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RESEARCH ARTICLE

EFFECTIVENESS OF EARLY WARNING SYSTEM IN COASTLINE COMMUNITIES IN CAMARINES SUR, PHILIPPINES

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ABSTRACT

The study determined the degree of effectiveness of Early Warning System (EWS) in the selected coastline communities in Camarines Sur, Philippines. The researcher used descriptive method and structured questionnaire was employed to determine the degree of effectiveness of household communities. The results of the study on the degree of effectiveness on EWS along property: Lessen damages to houses ranked first with the highest mean score of 3.10 while to prevent vehicles and equipment ranked last with a mean rating of 2.76, both interpreted as effective. The general weighted mean is 2.92 interpreted as effective. The results of the study on the degree of effectiveness on EWS along environment: Minimize damages of flora and fauna ranked first with a mean rating of 3.02 while and minimize alteration of community with a mean rating of 2.86 ranked last, both interpreted as effective. The general weighted mean rating is 2.93 interpreted as effective. The results of the study on the degree of effectiveness on EWS along livelihood: to minimize damages to fishing, and marine resources ranked first with a mean rating of 2.95, while to reduce losses to farming and agricultural crops production ranked last, with a mean rating of 2.85, both interpreted as effective. The general weighted mean is 2.91 interpreted as effective.

INTRODUCTION

The Philippines is considered to be one of the most disaster prone countries in the world due to its geo-physical location and socio-economic conditions (L.A Acosta *et al.*, 2016). The frequency of natural disasters has been growing over the years, resulting in loss of life, damage to property and destruction of the environment (Rahman, 2014). Disasters that hit the country since 2010 have left about P285 billion in damaged properties and claimed the lives of more than 13,000 persons. The biggest damage was recorded in 2013 when Typhoon Yolanda – considered the most powerful storm to make landfall in recorded history – ravaged the Visayas (Romero, 2015). It is a government's obligations to safeguard people through, as an example of many possible efforts, the creation, conservation and updating of early warning system. Even if valuable early warning systems are established at the local level, each government has an accountability to coordinate nationally to guarantee coverage of EWS where necessary to protect lives and livelihoods (IFRC, 2012). This should be mandated to governmental institutions through legislation and clear policy, accompanied by resource allocation. However, the efficiency of such systems is to be measured in terms of lives saved and reduction in losses, which is directly related to the execution of an anticipated response by the people and institutions once a warning is issued (RIMD, 2006). This paper speaks views on early warning systems, and what it takes to transform them into effective, people-centered systems.

Objectives of the Study

This study was conducted to determine the degree of effectiveness of early warning system along people, property, environment and livelihood in coastline communities in Camarines Sur, Philippines.

MATERIALS AND METHODS

The researcher used descriptive method to determine the degree of effectiveness of household in the selected communities in Camarines Sur, Philippines. A structured survey was employed to collect the needed information. The responses of the people interviewed were validated by asking the secondary opinions and views of the barangay officials and household heads in the community.

RESULTS AND DISCUSSIONS

Degree of Effectiveness of Early Warning System along People: The results of the study along property showed that: Minimize the loss of life ranked first with the highest mean score of 3.11 while preventing sickness and illnesses ranked last with the lowest mean rating of 2.93, which both interpreted as effective. The general weighted mean is 3.02 with an interpretation of effective. The early warning system contributed in minimizing the loss of life because the people in the community have already learned the value of the early warning systems and how these can help them avoid the different negative effects on their physical well-being while to prevent sickness and illnesses ranked last because the people in

