Economic Resiliency Model for Disaster Mitigation in Floating Barangays of Malolos City, Bulacan, Philippines

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Abstract: Small islands face many vulnerabilities brought about by natural and anthropogenic causes. These exposures pose potential community losses triggered by disruption in their economic activities. Island system economies are always affected by natural disasters that gives an adverse impact to the community. Mitigating the risk and shocks by disasters means stabilizing and implementing the proper disaster risk reduction management. It entails thorough understanding about the susceptibility and exposure of households to various natural and man-made disasters. Philippines is one of the countries that has many small island communities that are enormously exposed to the shocks of climate change and disaster hazards. This study aims to create an economic resiliency model that can potentially lessen the impact of disaster-related problems in the Philippines particularly in the island communities. Using the islands in Malolos, Bulacan, Philippines as a case in point, the study determined the variables that upkeep economic resiliency during disastrous events. Anchored on the variables used by Orencio & Fujii (2013), adapted from the model of Twigg (2007), this research established the variables that strengthen floating community resiliency. The study used the quantitative approach using the logistic regression and using descriptive-causal design to determine community and economic resilience of the community. The results were derived using descriptive statistics and followed by regression analysis. This study attempted to quantify the factors, which likely influence the resiliency of a certain community, through logistic regression. Results show Infrastructure, Social Protection, Local Government Invention, Education and Training on Disaster Risk Reduction Activities as significant factors in ensuring economic resiliency of island communities to mitigate the adverse impact of disastrous events. Island system economies are always affected by natural disasters that gives an adverse impact to the community. Mitigating the risk and shocks by disasters means stabilizing and implementing the proper disaster risk reduction management. It entails thorough understanding about the susceptibility and exposure of households to various natural and man-made disasters. Inconclusion, the ISLET Model for economic resiliency of floating communities was constructed. The study recommends the ISLET model that would support economic resiliency for island communities during disastrous events. ISLET stands for Infrastructure, Social protection, LGU intervention, Education and Training on Disaster Risk Reduction (DRR) Activities. Itis vital to adopt the ISLET model in order to mitigate food insecurity, contingent deficiency, inability shift to another livelihood source, lack of proper technology and separation from mainland that limits their interface with government agencies and other parties that would harness the economy of the population.

Keywords: community resiliency, disaster prone areas, economic model, floating community, Malolos City Islands

Introduction

It is undeniable that many coastal and small island communities in the Philippines are enormously exposed to the shocks of climate change and hydro-meteorological hazards (Hiwasaki et al, 2014).The island communities have slow economic development because the locals cannot address the declining aquatic resources due to precarious change in weather patterns and garbage pollution originating from human activity (Berse, 2016). Issues like

accessibility to basic services and mobility constraint due to limited transportation mode hampers the development and economic activity in the island communities. Consequential adverse impact on human conditions and productivity has always been aggravated by exposure to natural hazards. Saleh & Weinstein (2016) said that the effect of coastal population is expected to escalate due to increasing developments in the coastal area, dilapidation of coastal habitat and climate change. Thus, establishing the challenging need to address disaster and economic resiliency. Coetzee, Niekerk & Raju (2016) found several literatures that emphasizes the fact that risk is a function of people's vulnerability (social, economic, political, physical and environmental) intermingling with hazards, leading to the fact that that disaster is ignited with risk vulnerability and hazard. They further noted that the people's vulnerability to natural hazards and a lack of capacity to address identified vulnerabilities makes a society more susceptible to the impact of a disaster and often amplifies the eventual damage. Rose (2007) looks at it in another way, as she give simple function that risk is a function of threat, vulnerability and consequence. (*Risk = f(threat, vulnerability, consequence),* illustrating the fact that resilience initiatives is very necessary in any business venture.

Chandra et al (2017) said that Philippines location in the ring of fire makes it highly vulnerable to climate change impacts because of their exposure to extreme disasters and constrained human capacities. As an archipelago, island communities are exposed to these vulnerabilities. One of the most vulnerable yet highly populated islands are the floating communities in Malolos City namely: Pamarawan, Masile, Caliligawan and Namayan, w located off the coast of Malolos, a coastal town in Bulacan Province in Central Luzon. Based on the 2015 Philippine Statistical Authority data, the total population of these islands have reached beyond six thousand. The islands are located in the river delta of Manila Bay from the Panasahan river of Malolos, Bulacan. Its location exposed the people to susceptibility and danger brought about by disasters caused by nature and man.

Existentially, the island is prone to sea level rise due to tidal changes wherein the low lying areas of the island are frequently submerged. The geographical isolation of the islands in Malolos City and the locals are economically restricted due to natural disturbances of the rising sea water and flooding decreasing fish catch overtime; hence it is important to understand the key factors that can potentially lessen the burden of the citizens of the said area and lead to economic resiliency in times of disaster. This study aims to create an economic resiliency model that can potentially lessen the impact of disaster-related problems in the Philippines particularly in the island communities.

