

Israel, Danilo C.; Bunao, David Feliks M.

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Research on urban resilience to natural disasters of households, firms, and communities in the Philippines

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Philippine Institute for Development Studies
Surian sa mga Pag-aaral Pangkaunlaran ng Pilipinas

Research on Urban Resilience to Natural Disasters of Households, Firms, and Communities in the Philippines

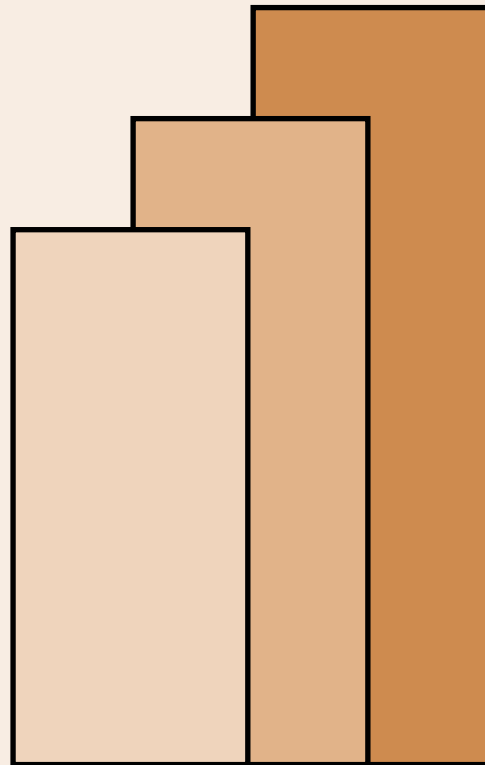
Danilo C. Israel and David Feliks M. Bunao

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The Research Information Staff, Philippine Institute for Development Studies
18th Floor, Three Cyberpod Centris – North Tower, EDSA corner Quezon Avenue, 1100 Quezon City, Philippines
Tel Numbers: (63-2) 3721291 and 3721292; E-mail: publications@mail.pids.gov.ph

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Research on Urban Resilience to Natural Disasters of Households, Firms and Communities in the Philippines

Danilo C. Israel and David Feliks M. Bunao

Abstract

The paper looks into the current socioeconomic research on resilience to natural disasters among urban households, firms and communities in the Philippines. It reviews the related analytical frameworks, methodologies and empirical studies already available with the end purpose of identifying research gaps and recommending studies and actions that can be undertaken to address them. The paper explains that the Philippines and Manila at present are among the least resilient countries and cities in the world. It also shows that there are foreign and locally- developed analytical frameworks and methodologies on the urban resilience that have been used in research. Furthermore, it found that there are already a number of empirical studies covering resilience of households, firms and communities particularly to natural disasters than have been conducted in specific urban areas like Metro Manila and other Philippine cities. From the review, the paper identifies some gaps in the current research on urban resilience and recommended specific researches and related activities that can be undertaken in the future.

Keywords: Resilience, Urban Resilience, Natural Disasters, Socio-Economic Studies, Households, Firms, Communities

Urban Resilience to Natural Disasters among Households, Firms and Communities in the Philippines

Danilo C. Israel and David Feliks M. Bunao¹

I. Introduction

Resilience is a widely researched subject internationally at present. Among others, research on resilience has been viewed as filling in the gaps of traditional disaster risk and vulnerability oriented-approaches and extending the focus to potentials, opportunities and capacities of natural disaster-prone populations (UNDP-UDC 2013). In the Philippines, socioeconomic research on resilience in particular is also gradually gaining momentum as the country needs to conduct more and in-depth empirical studies on macroeconomic and microeconomic vulnerability and how systems resilience can be boosted and strengthened (Llanto 2016).

In the area of microeconomic analysis, households, firms and communities are among the most important socioeconomic units considered. Likewise, urban areas are of critical significance because of the leading role they play in overall economic development. In a similar vein, natural disasters have been a major development problem in the country due to its geographical location and. Thus, it is necessary that the issue of urban resilience to natural disasters among households, firms and communities is a major domain in socioeconomic resilience research efforts in the country.

The general objective of this paper is review the socioeconomic researches conducted on urban resilience to natural disasters among households, firms and communities in the Philippines. The end purpose is to identify gaps in the current research and recommend future studies can be undertaken to address them. Specifically, the paper a) provides the relevant definitions or relevant terms; b) discusses the current state of the Philippines and its cities in terms of resilience in comparison to other countries and cities; b) reviews the frameworks of analysis, and analytical models and methodologies used in resilience research in general and urban resilience research in particular; c) presents the different socioeconomic and policy studies conducted in the Philippines on urban resilience; and d) identifies gaps in research and provide some recommendations for future research. The paper uses secondary data and information from the relevant existing literature and primary information gathered from key informants. The paper is not comprehensive in that time and access limitations allow coverage only to studies which were available as of this writing.

¹ The authors are Senior Research Fellow and Research Analyst II of the Philippine Institute for Development Studies (PIDS).

II. Definitions

Resilience

Different definitions of resilience has been provided by international development institutions (Table 1)². While the definitions vary, they contain the common elements of capacity to bounce back after a shock and the capacity to adapt to change (FAO, IFAD and WFP 2012). In the Philippines, resilience is officially defined in the context of natural disasters as “the ability of a system, community, or society exposed to hazards to resist, absorb, accommodate, and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions” (NDCC 2010).