the community are not sure if the early warning system can contribute in preventing sickness and illnesses. In the study conducted by Kafle (2017) pointed out that advances in science and technology during the last decade have improved the potential of early warning to reduce human loss. Early warning systems also must be comprehensible and accessible to all users. They must deliver clear and concise messages tailored to respective social and cultural contexts. The ability to deliver vital information to public at risk has not always been successful. In many cases, local mechanisms for communicating risk and interpreting warnings remain very weak. Early warning and early action often prevent a hazard turning into human disaster by preventing loss of life and reducing the economic and material impacts. An effective EWS enables the concerned authorities and at-risk communities, warning messages, and building and mobilizing their response capabilities to reduce risk. According to World Meteorological Organizations (2017), many countries have been to disasters experiencing significant losses in lives and livelihoods of their citizens. Adoption of the Hyogo Framework for Action (HFA) by 168 countries has led to a paradigm shift in disaster risk management from emergency response to a comprehensive approach which also includes preparedness and preventive strategies to reduce risk. Early warning Systems (EWS) are well recognized as a critical life-saving tool for floods, droughts, storms, bushfires, and other hazards. The recorded economic losses linked to extreme hydro-meteorological events have increased nearly 50 times over the past five decades, but the global loss of life has decreased significantly, by a factor of about 10, thus saving millions of lives this period.

Degree of Effectiveness of Early Warning System along Property: The results of the study on the degree of effectiveness on EWS along property showed that: Lessen damages to houses ranked first with the highest mean score of 3.10 while to prevent vehicles and equipment ranked last with a mean rating of 2.76, both interpreted as effective. The general weighted mean is 2.92 interpreted as effective. This means that the present systems used in the respondent communities are effective in preventing the destruction of the people's property. According to the people in these communities, as interviewed by the researcher, whenever they observe that there is an impending disaster, they try to find ways to get news from the radio or television and wait for the government's announcement of the impending calamity. The practice of being alert on the advisories helps the community to prepare for the impending disaster and be able to secure their property. According to FEMA (2014), risk exposure refers to the potential of life, personal injury, economic injury, and property damage resulting from natural hazards by assessing the vulnerability of people, building, and infrastructure to natural hazards. The result is supported by Ng (2014), who posited that to keep the public updated of impending storm surges floods or landslides the Department of Science and Technology (DOST) has created an early warning system. The system is designed to alert residents - especially those living in densely populated areas. The team proposed enforcing 'no-build' zones in coastal areas, several measures to minimize disaster risks, such as enhancing the resiliency of residential and commercial structures to lessen its damage, and building natural and man-made barriers to soften the impact in the event of a storm surge. Further, Ashad (2013) said that after the implementation of the Early Warning System by the Practical Action, human casualties and loss of movable

property have drastically declined in the mid-western and central regions. Timely information about the state of rivers can save the life of hundreds of people and property worth of billion rupees annually. This is what Practical Action's Early Warning System showed in far-western and mid-western regions. Unlike in the past, farmers of Bnake and Bardiya districts avoided the damage of movable property and human casualties this year. Although floods in Karnali River and West Rapti smashed farmlands, people and their property were safe. However, the rain and flood in Mahakali River and its attributes devastated the life of people and damaged property worth millions of rupees. The Hyogo Framework for Action (HFA) emphasized the importance of preventing loss of lives, property, and livelihoods and reducing potential economic impacts rather than merely reacting to disaster occurrences. It also advocated a multi-hazard approach to improve the effectiveness of risk reduction activities.

Degree of Effectiveness of Early Warning System along Environment: The results of the study on the degree of effectiveness on EWS along environment: Minimize damages of flora and fauna ranked first with a mean rating of 3.02 while and minimize alteration of community with a mean rating of 2.86 ranked last, both interpreted as effective. The general weighted mean rating is 2.93 interpreted as effective. This means that the present systems used in the respondent communities are effective in alerting the people to the negative effects of the impending disaster to the environment. The people in the communities have prepared Mitigative measures such as developing a flora and management plan to confirm potential impacts and provide details of biodiversity management measures and procedures to minimize and manage the impacts on biodiversity. According to the study conducted by Kafle (2017), it was mentioned that early warning systems are frequently applied as cost-effective risk mitigation measures against natural hazards, which provide timely information on future or ongoing events to reduce the loss of life and damages. In contrast to structural, protection measures such as dams, galleries, and rock fall nets, EWS are cheaper, have shorter installation time and have a lower impact on the environment, reliability and effectiveness of early warning systems for natural hazards (Martina Sattelle, Michael Brundi & Daniel Straub, 2015). According to the Food and Agriculture Organization (2016), shocks and crises caused by climate extremes such as drought, floods, and hurricanes destroy crops, livestock and fish resources, as well as agriculture, livestock and fishing/aquaculture infrastructure and productive assets such as irrigation systems, livestock shelters, docks, and landing and post-harvest facilities, reducing overall food production capacity. They can interrupt market access, trade, and food supply, reduce income, deplete savings, erode livelihoods and increase hunger. At the same time, disasters contribute to ecosystem degradation and loss, including increased soil erosion, declining rangeland quality and salinization of soils. In turn, increasing environmental degradation reduces the availability of goods and services, and shrinks economic opportunities and livelihood options.