Resiliency of island system

Unger (2011) have stated that resiliency is the ability to pull through from shocks and stresses in a time appropriate and effective manner. Several authors suggest that community resiliency covers components from both physical and social realms, whereby most individuals are as successful as their communities as a whole (Cohen et al, 2013; Unger, 2011). Economic resiliency on the other hand, is the ability of a community to maintain its function despite of any shock. (Rose, 2007). Community disaster resilience as operationally defined involves the capacities to: absorb stress or damaging forces through resistance, proper planning and adaptation; continue to perform basic functions and structures during disastrous events; and recover or pull through after an event (Twigg, 2007). Constructing island disaster resilience therefore goes well beyond merely responding to the needs of communities after a disaster but involves managing and maintaining functions before and during the event. At the Regional Policy Briefing on "Building resilience in small island economies: from vulnerabilities to opportunities," held at Pointe aux Piments, Mauritius in 2012, it was disclosed that despite the susceptibilities that the small islands are facing, new developments in technology and communications, improving economic conditions, and favorable policy frameworks provide new opportunities to small island states to maximize sharing of best practices, experiences and exploit commonalities to enhance their resilience. Good governance is an integral element of policy-making and capacity building to enhance economic resiliency. The fusion of technological, social, financial and structural capital are vital elements necessary to support resiliency and for shifting from vulnerability and dependence to one of resilience and sustainability. Briguglio (2006) mentioned that "islands will always be vulnerable; this will never change. However, they can do things to mitigate risk of being harmed by external shocks by increasing their resilience. Resilience is policy-induced. vulnerability is inherent.". As Haskins (2012) put it, "while vulnerability is inherent to small islands, strategies can be put in place to mitigate the risk of being harmed by external shocks by increasing their resilience". Exploring new areas of economic development must be coupled with sound policies targeted on widening the opportunities for small island economies that capitalizes the inter-linkages between various sectors like agriculture, tourism, information, communication, infrastructures and finance among others.

Health, Well Being and Social Protection in times of Disaster

Any disaster would be catastrophic experience to any family or household. This is the reason why there are also several researches that tackles about the health and well-being of an individual after disasters. For instance, in the research of Chan et al (2017) with the victims of typhoon Yolanda (international name: Super Typhoon Haiyan), they found out that those who are disaster-exposed in the area were more distressed and suffered from more symptoms of PTS (posttraumatic stress) 1.5 to 4 months after the said event. Results show that typhoon-related stressors, of the victims includes financial instability, physical injury, and perceived life threat, which appears to be more detrimental to mental health than other stressors.

Ampuero et al (2015) explored the factors enhancing mental well-being of people affected by a tsunami on Robinson Crusoe Island in 2010. They found out that natural environment, meaningful activities, local food, social activities, lifelong learning, transport and security are the factors that enhances the well-being and resilience after the said catastrophic event. Herrman (2012) also said that mental health and resilience depend on interactions between personal and wider social factors, such as safety and access to education and work.

Another important factor to consider in times of disaster would be social protection. Wickramasinghe (2013) said that disaster-related social protection instruments alleviate the plight of disaster victims falling into poverty and warrant an acceptable level of well-being during and after disasters. Authors that made different research in countries such as Pakistan, Fiji and Oceania also affirms to the fact that social protection mitigates the negative impacts of natural disasters, on aspirations, that can possibly be related to risk perceptions (Brown, Daigneault, Tjernström & Zou, 2018; Kosec & Mo, 2017). In the Philippines however, Mangada (2016) have seen a different problem after the Super Typhoon: it is the inadequate inclusiveness and sensitivity of formal institutions to the needs of the survivors. The research found out that the victims (especially women) have problems with social stigma, food, water and sanitation, housing and income.

Managing Disaster

While all possible efforts are made to prevent and mitigate the impact of disaster, optimizing efforts is central to improving resilience in different countries. (Langeland et al, 2015) Djalante, Holley, & Thomalla, (2011) on the other hand suggested the adaptive governance (AG) to emphasize environmental and natural resource governance approaches that share some or all of the following principles: polycentric and multilayered institutions, participation and collaboration, self-organization and networks, and learning and innovation. Davidson et al (2016) said that ecological systems are managed by people and their resilience is inherent in their own structure and function, whereas the socio-ecological, urban, disaster, and community domains make people an integral part of the system. Although concerns have also been expressed about the failure to recognize resilience as socially *contingent* or the one who is the direct stakeholder of this resiliency? (Brown, 2014; Davidson et al, 2016) Nadadsdy (2007) on the other hand would ask “who decides the most desirable system state?” All of these would all boil down with “intelligent management” of the problems associated with uncertainty and complexity be possible. (Ravetz, 2007) For Howe and Bang (2017) the national government is the primary duty-bearer for good governance, which includes natural disaster risk management.

Pedcris M. Orencio and Masahiko Fujii (2017) introduced an index for quantifying disaster resilience of coastal communities; to get the Index for a Disaster-Resilient Coastal Community, the journal suggests the division of two indicators: Process Indicators and Outcome Indicators. The Process Indicators were developed based on the Integrated Community-Based Risk Reduction (ICBRR) model used by the Canadian Red Cross and the Indonesian Red Cross Societies for building disaster-resilient organizations; whereas the Outcome Indicators were based on the elements that would attribute to the AHP. The Analytical Hierarchy Process (AHP) is a decision system using human cognition in determining the relative importance among a collection of alternative using paired comparisons. Decision makers are also needed for the AHP, they are composed of the local officials, service providers on costal management and disaster planning and community members; they were considered to be the local experts.