Table 1: Definitions of resilience by international development institutions

Publication	Definition
Rockefeller Foundation (2013)	Resilience is ability of a system, entity, community or person to withstand shocks while still maintaining its essential functions. Resilience also refers to an ability to recover quickly and effectively from catastrophe, and a capability of enduring greater stress.
OECD (2013)	Resilience is the ability of individuals, communities and states and their institutions to absorb and recover from shocks, whilst positively adapting and transforming their structures and means for living in the face of long-term changes and uncertainty. Often
USAID (2012, 2013)	Resilience is the ability of people, households, communities, countries, and systems to mitigate, adapt to and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth.
EU (2012a,b)	Resilience is the ability of an individual, a household, a community, a country or a region to withstand, adapt, and quickly recover from stresses and shocks such as drought, violence, conflict or natural disaster.
IFRC (2012)	Resilience is the ability of individuals, communities, organizations, or countries exposed to disasters and crises and underlying vulnerabilities to: anticipate, reduce the impact of, cope with, and recover from the effects of adversity without compromising their long-term prospects.
FAO (2011)	Resilience is the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.
Oxfam (2009)	Resilience is the ability of a joint social and ecological system – such as a farm – to withstand shocks, coupled with the capacity to learn from them and evolve in response to changing conditions. Building resilience involves creating strength, flexibility, and adaptability.
ADB and IFPRI (2009)	Resilience is used to describe the magnitude of a disturbance that a system can withstand without crossing a threshold into a new structure or dynamic. In human systems, resilience refers to the ability of communities to withstand and recover from

² Definitions by individuals are also found in the literature (e.g. Frankenberger et al. 2013)

	stress, such as environmental change or social, economic, or political upheaval, while for natural systems, it is a measure of how much disturbance (e.g., storms, fire, and pollutants) an ecosystem can handle without shifting into a qualitatively different state.
UNISDR (2007)	Resilience is the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.
UN (2005)	Resilience is the capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure

Source of data: <http://www.2020resilience.ifpri.info/files/2013/08/resiliencedefinitions.pdf>

Urban resilience

Urban resilience defined as the is the ability of an urban system-and all of its constituent socio-ecological and socio-technical networks across temporal and spatial scales-to maintain or rapidly return to its desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity (Jha, Miner, and Stanton-Geddes 2013). Other different but similar definitions can be found in the existing relevant literature.

Natural disaster

A natural disaster is an event caused by natural hazards that overwhelm local response capacity and greatly affect the social and economic development of a region (Sivakumar, 2005). It is classified into three categories based on its origin: (1) hydro-meteorological disasters like typhoons, floods, drought, and extreme heat waves; (2) geophysical disasters like earthquakes and volcanic eruptions; and (3) biological disasters like epidemics and insect infestations (Cavallo et al., 2010). From an economic perspective, a natural disaster can be defined as a natural occurrence that causes a disruption to an economic system, with a significant negative impact on assets, production factors, output, employment, or consumption (Hallegatte and Przulski 2010).

Resilience to natural disasters

In the context of natural disasters, resilience is the ability of individuals, communities and states and their institutions to absorb and recover from natural shocks while positively adapting and transforming their structures and means for living in the face of long-term changes and uncertainty (OECD, 2013). It is the ability of countries, communities, businesses, and individual households to resist, absorb, recover from, and reorganize in response to natural hazard events, without jeopardizing their sustained socioeconomic advancement and development (ADB, 2013).

III. Relative Resilience of the Philippines

The Philippines relative to other countries

In 2016, a Global Resilience Index (GRI) was prepared using the definition of resilience as a combination of the vulnerability of a country to supply chain disruption and the country's ability to recover from such disruption (FM Global 2016). This index uses nine key drivers of resilience including: Conflict and political unrest, terrorism, corruption, vulnerability to oil shortages and price shocks, natural disasters, extreme weather, maturity in risk management capabilities, investment in risk management, infrastructure, and the quality of local suppliers. The drivers are aggregated into three broad factors –economic, risk quality and supply chain – which, in turn, combine to form the index.

The aforementioned GRI provided ranked scores for 130 countries and territories around the world. Of the countries considered, Switzerland and Norway occupied the top two places in the index (Table 2). Switzerland placed first overall (composite) and for the supply chain factor, second for the economic factor, and 73rd for the risk quality factor. On the other hand, Norway ranked second overall, third for the economic factor, 10th for the risk quality factor, and 12th for the supply chain factor. It is interesting to note that top seven of the 130 countries considered are all located in Europe while the U.S. only ranked 7th, Canada 8th, and Australia 9th in the index.

Table 2: Global Resilience Index, top ten countries, 2016

Country	Factors							
	Composite		Economic		Risk Quality		Supply Chain	
	Rank	Score	Rank	Score	Rank	Score	Rank	Score
Switzerland	1	100	2	94.9	73	57.2	1	100
Norway	2	99.6	3	89.6	10	80.3	12	82.4
Ireland	3	98.4	7	77.2	1	100.0	25	73.8
Germany	4	94.6	16	72.1	13	78.4	4	91.2
Luxembourg	5	94.5	1	100	79	54.5	11	84.4
Netherlands	6	94.3	20	68.9	9	80.5	3	92
United States	7	94.2	13	72.2	3	88.4	17	80.5
Canada	8	92.7	19	69	2	88.7	21	80.2
Australia	9	90.9	10	76.5	8	81.0	23	75.6
Denmark	10	90.8	5	77.8	70	64.0	6	90.3

Source: Modified from FM Global (2016)

On the other hand, Venezuela and the Dominican Republic occupied the bottom two places in the GRI (Table 3). Venezuela placed last overall and for the economic factor, 127th for the risk quality factor, and 128th for the supply chain factor. The Dominican Republic ranked 62nd for the economic factor, last for the risk quality factor, and 94th for the supply chain factor. It can

be seen that five of the bottom are located in South America, four are in Africa and one is in Europe.