Degree of Effectiveness of Early Warning System along Livelihood: The results of the study on the degree of effectiveness on EWS along livelihood: to minimize damages to fishing, and marine resources ranked first with a mean rating of 2.95, while to reduce losses to farming and agricultural crops production ranked last, with a mean rating of 2.85, both interpreted as effective.

Table 1. Degree of effectiveness of the early warning system along people

Parameters	Coastline Communities			Overall					
	A	B	C	D	E	F	Wm	r	Int.
Minimize the loss of life	3.81	3.56	3.08	3.01	3.23	2.66	3.11	1	E
Lessen the persons injury	3.73	3.24	3.05	3.03	3.14	2.60	3.01	2	E
Prevent sickness/illnesses	3.71	3.22	3.04	3.02	2.91	2.45	2.93	3	E
Average Weighted Mean	3.75	3.34	3.06	3.02	3.09	2.57	3.02		E

Legend: 3.26-4.00 – Highly Effective (HE); 2.51-3.25 – Effective (E); 1.76-2.50 – Moderately Effective (ME); 1.00-1.75 – Not Effective (NE); wn – weighted mean; r – rank; Int. – Interpretation

Table 2. Degree of effectiveness of the early warning system in the communities along property

Parameters	Coastline Communities			Overall					
	A	B	C	D	E	F	Wm	r	Int.
Lessen damages to houses	3.72	3.61	3.08	3.11	3.04	2.67	3.10	1	E
Avoid damages to appliances	3.64	3.17	2.92	3.03	2.93	2.43	2.90	2	E
Prevent vehicles and equipment	3.66	3.09	2.60	3.03	2.76	2.30	2.76	3	E
Average Weighted Average	3.67	3.29	2.87	3.06	2.91	2.47	2.92		E

Legend: 3.26-4.00 – Highly Effective (HE); 2.51-3.25 – Effective (E); 1.76-2.50 – Moderately Effective (ME); 1.00-1.75 – Not Effective (NE); wn – weighted mean; r – rank; Int. – Interpretation

Table 3. Degree of effectiveness of the early warning system in the communities along environment

Parameters	Coastline Communities			Overall					
	A	B	C	D	E	F	Wm	r	Int.
Minimize damages of flora and fauna	3.58	3.78	2.79	3.15	2.76	2.60	3.02	1	E
Reduce damages to agricultural landscape	3.41	3.69	2.75	3.05	2.54	2.50	2.90	2	E
Minimize alteration of the community	3.52	3.58	2.64	3.04	2.54	2.50	2.86	3	E
Average Weighted Mean	3.50	3.68	2.73	3.08	2.61	2.53	2.93		E

Legend: 3.26-4.00 – Highly Effective (HE); 2.51-3.25 – Effective (E); 1.76-2.50 – Moderately Effective (ME); 1.00-1.75 – Not Effective (NE); wn – weighted mean; r – rank; Int. – Interpretation

Table 4. Degree of effectiveness of the early warning system in the communities along livelihood

