aldrich and Meyer, 2015). Therefore, such failure to react in a timely manner led to more severe consequences.

The results from the comparative analysis reveal that while Japan and the Philippines have experienced different levels of success in disaster risk communication, this phenomenon can be attributed to levels of development. Japan has made advancements in governance, technology, institutional preparedness, and disaster education that helped improve various parts of disaster risk communication. In the Philippines, structural social inequality, overall institutional capacity, and communication barriers have led to less functional warning systems. Overall, this conclusion supports the argument promoted by the PAR Model that disaster results are more determined by social vulnerability than the hazard itself (Wisner et al., 2004).

D. Synthesis of Findings

According to the findings of this comparative research, the results of disaster risk communication are influenced not just by the presence of warning systems, but by factors such as the development conditions that underpin creation, communication, understanding, and response to disaster-related information. The study utilizes Most Different Systems Design (MDSD), where Japan and the Philippines are compared and analyzed in terms of their different social, economic, and governance systems, while both countries are exposed to natural hazards. The two countries are critically different in terms of the disasters they experience; however, disaster risk communication outcomes depend on the level of structural vulnerabilities rather than the types of disasters that might impact certain countries.

The institutional capacity and governance framework greatly impacted the two countries' disaster risk communication. Japan's centralized disaster management system with ample resources allowed the country to continuously invest in early warning technologies, emergency communication, and disaster education throughout Japan. Institutional capacity guaranteed that warning messages reached the public quickly and without interruption while making sure the public understood disaster-based principles. However, even though the Philippines institutionalized disaster risk reduction activity with the Republic Act No. 10121, the differences in institutional capacity, resource accessibility, and technical knowledge hindered the successful implementation of prep programs. As a result, the disaster-based communication process was not effective in all regions and in some areas, such as Eastern Visayas.

The results demonstrate the importance of the public's knowledge regarding the success of communication. Japan and the Philippines both issued warnings effectively, but they differed in their communities' interpretation and actions. In Japan, the presence of disaster training and evacuation practice promoted disaster knowledge among the citizens, which enabled them to follow the messages and act accordingly. By contrast, the example of the Philippines during Typhoon Yolanda showed that many residents were unaware of technical terms, such as storm surge, which led to incorrect estimations of the threat despite the official warnings being issued. Therefore, it can be stated that disaster communication should focus on clarity of the message and suitability for the local audience as opposed to relying on technology alone.

The comparative analysis clearly indicates that social vulnerability has a significant effect on the results of communication. In Japan, trust in institutions and the coordination between government and communities increased the propensity of people to obey official recommendations. In contrast, the communication results in the Philippines were affected by socioeconomic inequality, poor housing conditions, damage to communication infrastructure, and informal networks of social contacts utilized in decision-making. While these networks provided important assistance in times of danger, they reinforced existing beliefs about the risks related to disasters and prevented people from evacuating. These results align with previous findings indicating that disaster communication is a social process that is affected by trust, community ties, and access to reliable information.

From the Perspective of the Pressure and Release (PAR) Model, this study shows that the root causes, dynamic pressures, and unsafe conditions work together to produce results in disaster risk communication. Japan's comparative economic development made it less susceptible to structural vulnerability as a result of effective governance, technological infrastructure, institutional preparedness, and public education about disasters. As opposed to that, the existing structural inequalities in the Philippines made the country vulnerable to being affected by ineffective communication already prior to the inception of Typhoon Yolanda. Therefore, the findings of this analysis confirm the ideas presented by Wisner et al. (2004), stating that the social construction of disasters occurs due to the interaction of risks and vulnerability rather than hazards.

Overall, the comparative evidence backs up the main argument of this research that development is a key factor in the effective delivery of emergency communications. Even though the availability of advanced technology and adoption of formal disaster policies are still necessary, they are not enough in cases where authorities do not provide institutions that facilitate communication, people do not have access to information, and many lack adequate literacy and social conditions to receive disaster warnings. Therefore, the cases of Japan and the Philippines demonstrate the need for a combined approach to improving disaster risk communication, which should include technological innovation, people-centered governance and ongoing education of the public, messages that are easily understood by locals, and long-lasting measures to decrease vulnerability.

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III. CONCLUSION

This study focused on the disaster risk communication situation in the Philippines and in Japan as they responded to the two disasters—the Great East Japan Earthquake and Tsunami in 2011 and Typhoon Yolanda (Haiyan) in the Philippines in 1983—in order to compare the two using the Pressure and Release (PAR) Model. Although both countries were exposed to similar natural hazards because they were in the same region (the Pacific Ring of Fire), the results of disaster risk communication were different between the two countries. The results show significant links between these differences and differences at governance, institutional, socio-economic, and public preparedness levels.

In the comparative analysis, it was found that Japan's long-term investments in disaster risk reduction, scientific monitoring and early warning technologies, and disaster education supported each step of the process of disaster risk communication. These factors contributed to the swift dissemination of warnings, enhanced public awareness of hazard messages, and timely protective measures. The Philippines, on the other hand, while having established institutional and legal frameworks for disaster management, also had most of the other issues mentioned above (persistent socio-economic inequalities, uneven implementation of the disaster management framework across local government units, limited communication infrastructure and gaps in public understanding) that also affected the effectiveness of the warning systems during Typhoon Yolanda. The results suggest that disaster risk communication is likely to be effective if institutions have the capability to generate credible information, effectively communicate with the community, and ensure that the community is ready to interpret and respond.

The results also provide additional evidence to the core argument in the Pressure and Release Model, that disaster effects are influenced by social vulnerability, not just the physical hazard itself (Wisner et al., 2004). Governance structures, institutional preparedness, and socio-economic development impacted the link between root causes and dynamic pressures and unsafe conditions that culminated in the disaster risk communication outcomes in both countries. The disaster of 2011 in Japan showed that it is possible for even high-tech systems to fail in the face of extreme hazards and cascading events. In the same way, the experiences in the Philippines show that warning systems can be present without effective public response, which may be due to structural vulnerabilities that have not been addressed.

This study adds to the existing body of knowledge on disaster governance by showing that effective disaster risk communication has been the result of a process of institutional development, public preparedness and inclusive governance. This means that investments have to go beyond only technology, and have to include disaster education, institutional capacity, community involvement and access to reliable information, all of which are important to strengthen communication systems. This comparison could be extended to include other disaster-prone countries, or to look at the impact of new digital communication technologies and community-based warning systems on disaster risk communication in the various disaster governance contexts.

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