For the Philippines, specifically, the country was ranked 108th for the composite index, 84th for the economic index, 114th for the risk quality index, and 90th for the supply chain index. Thus, the country was in the bottom 25 of the GRI and ranked very low in all of indexes for individual factors considered.

Table 3: Global Resilience Index, bottom ten countries, 2016

Country	Factors							
	Composite		Economic		Risk Quality		Supply Chain	
	Rank	Score	Rank	Score	Rank	Score	Rank	Score
Honduras	121	32.5	112	27.9	117	37.9	78	34.3
Jamaica	122	31.1	119	23.8	117	37.9	74	35.3
Algeria	123	30.9	118	24.1	75	56.2	116	16.8
Egypt	124	29.0	125	16.4	75	56.2	107	20.6
Ukraine	125	28.5	127	10.9	79	54.5	95	27.1
Mauritania	126	27.9	116	24.5	36	66.1	130	0.0
Nicaragua	127	26.1	104	32.5	117	37.9	120	14.5
Kyrgyz Republic	128	22.2	128	7.5	97	52.5	110	18.1
Dominican Republic	129	20.4	62	42.4	130	0.0	94	27.6
Venezuela	130	0.0	130	0.0	127	24.1	128	2.3

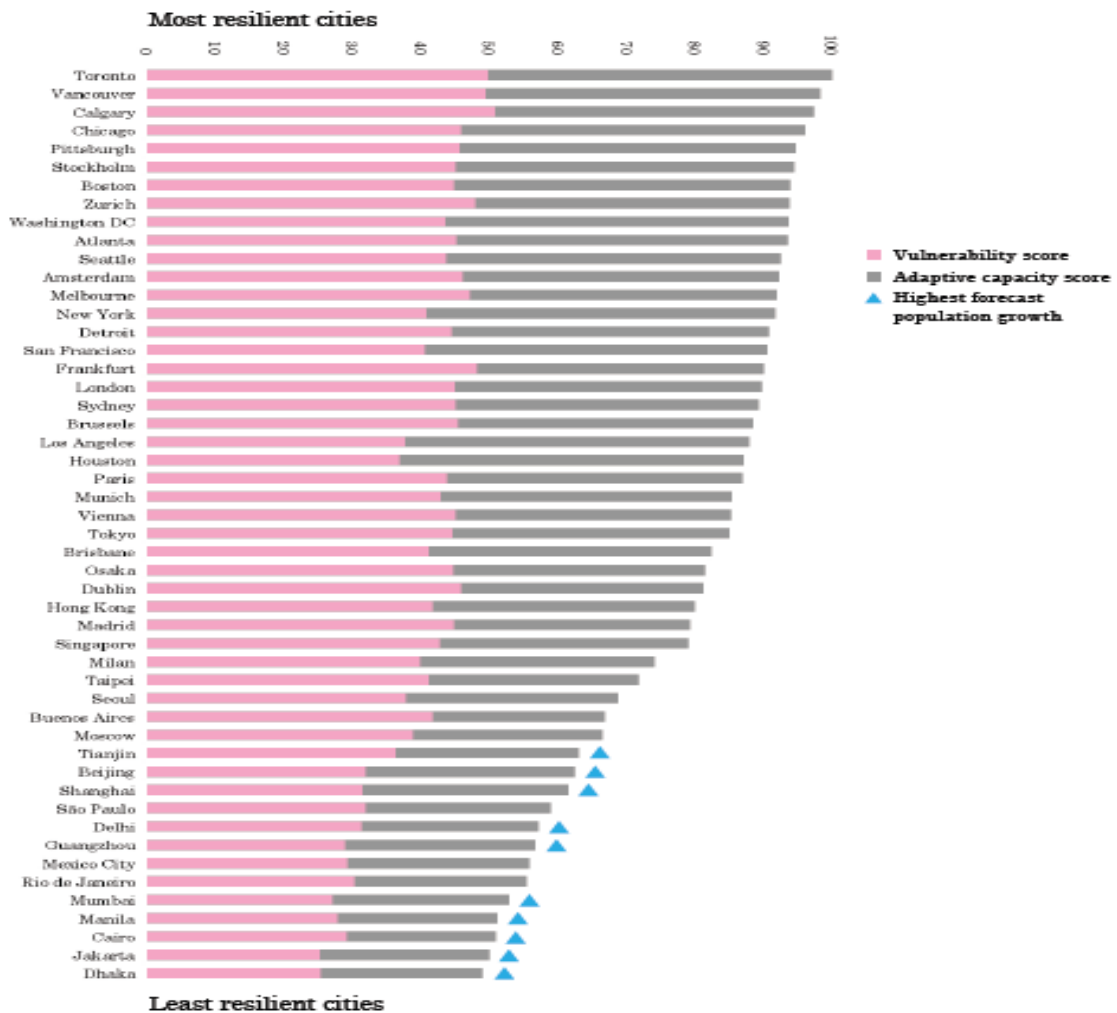
Source: Modified from FM Global (2016)

Manila relative to other world cities

In 2014, a resilience ranking of fifty world cities was done (Grosvenor 2014). In this work, resilience was defined as the ability of a city to avoid or bounce back from an adverse event which comes from the interplay of vulnerability and adaptive capacity. Furthermore, resilience was measured as a six stage process: 1) the key components of vulnerability and adaptive capacity were identified; 2) accurate independent data were collected, from as many sources as possible, on each component; 3) the different individual data sets were transformed into ordinal ranking systems with the same distribution and units so that the data sets can be added together and averaged; 4) the cities in each individual component of vulnerability and adaptive capacity were ranked, so that the relative position of each were known; by means of an un-weighted average, an overall ranking of cities for vulnerability and adaptive capacity were created; and 6) the ranking from vulnerability and adaptive capacity were averaged again and create an overall ranking of world cities in terms of their resilience.