According to the Nobel awardee Elinor Ostrom, people will be more likely to govern the commons when they are fully knowledgeable about the costs and benefits of managing open access resources while being empowered to decide the way things should be done (Forsyth & Johnson, 2014). In her empirical study about the commons, eight design principles were identified that would improve the effectiveness and sustainability of common resources: clear knowledge about the physical and ecological properties of the resource, clear rules of membership (knowing who is entitled to use the resource), clear identification of people who can have access to the resource, similarity local

conditions and guidelines of access distribution, ground for group decision, communal resource monitoring, graduated sanctions, conflict

Role of Financial Institutions in Disaster Mitigation

In the study of Briguglio (1995), factors were identified that contribute to the threat of small island developing states, namely: small size, insularity and remoteness, prone to natural disasters, and environmental factors. Inhabitants are challenged by sense of insecurity, insufficient food and loss of livelihood. According to Manta (2016), Microfinance can help rural households in upgrading their business, and it is recommended for the microfinance to develop more and to tailor made for the needs of family, as well as mentioned the need of education. Ikpefan, Taiwo and Areghan (2016) also acknowledged that higher education does increase the income of microfinance institution clients, as well as that the government should tackle the problems of electricity, water, and efficient transportation system. As such, microfinance is not the only way to alleviate poverty: however, this can be a great start for the small island communities. As mentioned, not only will microfinance provide financial assistance for capitals, but it will also provide health, education and housing assistance. Since small islands are usually remote areas, with fewer resources compared to others, microfinance can help them learn how to efficiently manage their resources.

Oerther (2016) have shown a good example of how insurance can help in the aftermath of disaster. They set Caribbean Catastrophe Risk Insurance Facility (CCRIF) as an example, wherein the company used parametric insurance as a means of providing financial liquidity to Caribbean nations after a devastating tropical cyclone (aka, hurricane), an earthquake, or excess rainfall.

Methodology

The study employed quantitative approach using descriptive-causal design (Brewer & Kubn, 2010)to determine community and economic resilience of the community. Widely used in economic research, it gives an overview of the results using descriptive statistics (such as mean, percentages and cross tabulation) and followed by regression analysis. This study attempted to quantify the factors, which likely influence the resiliency of a certain community, through logistic regression. The quantitative results may entail those which could not depict other areas of resiliency of the community.

Selection

There were a total of 40 (forty) selected qualified respondents, ten (10) from every island barangay. The respondents have a screener question to ensure that they are part of the targeted population the researchers intended. The question is written in Filipino (Tagalog) for simpler and clearer understanding. All qualified respondents from this study have met the following criteria: (1) Head of the household; (2) Resident of the island for at least 10 years; (3) Fishing or with family member who does fishing for livelihood for more than 10 years; and (4) Experienced disaster more than 10 times. Qualifying questions allow the researchers to remove respondents who are ineligible based on the pre-determined criteria of the research (Siniscalco & Auriat, 2005). In the study of Ancheta, Membrebe, Valeroso& Santos (2019), it was proven that for the residents of Pamarawan, the biggest disaster in their area is the occurrence of flood. Hence, if the respondents experienced flood more than ten (10) times, they will be considered effective. It was established that all the respondents have experienced floods as disaster frequently which is beyond the required number which is 10.

Study Site

The island communities are situated between the river delta of Malolos and the Manila Bay; its distance from the capital city of Manila is 25 kilometers. According to the 2016 Barangay Profile, the island has a lot area of 264 hectares, including fishponds (see Figure 6). Pamarawan being the biggest among the islands has a population of 4,003 consisting of 804 households where main sources of livelihood are from fishing and salt-making and considered as one of the poorest barangays in the province of Malolos, based on the 2015 census data of the Malolos City Government.

In this isolated community, the barangay captain is deemed as the chief authority. The island lacks major physical, human support, natural and infrastructure facilities that would be the major components in making the place a livable environment. It can only boast of 1 public elementary school, 1 public high school, a single floor health center, 1 open basketball court, a 2-kilometer cemented road, 2 churches and a fish port. The only main access is through a 45 minute banca ride from the Panasahan Port of Malolos. Coastal communities were established in Bulacan as a way for the community to maximize their aquatic resources.