Parameters	Coastal Communities						Overall		
	A	B	C	D	E	F	wm	r	Int
Mitigate damages to livestock	3.49	3.65	2.74	3.14	2.61	2.52	2.93	2	E
Minimize damages to fishing and marine resources	3.44	3.53	2.69	3.08	2.84	2.59	2.95	1	E
Reduce losses to farming and agricultural crops production	3.49	3.27	2.69	3.13	2.63	2.55	2.85	3	E
Average Weighted Mean	3.48	3.48	2.71	3.12	2.69	2.55	2.91		E

Legend: 3.26-4.00 – Highly Effective (HE); 2.51-3.25 – Effective (E); 1.76-2.50 – Moderately Effective (ME); 1.00-1.75 – Not Effective (NE); wn – weighted mean; r – rank; Int. – Interpretation.

Table 5. Summary of the degree of effectiveness of early warning systems

Parameters	Coastline Communities			Overall					
	A	B	C	D	E	F	wm	R	Int.
People	3.75	3.34	3.06	3.02	3.09	2.57	3.14	1	E
Property	3.67	3.29	2.87	3.06	2.91	2.47	3.04	2	E
Environment	3.50	3.68	2.73	3.08	2.61	2.53	3.02	3	E
Livelihood	3.48	3.48	2.71	3.12	2.69	2.55	3.01	4	E
Average Weighted Mean	3.60	3.45	2.84	3.07	2.83	2.53	3.05		E

Legend: 3.26-4.00 – Highly Effective (HE); 2.51-3.25 – Effective (E); 1.76-2.50 – Moderately Effective (ME); 1.00-1.75 – Not Effective (NE); wn – weighted mean; r – rank; Int. – Interpretation.

The general weighted mean is 2.91 interpreted as effective. This means that the present early warning systems used in the respondent communities are effective. People in the community have already learned the value of the early warning systems and how these can help them avoid the different negative effects to their livelihood. Because of the early warning systems, people are being warned of the impending disaster and be able the communities to harvest their crops and marine resources and be able to sell it in the market before the disaster strike. According to Molinari *et al.*, (2015), community-based early warning systems (EWS) should be activated in response to warnings, to reduce potential impacts on lives and livelihood. Early warning systems (EWS) are recognized in both the Hyogo Framework for Action 2005-2015, and the Sendai Framework for Disaster Risk Reduction 2015-2030 as an important element of disaster risk reduction, and hence to the achievement of sustainable development and

sustainable livelihoods. Disaster occurrences and impact are increasing, mainly owing to an increase in the size and vulnerability of exposed populations, but also possible to increase in the frequency and severity of certain hydro-meteorological hazards as a result of climate change. Economic losses from disasters greatly set back hard-won development gains. In the same manner, Kafle (2017) claimed that early warning and early action could often prevent a hazard turning into human disaster by preventing loss of life and reducing the economic and material impacts. An effective EWS enables the concerned authorities and at-risk communities to know about the hazards of the locality, community vulnerabilities, and impending risk, warning messages, and building and mobilizing their response capabilities to reduce risks. She also added that early warning helps to reduce economic losses allowing people to better protect their assets and livelihoods. For example, they can

safeguard homes, save livestock or find out safest locations for shelter in times flood or other disaster events, thus limiting not only the immediate impact of disaster but also the effects on assets that can reduce economic well-being and increase poverty. As found out in this study, during the interviews conducted, the major factor that affects the level of readiness of the people, and in turn the effectiveness of the early warning systems in mitigating the injuries to the people, damage to properties and the environment, and the loss of livelihood is the attitude of the people towards disaster risk reduction. This is line with the findings of Menes, W. (2013). In his study, the behavior of the people towards climate change was considered, particularly on its effect-how natural disasters such as flood, landslide, storm surge and earthquake. Moreover, it determined the readiness of the Local Government Units in Camarines Sur through the responses of the marginalized and vulnerable constituents about preparedness being done at the Municipal level, most particularly the budget for this purpose which is given under 70% of the 5% Disaster Risk Reduction and Management Fund, the availability of rescue equipment and how they were utilized and accessed by the ordinary residences during times of calamity and disaster and the relief operation conducted and how they executed it. Are these relief items given to the right beneficiaries? This determined the response of the people about recovery and rehabilitation programs by the LGUs after calamities, its budget and their capabilities in handling it. Moreover, it also established how people treated about the effects of climate change disasters and environmental laws given through mass media, public assembly, flyers and streamers, megaphone and telecommunications. It is believed that the people's positive attitude and behavior towards climate change and its effect will reduce if not eliminate casualties.