The results of the aforementioned ranking of fifty world cities are summarized below (Figure 1). The three most resilient cities in the world were in Canada (Toronto, Vancouver and Calgary) while six were in the US (Chicago, Pittsburg, Boston, Washington DC, Atlanta and Seattle) while one is in Europe (Stockholm). The middle group of cities, ranked 11 to 30, were also considered resilient. Most European cities fall into this group of countries including the weakest (Moscow, Milan and Madrid) and the strongest (Zurich, Amsterdam and Frankfurt). The bottom 20 cities were considerably weaker than the top 30 and were considered the least resilient. Many of these were found in Asia while a few were in Europe, South America, Africa particularly Cairo and North America particularly Mexico. It can be seen from Figure 1 that of the bottom ten countries, 7 were in Asia (Dhaka, Jakarta, Manila, Mumbai, Guangzhou, Delhi and Shanghai). Manila, in particular, was rated 4th from the bottom only ahead of Dhaka, Jakarta and Cairo in terms of overall city resilience.

Figure 1: Resilience ranking of selected world cities, 2014



Source: Grosvenor (2014)

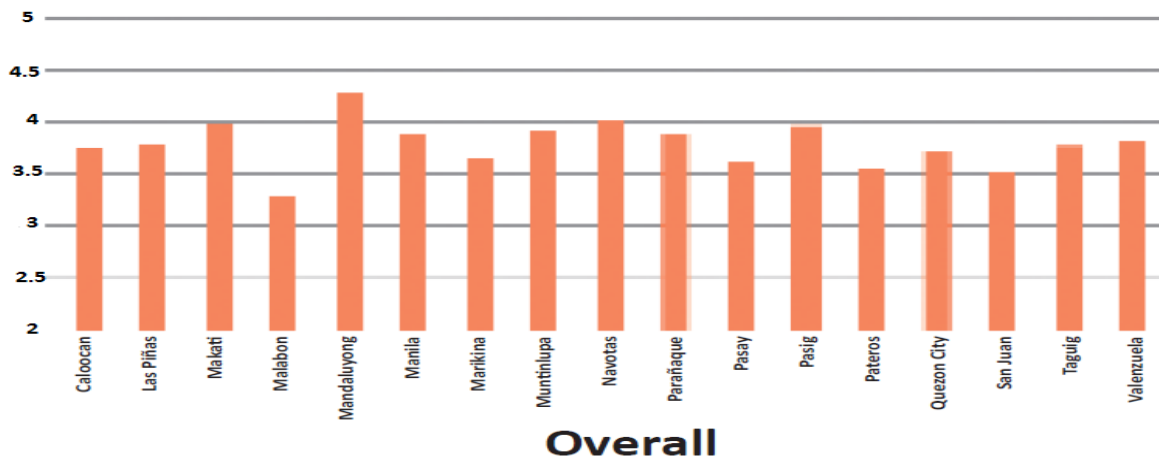
City of Manila versus other cities of Metro Manila

In 2010, the Climate and Disaster Resilience Initiative (CDRI) used the Climate Disaster Resilience Index (CDRI) to analyze the existing level of climate disaster resilience of sixteen cities and one municipality in Metro Manila (Shaw, Takeuchi and Fernandez 2010). In this study, climate-related natural hazards were considered specifically, such as typhoons, flooding, sea-level rise, rainfall-induced landslides, heatwave, and drought. CDRI was used to measure climate disaster resilience by considering five dimensions including physical, social, economic, institutional, and natural. The CDRI values ranged from one to 5 which were the averages of the individual indices of the aforementioned five dimensions. Higher CDRI values were equivalent to higher preparedness of an individual city to cope with climate change and natural disasters and vice versa.

Based on the CDRI values generated, the City of Manila was ranked sixth (about equal to Paranaque) in overall climate disaster resilience among Metro Manila cities and municipality after Mandaluyong, Navotas, Makati, Pasig, and Muntinlupa (Figure 2). Therefore, the capital city of the Philippines is clearly not among the top resilient cities in the urbanized area of Metro Manila³.

To summarize the section, the Philippines and Manila were among the least resilient countries and cities in the world. Much, therefore, clearly needs to be done and quickly before they can be resilient places for people to live in.

Figure 2: Overall climate disaster resilience score of Metro Manila, 2010



Source: Shaw, Takeuchi and Fernandez (2010)

³ For Metro Manila, out of a perfect score of 5.0 the individual CDRI indexes for the dimensions were 4.35 for physical, 4.01 for social, institutional, 3.14 for economic, 4.20 for institutional, and 3.15 for natural and an overall CDRI of 3.77.