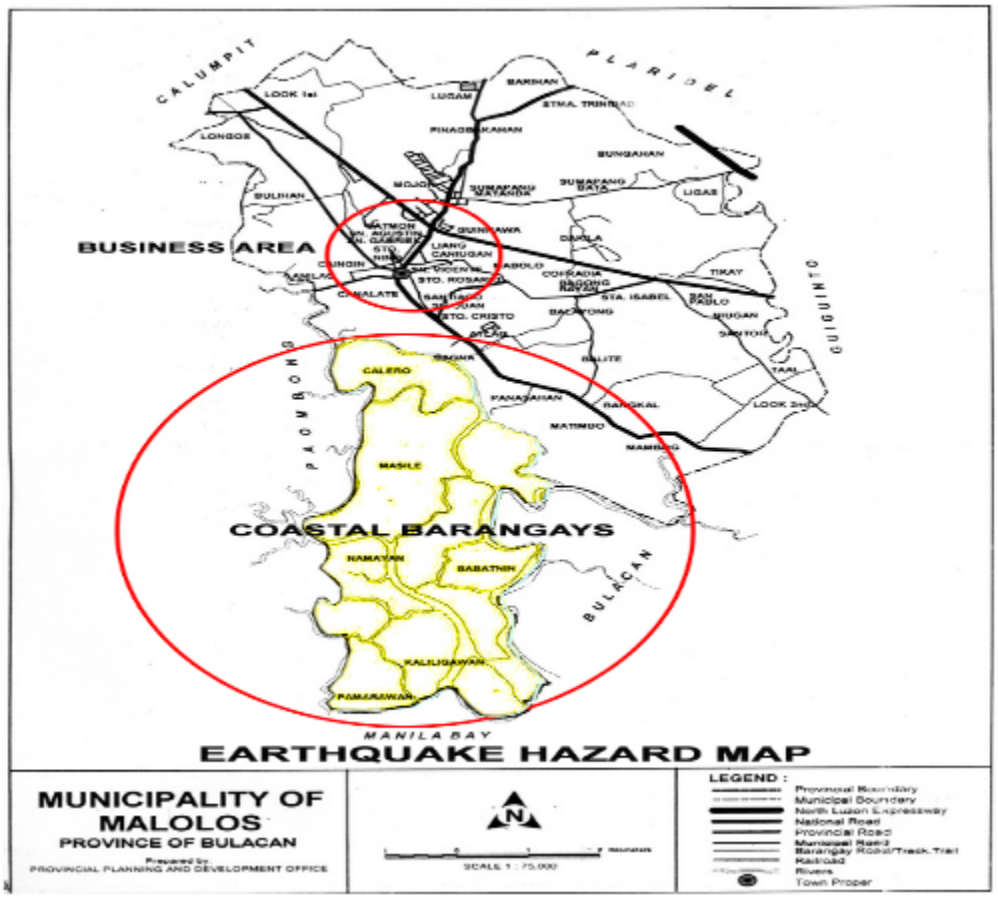

Figure 1 Map of Islands in Malolos City. Source: City Planning and Development Office

The smaller islands of Masile, Kaliligawan, Namayan have no medical facilities existing. With a combined population of more than two thousand, these islands can only boast of one small elementary school in each community. The only space breaks these islands have is one basketball court where physical activities can be exerted. The only transportation mode existing in these communities are fishing boats which they also use for their livelihood sourcing. There is no shoreline that separates the water from the locality and waste management facilities are nowhere to be found.

Instrument

The questionnaire is composed of eight (8) parts, that demonstrates the eight possible factors that can yield to disaster resiliency, namely: Environmental and Natural Resource Management; Human Health and Well Being; Sustainable Livelihood; Social Protection; Financial Instrument; Physical Protection, Structural and Technical Measures; Planning Regimes; and Socio-economic Profile. The first seven factors were adapted from the research of Orencio & Fujii (2013), see Table 1. These were the same questions employed in the questionnaire, using a Likert scale ranging from one to five (1-5). Two (2) questions from the said tool, which are: "Compliance with standard international planning" "Compliance with international standards that consider hazard risks" and "Planning Regimes", were excluded since those may no longer be applicable in the chosen community. Socio-economic status was based in the Marketing and Opinion Research Society of the Philippines (MORES) minimized into five clusters. (Lucagbo, 2015) These clusters are socio-economic classes (SEC): (1) AB, (2) Upper C, (3) Lower C, (4) D and (5) E. If the respondent belongs to SEC AB, they can be classified under high income, as well as good living conditions. But if the SEC is getting lower, it means that the income and living condition of the community is waning.

Table 1. Factors that can yield to Disaster Resiliency by Orencio & Fuji (2013) basing on the results from the survey

			Mean	Interpretation
Environmental and Resource Management	*Disaster-resilient Communities*	Understanding of functioning environment and ecosystems	4.80	Very Important
		Environmental practices that reduce hazard risk	4.88	Very Important
		Preservation of biodiversity for equitable distribution system	4.90	Very Important
		Application of indigenous knowledge and technologies	4.23	Important
		Access to community-managed common property resources	4.40	Important
	Enabling Environment	Supportive policy and institutional structure	4.60	Very Important
		Prevention of unsustainable land use	4.58	Very Important
		Policy linking environmental management and risk reduction	4.73	Very Important
		DRR policies and strategies integrated with climate change	4.78	Very Important
		Availability of local experts and extension workers	4.68	Very Important
Health well being	*Disaster-resilient Communities*	High physical ability to labor and good health	4.78	Very Important
		High level of personal security and freedom psychological threats	4.75	Very Important
		Secured food supply and nutritional status during crisis	4.88	Very Important
		Access to water for domestic needs during crises	4.93	Very Important
		Awareness of means and possession of skills of staying healthy	4.90	Very Important
		Management of psychological consequences of disasters	4.95	Very Important
		Trained workers to respond to physical and mental consequences of disasters	4.83	Very Important
	Enabling Environment	Public health structures integrated into disaster emergency plans	4.95	Very Important
		Community structures integrated into public health systems	4.68	Very Important
		Health education programs relevant to crisis	4.85	Very Important
		Policy for food security through market and nonmarket interventions	4.88	Very Important
		Multi-sector engagement for managing food and health crises	4.93	Very Important
		Emergency plans provide buffer stocks of food, medicines, etc.	4.95	Very Important
Sustainable Livelihood	*Disaster-resilient Communities*	High level of local economic and employment stability	4.75	Very Important
		Equitable distribution of wealth and livelihood in community	4.6	Very Important
		Livelihood diversification in rural areas	4.78	Very Important
		Fewer people engaged in unsafe livelihood	4.26	Important
		Adoption of hazard-resistant agriculture	4.25	Important
		Small enterprises with protection and business continuity/ recovery plans	4.85	Very Important
		Local market and trade links protected from hazards	4.80	Very Important
	Enabling Environment	Equitable economic development	4.83	Very Important
		Diversification of national and sub- national economies	4.58	Very Important
		Poverty-reduction targets vulnerable groups	4.62	Very Important
		DRR reflected as integral part of policy for economic development	4.90	Very Important
		Adequate and fair wages guaranteed by law	4.85	Very Important