The summary of results on the degree of effectiveness of the Early Warning System along people, property, environment, and livelihood. People ranked first, followed by property, environment, and livelihood with mean scores of 3.14, 3.04, 3.02, and 3.01, respectively interpreted all as effective. This means that the people perceived the Early Warning System as effective in providing them with the necessary warning and information. The positive response of the people to the early warning systems means that they value how hazards warnings save lives and property. According to the people in the community, they now realize how important information, infrastructure, and mechanisms to reduce the loss of life and property during and after a disaster. Rahman (2015) said that natural disasters cause extensive and damage to lives and livelihoods of people living in prone areas like Sirajganj district of Bangladesh. On the other hand, people need to continue and strengthen their efforts to prevent natural disasters. To innovate technology and its application so that people can reduce damage and loss is also needed. Localized early warning messages offer one such effective technological application which has been very effective for reducing disaster loss and damage to disaster-prone areas of Bangladesh. The importance of early warning system in preventing injuries and losses was emphasized in the study conducted by Deutsche Gesellschaft for Internationale Zusammenarbeit-GIZ (2013). According to its report, early warning system helps mitigate countries' susceptibility to climate change impacts by reducing their vulnerability to extreme events and therefore minimizing the risk of people's lives and livelihoods. Low cost, people-centered early warning systems in which Disaster Risk Reduction (DRR) committees play a leading role provide crucial development opportunities for least-developed

countries. Pioneering work has been done in Mozambique, where, commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) and Munich Re Foundation, the simple and effective Búzi Early Warning System was developed.

Conclusions and Recommendations

The early warning system contributed in minimizing the loss of life because the people in the community have already learned the value of the early warning systems and how these can help them avoid the different negative effects on their physical well-being while to prevent sickness and illnesses ranked last because the people in the community are not sure if the early warning system can contribute in preventing sickness and illnesses. The present systems used in the respondent communities are effective in preventing the destruction of the people's property. According to the people in these communities, as interviewed by the researcher, whenever they observe that there is an impending disaster, they try to find ways to get news from the radio or television and wait for the government's announcement of the impending calamity. The practice of being alert on the advisories helps the community to prepare for the impending disaster and be able to secure their property. The present systems used in the respondent communities are effective in alerting the people on the negative effects of the impending disaster to the environment. The people in the communities have prepared Mitigative measures such as developing a flora and management plan to confirm potential impacts and provide details of biodiversity management measures and procedures to minimize and manage the impacts on biodiversity; and the present early warning systems used in the respondent communities are effective. People in the community have already learned the value of the early warning systems and how these can help them avoid the different negative effects to their livelihood. Because of the early warning systems, people are being warned of the impending disaster and be able the communities to harvest their crops and marine resources and be able to sell it in the market before the disaster strike. Likewise, instill in the minds of the household communities the importance of the early warning systems and how these EWS can help them in avoiding the different negative effects on their physical well-being. Enforcing 'no-build' zones in coastal areas, several measures to minimize disaster risks, such as enhancing the resiliency of residential and commercial structures to lessen its damages, and building natural and man-made barriers to soften the impact in the event of a storm surges; come up with a cost-effective risk mitigation measures against natural hazards, which provide timely information on future or ongoing events to reduce loss of life and damages. In contrast to structural, protection measures such as dams, galleries and rock fall nets, EWS that are cheaper, have shorter installation time and have lower impact on the environment, reliability and effectiveness of early warning systems for natural hazards; and community-based early warning systems (EWS) should be activated in response to warnings, to reduce potential impacts on lives and livelihood.

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