IV. International Research on Resilience

Mapping of disaster resilience measurements

Disaster resilience measurements which have been used were mapped in terms of various parameters of interest (Winderl 2014, Appendix Table). As shown in the mapping, numerous indices, indicators, frameworks and other tools have been developed over time by various development institutions and individuals. Some of these measurements focused on natural disasters and their socio-economic dimensions as part of an overall study on resilience. Many also concentrated on households and communities as the smallest unit of analysis. Not one, however, directly covered businesses.

The methodologies covered in the mapping generally employed quantitative analysis but others also used the qualitative approach; were either participatory or not; utilized primary and/or secondary data; and were either in the early stages of development or already under implementation. Based on the mapping, it was shown that research on resilience of households and communities, but few or none at all on businesses, have already been conducted at the international level.

International frameworks for resilience

As shown also in the aforementioned mapping, frameworks for studying resilience in general already exist. An example is the Department for International Development (DfID) framework (DfID 2011). This framework aims to improve the understanding of the different elements considered in building resilience (Figure 3). It is made up of four elements, namely, context, disturbance, capacity to deal with disturbance and reaction to disturbance. First, context defines whose resilience are analyzed. These context include systems or processes. Second, the disturbance faced, or shocks or stresses, are identified. Shocks are sudden events that impact on the vulnerability of the system and its components such as floods, typhoons, landslides, drought or earthquakes.

The DfID framework, further explains that stresses are long-term trends that undermine the potential of a system or process and increase the vulnerability of actors within it. Third, the capacity of the system or process to deal with the disturbance based on the levels of exposure, level of sensitivity and adaptive capacity is determined. Lastly, reaction to the disturbance which is how the system or process responds to the aftermath of the disaster, is analyzed. It can result into four outcomes: bounce back better wherein the system or process is more able to deal with future shocks and stresses, bounce back to normal pre-existing conditions, recover but worse than before, or collapse.

Figure 3: DfID resilience framework



Source: DfID (2011)

International frameworks for urban resilience

There are also existing frameworks for the study of urban resilience some of which are shown below (Table 3). One example is that of Tyler and Moench (2012) (Figure 4). In this framework, the three key elements of urban resilience are the systems, agents and institutions. Systems are the physical infrastructure and ecosystems that provide key services such as food production, runoff management or flood control. Agents include individuals (consumers), households (as units for consumption, social reproduction capital accumulation), and public and private sectors (government agencies, private firms, civil society organizations). Institutions are the social rules or conventions that structure human behavior and exchange in social and economic interactions.

On the other hand, the characteristics of a resilient system in the aforementioned framework include flexibility and diversity, redundancy and modularity and safe failure. Flexibility and diversity are the ability to meet service needs under a wide range of climate conditions. Redundancy and modularity are the capacity to accommodate unexpected service demand or extreme climate events. Safe failure is the ability to deliver key services even under failures. Failure in one part of the system will not lead to failures of other parts. The framework operates on the assumption that agents, institutions and systems interact with each other in order to assess the vulnerability of a community. During the process, both local and scientific knowledge are used therefore shared learning occurs. Knowledge from the shared learning is then used in resilience building efforts. The agents, institutions and systems have specific roles in the identification, prioritization, design, implementation and monitoring process. Since climate

change is an ongoing process, shared learning will be also continuous and will improve over the passage of time.