		Supportive policy on equitable use and access to common resources	4.80	Very Important
		Incentives to reduce vulnerable livelihood	4.79	Very Important

Social Protection	*Disaster-resilient Communities*	Social support and network systems on DRR activities	4.95	Very Important
		Cooperation with local community for DRR activities	4.93	Very Important
		Community access to basic social services	4.93	Very Important
		Established social information and communication channels	4.88	Very Important
		Collective knowledge and experience of management of previous events	4.78	Very Important
	Enabling Environment	Social protection and safety nets for vulnerable groups	4.80	Very Important
		Coherent policy and networks for social protection and safety nets	4.80	Very Important
		Comprehensive partnership with external agencies on DRR	4.83	Very Important

Financial Instruments	*Disaster-resilient Communities*	Enough household and community asset bases to support crisis-coping	4.83	Very Important
		Costs and risks of disasters shared through collective ownership of assets	4.80	Very Important
		Access to savings and credit schemes, and microfinance services	4.78	Very Important
		Community access to affordable insurance from viable institutions	4.63	Very Important
		Community disaster fund to implement DRR activities	4.85	Very Important
		Access to money transfers and remittances from members abroad	4.73	Very Important
	Enabling Environment	Government and private sector support for financial mitigation	4.80	Very Important
		Economic incentives for DRR actions	4.75	Very Important
		Microfinance, cash aid, credit loan guarantees made available	4.77	Very Important

Physical Protection; structural and technical measures	*Disaster-resilient Communities*	Decisions and plans on built environment consider hazard risks	4.88	Very Important
		Security of land ownership/tenancy rights	4.85	Very Important
		Adoption of hazard-resilient construction and maintenance practices	4.85	Very Important
		Community capacities and skills to build, retrofit, maintain structures	4.68	Very Important
		Infrastructure and public facilities to support emergency management needs	4.75	Very Important
		Resilient and accessible critical emergency facilities	4.78	Very Important
		Resilient transport/service infrastructure and connections	4.83	Very Important
	Enabling Environment			
		Compliance of public infrastructure with standards	4.73	Very Important
		Carry out vulnerability assessment for all infrastructure system	4.83	Very Important
		Retrofitting critical public facilities and infrastructure in high risk areas	4.83	Very Important
		Security of access to public health and other emergency facilities	4.90	Very Important
		Legal systems protect land access and ownership and tenancy rights	4.75	Very Important
		Legal and economic systems respond to population patterns	4.73	Very Important

Data Analysis

Factors affecting economic resiliency was measured using logistic regression. Logistic regression (Gujarati, 2004) is a special form of regression used in determining the impact of independent variables with dependent variables that have binary responses (Yi=1,0 or simply yes or no). The results that may be derived can be interpreted as the probability that Y=1 when the regressor variable is Xi. Since there are only two possible answer in analyzing logistic regression, the mean response would be $E(Y_i)=1xp_i+0x(1-p_i)=p_i$. Thus, the results that we may derive could be interpreted as the probability that Y=1 when the regressor variable is Xi. On the book of Gujarati (2004), it was mentioned that a logit model could be represented like the equation listed below:

$$L_i = \ln\left(\frac{P_i}{1-P_i}\right) = Z_i = \beta_0 + \beta_1 X_1 + u$$

Eq. 1 General equation for Logistic regression

Pi/1-Pi is simply the odds ratio in favor of having a yes— the ratio of the probability that the researcher will get a yes to the probability that will get a no. The equation above shows L_i, the log of the odds ratio, is not only linear in X, but also (from the estimation viewpoint) linear in the parameters. L_i is called the logit, and hence the name logit model for models in general is like the one seen in equation 1.

The equation above shows Li, the log of the odds ratio, is not only linear in X, but also (from the estimation viewpoint) linear in the parameters. Li is called the logit, and hence the name logit model for models like the one seen on equation 1. (Gujarati & Porter, 2010) The logistic regression model of this research can be seen in equation 2 below:

$$Res = \ln\left(\frac{P_i}{1-P_i}\right) = Z_i = = \beta_0 + ENRM_1X_1 + HWB_2X_2 + SL_3X_3 + SP_4X_4 + FI_5X_5 + PPST_6X_6 + SEC_7X_7 + \varepsilon$$

(Eq. 3)

Where:
Res = Respondent's answer if they were able to recover from the disaster they have encountered (Binary dependent variable which is answerable by "Yes" or "No")
ENRM = Environmental and Natural Resource Management
HWB = Human Health and Well Being
SL = Sustainable Livelihood
SP = Social Protection
FI = Financial Instrument
PPST = Physical Protection, Structural and Technical Measures
SEC = Socio-economic Classification
ε = Error term

Results

The results revealed the cross tabulations of respondents demographically and the logistic regression output that that identified the significant impact of variables that would harness the disaster resilient community.

Demographic Profile of the Respondents

The researchers gathered forty (40) respondents and Table 2 shows the cross tabulations of respondents in every Barangay based on gender. Majority of the respondents are female, since most of the male fishermen are in the bay to fish or resting after work.

Table 2. Cross tabulations of respondents in every Barangay based on gender

			Gender		
			Male	Female	Total
Barangay	Pamarawan	Count	4	6	10
		% within Barangay	40.0%	60.0%	100.0%
	Namayan	Count	1	9	10
		% within Barangay	10.0%	90.0%	100.0%
	Caliligawan	Count	2	8	10
		% within Barangay	20.0%	80.0%	100.0%
	Masile	Count	4	6	10
		% within Barangay	40.0%	60.0%	100.0%
Total		Count	11	29	40
		% within Barangay	27.5%	72.5%	100.0%

On the other hand, Table 3 shows Cross tabulations of respondents in every Barangay based on Age Group. From this table, we can infer that majority of the respondents are in the age group of 50 and above, which is 45% of the total respondents.

Table 3. Cross tabulations of respondents in every Barangay based on Age Group

			Age Group							
			20-24	25-29	30-34	35-39	40-44	45-49	50 and above	Total
Barangay	Pamarawan	Count	0	0	5	1	1	1	2	10
		% within Barangay	0.0%	0.0%	50.0%	10.0%	10.0%	10.0%	20.0%	100.0%
	Namayan	Count	0	0	1	2	1	1	5	10
		% within Barangay	0.0%	0.0%	10.0%	20.0%	10.0%	10.0%	50.0%	100.0%
	Caliligawan	Count	1	1	2	0	0	0	6	10
		% within Barangay	10.0%	10.0%	20.0%	0.0%	0.0%	0.0%	60.0%	100.0%
	Masile	Count	0	1	0	1	3	0	5	10
		% within Barangay	0.0%	10.0%	0.0%	10.0%	30.0%	0.0%	50.0%	100.0%
Total		Count	1	2	8	4	5	2	18	40
		% within Barangay	2.5%	5.0%	20.0%	10.0%	12.5%	5.0%	45.0%	100.0%

Last demographic profile to be shown in this paper is the socio-economic classification or status of the respondents. Table 3 shows Cross tabulations of respondents in every Barangay based on their socio-economic classification. From this table, it is obvious that majority of the respondents are really less fortunate, since majority of them (64.1%) are in socio-economic class D, while 12.8% can be classified to socio-economic class E, which means they have a very low income and living condition.

Table 4. Cross tabulations of respondents in every Barangay based on Socio-economic Classification

			SEC					
			AB	Upper C	Lower C	D	E	Total
Barangay	Pamarawan	Count	1	0	3	6	0	10
		% within Barangay	10.0%	0.0%	30.0%	60.0%	0.0%	100.0%
	Namayan	Count	0	0	0	10	0	10
		% within Barangay	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%
	Caliligawan	Count	0	0	0	6	4	10
		% within Barangay	0.0%	0.0%	0.0%	60.0%	40.0%	100.0%
	Masile	Count	0	1	4	4	1	10
		% within Barangay	0.0%	10.0%	40.0%	40.0%	10.0%	100.0%
Total		Count	1	1	7	26	5	40
		% within Barangay	2.5%	2.5%	17.5%	65.0%	12.5%	100.0%

Data Analysis using Logistic Regression

This study wants to determine the factors that could affect resiliency in island communities located in Malolos, Bulacan. Table 5 shows the result from logistic regression that was derived from the survey. The results from the table will lead to a regression model seen in equation 4.

$$Res = 18.403 + 1.071\ ENRM_1 - 1.13HWB_2 - 2.335\ SL_3 - 8.353SP_4 + 1.449FI_5 + 6.926PPST_6 - 1.819SEC_7X_7 + \varepsilon$$

(Equation 4)

It also shows that among the variables, three variables are considered as statistically significant and they are Social Protection (SP), Physical Protection, Structural and Technical Measures (PPSTM) and Socio-economic classification (SEC).

Table 5. Results of Logistic Regression

	Coefficient	p-value	Odds Ratio
A ERM	1.071	0.504	2.919
A HWM	-1.130	0.676	0.323
A SL	-2.355	0.156	0.095
A SP DRC	-8.353	0.066	0.000
A FI EE	1.449	0.612	4.259
A PPSTM	6.926	0.092	1017.962
SEC	-1.819	0.078	0.162
Constant	18.403	0.164	98290122.2

With a beta-coefficient of 1.017, the results show that Environmental and Natural Resource Management (ENRM) have a positive impact with resiliency. As the odds ratio is 2.919, it is likely that it could affect resiliency by 74.48%. But since the p-value is 0.676, the said factor is statistically insignificant.