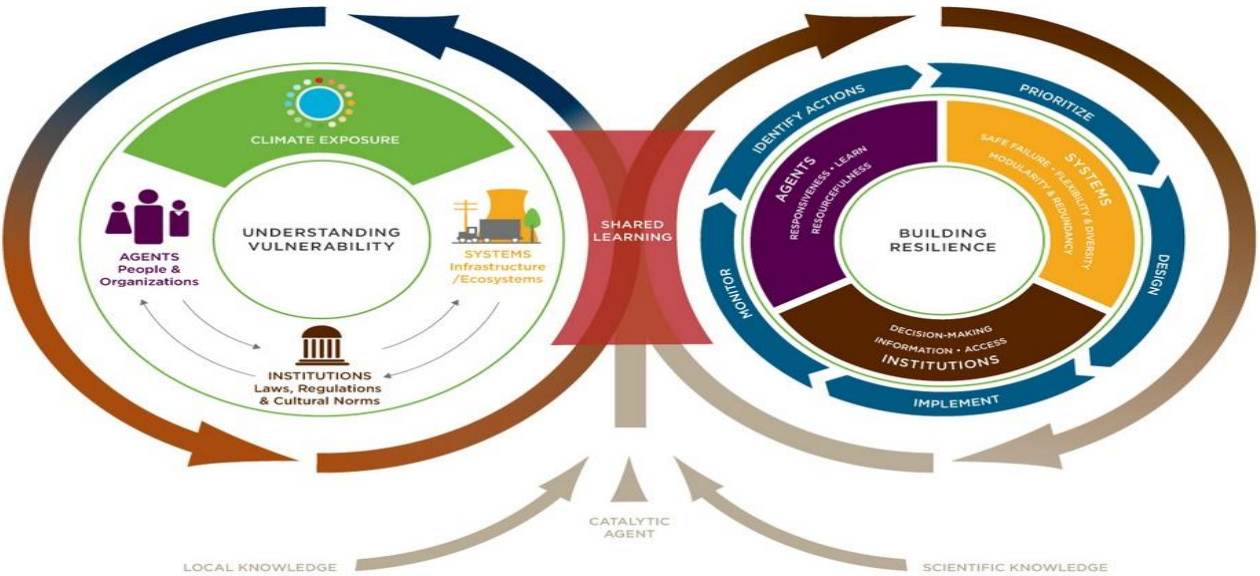
Table 3: Urban resilience frameworks

Author	Framework	Description
Kim and Lim (2016)	Conceptual framework for urban climate resilience	The conceptual framework consists of three parts, namely, 1) climate change disturbance system, 2) process of system transition, and 3) preemptive and responsive process. The climate change disturbance system identifies the various climate conditions and climate variability. The process of system transition refers to the changes in a city brought about by climate change. Lastly, the preemptive and responsive process relates to the disaster risk reduction of a city.
Jeffers et al. (2016)	Urban resilience analysis process	The framework explains the cyclical process of analyzing urban resilience. It involves five stages, namely: 1) identification of shocks, stresses, and key infrastructures, 2) selection of assessment methods and data collection, 3) assessment of infrastructure performance under shocks and stresses, 4) assessment of regional performance, and 5) assessment of resilience enhancing investments. At the center of the framework is the stakeholder engagement as it is necessary in each stage of the process.
Rockefeller Foundation (2014)	City resilience framework	The city resilience framework describes the 12 key indicators that determine the resilience of a city. These indicators are then classified into four categories, namely, 1) leadership and strategy, 2) health and wellbeing, 3) economy and society, and 4) infrastructure and environment. These indicators can help cities assess the extent of their resilience, pinpoint critical areas of weakness, and identify actions and programs to improve the city's resilience.
Jabareen (2013)	Resilient city planning framework	The resilient city planning framework explained the four interrelated concepts for building city resilience. The first component is the vulnerability analysis matrix in which the spatial and socio-economic mapping of future risks and vulnerabilities are conducted. The second concept, the urban governance, focuses on the governance, culture processes and roles of a resilient city. The third concept, prevention, refers to the actions geared towards greater urban resiliency. The last concept, uncertainty-oriented planning, suggests the need to review and revise current planning methods for climate change.

<p>Galderisi (2013)</p>	<p>The integrated model of urban resilience</p>	<p>The framework is structured as a cyclical process with three stages, namely: 1) pre-event stage, 2) emergency phase and 3) recovery/transition phase. In addition to the aforementioned stages, the framework is composed of three levels. The inner most level represents the core goals of urban resilience which are adaptability, transformability and persistence. The second level identifies the five capacities of urban resilience. The outer most level provides a specific set of capabilities that further explain the five capacities.</p>
<p>Tyler et al. (2012)</p>	<p>Urban resilience framework</p>	<p>The framework explains the process in which agents and systems interact with one another to strengthen urban resilience. The first process involves agents learning about climate change impacts and vulnerability of urban systems. The second process involves the assessment of climate impacts and assessment of vulnerabilities of agents by linking climate impacts to their capacities for learning, action and re-organization. The next process is developing resilience strategies to respond to the vulnerabilities identified. Finally, the projects would be identified and implemented which will lead to greater urban resilience.</p>

Sources of information: Above-cited literature

Figure 4: Urban climate resilience framework

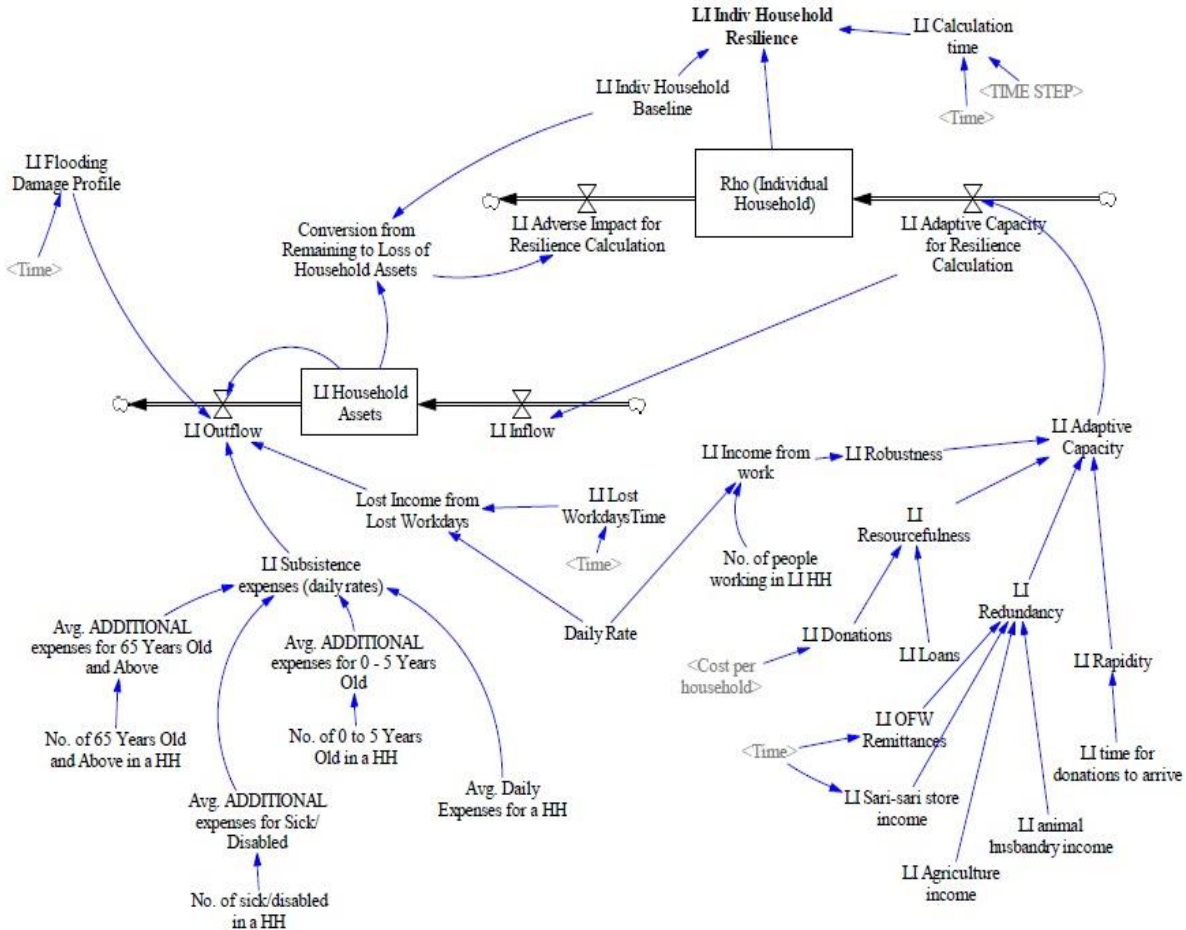


Source: Tyler and Moench (2012)

Philippine framework for urban resilience of households

There are few locally-developed frameworks in existence for studying urban resilience in the Philippines. A framework or model for studying the urban resilience of households to natural disasters, in particular, is that of Gotangco et al. (2014). This model (Figure 5) focuses on household assets as the key stock and adverse impacts and adaptive capacity are quantified in terms of losses or expenditures and income, respectively⁴. The model is based on data from surveys of low-income households. The authors explained that because it is possible for a natural disaster like flooding to affect low-income, middle-income and high-income households, three versions of the model can be developed to depict representative households for the three income groups. Resilience indices from the three models can then be aggregated and weighted according to the exposure fractions to produce the final quantitative socio-economic household resilience index.

Figure 5: System dynamics diagram of a low-income (LI) household resilience model



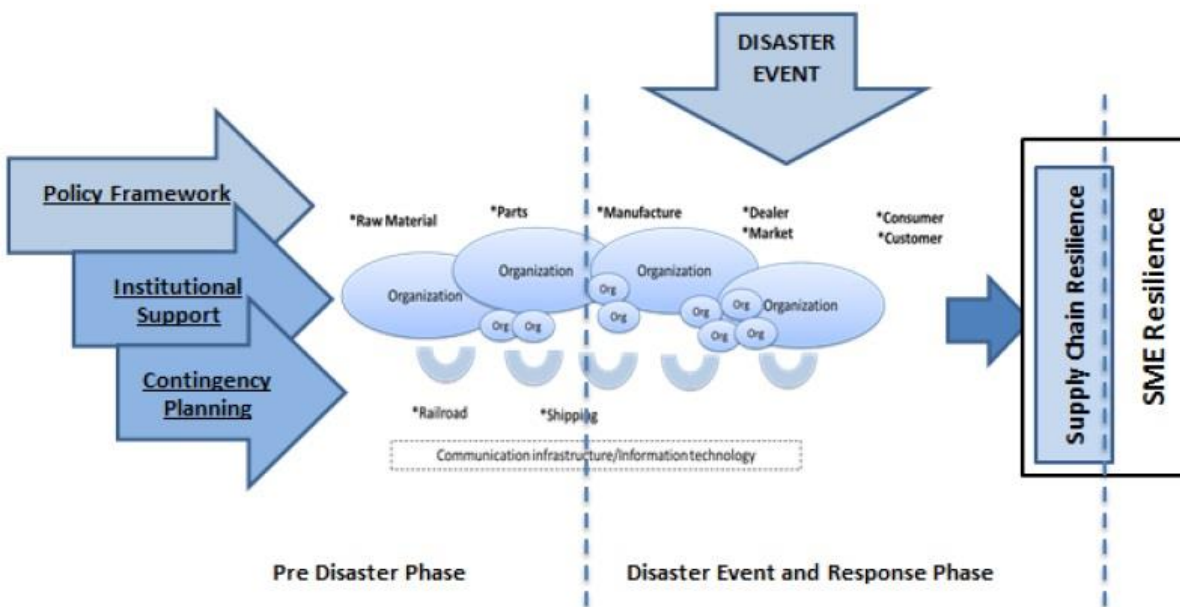
Source: Gotangco et al. (2014)

⁴ Gotangco et al. (2014) has a detailed discussion of the model.

Philippine framework for urban resilience of firms

A framework for urban resilience of firms in the Philippines is that used by Ballesteros and Domingo (2015) in studying small and medium enterprises (SMEs) (Figure 6). In this framework, building SME resilience is viewed in the context of the business and policy environment in which they operate⁵. SMEs operate within the domestic and global supply chain linked with organizations that make up the value chain and logistics. In the value chain, they are interfaced with big organizations from raw material to finished products and to the market/buyers. On the other hand, the flow of funds, goods and services from all nodes of the value chain comprise the logistics of which infrastructure, utilities and communications are considered the most critical aspects. The framework shows further that SMEs vulnerabilities and role in the supply chain imply that their ability to manage risks and to continue and recover on their business operations amid a disaster event can be defined by how the firm in particular and the supply chain, in general, address pre-and post-disaster imperatives.