Human Health and Well Being (HHWM) on the other hand has a beta coefficient of -1.13, which has a negative impact with resiliency. Since the odds ratio is 0.095, the researchers can say that the likelihood that it could affect resiliency is 8.68%. But since the p-value is 0.504, the said factor is statistically insignificant.

Table 5 shows that Sustainable Livelihood (SL) has a beta coefficient of -2.355, which means it has a negative impact with resiliency. Since the odds ratio is 0.323, the researchers can say that the likelihood that it could affect resiliency is 74.48%. But since the p-value is 0.156, the said factor is statistically insignificant.

It is seen in the results of logistic regression that the p-value (0.066) of social protection has a negative and significant impact to resilience of the community. With beta-coefficient of -8.353, this means an increase in the perspective in this factor, negatively contributes to the resilience of the community. However, the odds ratio of the variable is zero, which means the likelihood that the community will be resilient because of this factor is zero. This means that the perspective on the importance towards social protection may not necessarily increase the possibility of being resilient.

Financial Instruments (FI) on the other hand has a beta coefficient of 1.449, which means it has a positive impact with resiliency. Since the odds ratio is 4.259, the researchers can say that the likelihood that it could affect resiliency is 80.98%. But since the p-value is 0.612, the said factor is statistically insignificant. On the other hand, Physical Protection, Structural and Technical Measures (PPSTM) has a positive and significant impact to resilience of the community. This means an increase in the perspective in this factor, also increase the resilience of the community. With an odds ratio of 1017.962, this means the likelihood that the community will be resilient is close to 100%. This means that the perspective on the importance towards PPSTM will surely increase the resilience of the community. It was revealed that in the event of an alarming typhoon signal the residents are expecting that the structures in the area will be impaired. Hence, if there would be an action towards this factor, we can say that there could be a good help towards the resiliency of the community.

Finally, socio-economic class (SEC) has a negative and significant impact to resilience of the community. In this research, an SEC of AB is coded as 1 and an SEC of E is coded as 5. This means higher SEC, increases the resilience of the community. With an odds ratio of 0.162, this means the likelihood that the community will be resilient is close to 14%. This means that the SEC is important in achieving individuals' resilience towards disaster but does not increase the possibility all the time.

Discussion

These islands have frequent experience of floods coupled with heavy rains. Disaster is socially constructed as hindrance to support their livelihood, providing food to eat, and being inside their homes during disaster. Island system makes the community fully dependent on water-based livelihood, such as fishing and boating, for their daily sustenance. The research covered many factors that would strengthen their economic resiliency. Among all the variables that were considered by the respondent, it was the three factors on Human Health and Well-Being (HWB) and one factor on Social Protection (SP) that was ranked the highest as a resiliency factor the community perceived as very important. These are as follows:

- Management of psychological consequences of disaster
- Public health structures integrated into disaster emergency plans
- Emergency plans provide buffer stocks of food, medicines, etc.
- Social support and network systems on DRR (Disaster Risk Reduction)

Management of psychological consequences of disaster

Aside from the effects on life and properties, disasters cause burden on challenging the ability of the affected population to cope emotionally and psychologically from the trauma and the capacity to absorb stress. Relief efforts focus on the disaster's physical magnitude of disasters by bestowing immediate medical attention and attending to services such as water supply, shelter, food sufficiency and medicines. Impact on the psychological consequences on individuals, families and communities must be managed to mitigate the impact of exposure to disaster. This will support the adaptive capacity of the individuals to continue performing the economic functions during disastrous event. Interventions coming from trained workers are essential in responding to the physical and mental consequences of disasters. Community support mechanism will strengthen the individual ability to bounce back better after the disaster. Because of the scarcity of specialists and professionals in the island communities, intervention by trained individuals regarding disaster risk reduction and management is significant. Even high-income countries may lack specialists in rural areas, and disasters may disrupt access or overwhelm resources even where the supply is nominally adequate. Training the community including the family members, school-based staff and local barangay officials has the potential to greatly enhance the mitigation of the disaster impact, so that the people can easily adjust and continue functioning. This validates the study of Walsh (2007) pertaining to the value

of family and community resilience-oriented approach to recovery from traumatic loss after the occurrence of a catastrophic event which foster and strengthens family and community resilience.

Public health structures integrated into disaster emergency plans

Public health emergency preparedness has been described as "the capability of the public health and health-care systems, communities, and individuals to prevent, protect against, quickly respond to, and recover from health emergencies, particularly those whose scale, timing, or unpredictability threatens to overwhelm routine capabilities" (Bayntun et al, 2012). This is one of the exigencies that the island community needs during disastrous events. Their ability to maintain their economic function relies on the physical well-being that should be taken cared of specifically during and after a vulnerable situation. Absence of available health system integrated into disaster emergency plans impede the potential of resilience and the ability to bounce back better after a disaster.

Public health structure comprised all the facilities, institutions, resources and organizations existing to provide health services to people with or without crisis. In May 2011 during the World Health Assembly, the World Health Organization (WHO)asserted that public health structures are composed of service provision, health professional and non-professional trained workers, health education and information, health finance and government leadership. Health system approach to disaster management suggests that it should support emergency preparedness and crisis management capacities to enhance resiliency in the communities.

Emergency plans provide buffer stocks of food, medicines, etc.

Provision for food security, steady supply of medicines and emergency supplies are highly essential to the people of the island community during disastrous event. It affirms the study of Mangada (2016) that the inadequacy of food, water, sanitation, medicine, money and housing is a main problem by the victims of a disaster. A safe water supply is essential for the well-being of any community. There is always the possibility of water disruption, contamination during vulnerable situations, hence a safe water supply should be dispensable to minimize the risk to public health. In preparation before the disaster, the community is encouraged to obtain a supply of safe water for their personal consumption in the immediate aftermath of the emergency. In areas susceptible to disaster like the island communities, the community is encouraged to maintain a supply of 'long life' basic food rations sufficient for a family for a sufficient number of days. The giving of relief goods and food items is a way to ensure food security and protection from spoiled and contaminated food that could be a source of illness and diseases. The provision of medicine is highly significant for disease control and prevention among the people. This will mitigate the absence of facilities and workers that caters to the medical needs of the disaster victims.

Social support and network systems on DRR (Disaster Risk Reduction)

The study revealed the importance of social support in harnessing resilience. In the study performed by Walsh (2007), it was noted that community members are a natural support system with many advantages over external providers. Community engaged resilience is anchored on social support and network systems within the community. Inhabitants of an island community are isolated and relies heavily on each other with regards to diverse needs, whether its food, physical help or emergency assistance. Goodwill and closely knitted relationship with the people in the community nurtures social support. The locals have a strong community support system. A good camaraderie among the people is a basic gesture of helping each other. Knowing the people who will help in disaster risk reduction and interfacing with them establishes a social support system that is a vital economic coping mechanism in the community.

The people in the island addresses isolation disaster risk by linking with the island, the mainland institutions and civil society organizations in promoting social protection through enhancement of the island community capacity, developing self-sufficiency and building connectivity. Island capacity is enhanced through multifarious activities like skill and livelihood development and disaster risk reduction awareness. Self-sufficiency is developed through local sourcing of food and conversion of fish ponds to salt beds during summer months. Building connectivity focuses on ensuring communication access and reliable transportation transfer to and from other islands and the mainland.

Conclusion

Island system economies are always affected by natural disasters that gives an adverse impact to the community. Mitigating the risk and shocks by disasters means stabilizing and implementing the proper disaster risk reduction management. It entails thorough understanding about the susceptibility and exposure of households to various natural and man-made disasters. It is imperative that resilience among the island communities would lead to disaster situation adaptability, ability to respond effectively and recovery thereafter. Though island communities suffer from disastrous events, it is the resiliency and support policy that make their economy sustainable and continuing. The research found that poor households are more likely to rely on socio economic factors and physical protection, structural and technical measures in times of disaster resiliency. As these islands are located in the river delta of Malolos and at the mouth of Manila Bay, it is a given fact that majority of the people are highly vulnerable to climatic disasters such as storm surge and typhoon. The study revealed that infrastructure, medical facilities and food supply are the contributory factors that would harnessed the community resiliency in these island communities. Moreover, the factors on Human Health and Well-Being and Social Protection are essential for consideration in the formulation and strengthening of disaster risk reduction (DRR) policies. It was also cited by many respondents that people in the island communities rely heavily on NGO support and local government relief good supplies during disaster. Financial intermediation and stability also plays a significant role for disaster response and disaster recovery

The resilience of island communities is determined by the degree to which the community and person have planned and prepared their resources, and the capabilities of maintaining its function before, during and after the disastrous event. It is considerable that the dynamics between the stakeholders (community, LGU, NGO, various sectors such as health, finance etc), the environment and the Disaster Risk Reduction education would enhance the island community's economic resiliency. The partnership network between them can reduce the island's social, political and economic isolation and can expect increased resilience and reduced vulnerabilities of the communities to disaster. As Twigg (2009) has put it, economic resilience is giving greater weight on what the communities can do for themselves, how to muster their adaptive capacities, instead of focusing on their vulnerabilities to shocks, stresses and disaster, or their needs in an emergency.

Recommendation

The study recommends the **ISLET model** that would support economic resiliency for island communities during disastrous events. ISLET stands for **Infrastructure, Social protection, LGU intervention, Education and Training on Disaster Risk Reduction (DRR) Activities**. 1. Infrastructure built on durable materials and tenancy assurance is important, specifically in times of strong typhoons and surges. 2. Social protection are the basic necessities that people can access such as food, medicines, medical treatment, post-disaster briefing and public health facilities that should be readily available. 3. Local Government Intervention refers to the promulgating policies and assistance to the people and the island economy that is highly considerable. This provides the safety net to the people in isolated island communities. 4. Education presupposes advancement in social economic classification that would elevate people's knowledge, skills and ability to earn more in order to uplift their standard of living necessary in times of precarious situation. 5. Training on DRR activities would provide them the adaptive capacity during disaster that would give them an open mind in facing disaster uncertainties, institutionalizing personal commitment and awareness about the importance of conscious actions and collaborative effort needed in times of disaster and nurtures the mindset and practice of saving lives through proper planning, preparation and action that would save lives and properties. In addressing isolated barangay communities, it is vital to adopt the **ISLET model** in order to mitigate food insecurity, contingent deficiency, inability shift to another livelihood source, lack of proper technology and separation from mainland that limits their interface with government agencies and other parties that would harness the economy of the population.

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