Figure 6: Conceptual framework for resilience of firms



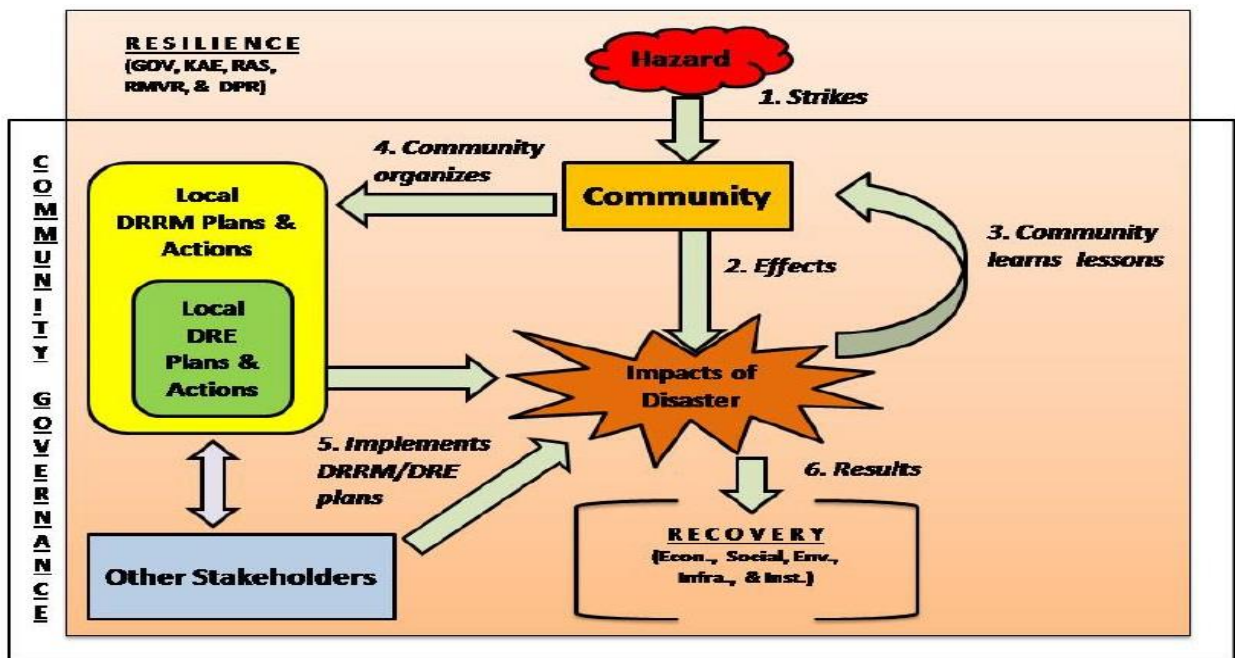
Source: Ballesteros and Domingo (2015)

⁵ A detailed discussion of the framework is contained in Ballesteros and Domingo (2015).

Philippine framework for urban resilience of communities

A framework that was used to study the urban resilience of communities in the Philippines is that of Florano (2015). This framework defines community governance as the aggregate decision, plans, and actions of the community in response to disasters brought about by a hazard or hazards⁶. Members or residents of the community get involved in governance by informing co-residents about the dangers of impending hazards, consult with one another and other external stakeholders/actors on how best to deal with the hazards and the disasters that they will bring to the community, make decisions, and implement those decisions through local policies, plans, programs, projects, and activities, which include local disaster recovery plans, strategies, and actions which are normally designed within the framework of the community's local disaster risk reduction and management plan. These are all incorporated in the local DRRM plans and/or local disaster recovery plans. With the participation of other stakeholders, recovery efforts proceed guided by these plans. These may or may not lead to the recovery of the community, which are usually measured through the restoration of the pre-disaster conditions and building back better.

Figure 7: Community Governance and Resilience Framework



Abbreviations: **GOV** – governance; **KAE** – knowledge & education, **RAS** – risk assessment; **RMVR** – risk management & vulnerability reduction; **DPR** – disaster preparedness & response **DRRM** – disaster reduction and management; **DRE** – disaster recovery; **Econ.** – economic; **Env.** – environmental; **Infra.** – infrastructural; **Inst.** – institutional.

Source: Florano (2014)

⁶ A detailed discussion of the framework is contained in Florano (2014).

V. Urban Resilience Studies in the Philippines

There are a number of socioeconomic studies done which are related to the urban resilience of households, firms and communities, in the Philippines. These works generally considered natural disasters as the issue of interest while other forms of disaster was covered in one case. Below, these studies are summarized⁷.

Resilience of households

Israel and Briones (2013) examined the correlation between natural disasters and household poverty in the Philippines (Table 4). It 1) reviewed past studies on adaptation and coping strategies in the Philippines and analyzed the disaster risk reduction and management system in the country; and 2) employed descriptive statistics and regression analysis to study the relationship between natural disasters and poverty using data from the 2011 Community-Based Monitoring System (CBMS) dataset for Pasay City, Metro Manila which covered 70,326 households.

Table 4: Natural Disaster Resilience-Related Studies on Urban Households in the Philippines

Authors/ Year	Methodology	Main Finding	Main Recommendation
Israel and Briones (2013)	<ul style="list-style-type: none"> - Pasay City - Typhoons and floods - CBMS 2011 Survey Data - Descriptive and regression analyses 	Households lost 7 percent of their per capita income due to typhoons and floods.	Government can be more accurate in the level of financial assistance to be provided to households affected by natural disasters.
Gotangco et al. (2014)	<ul style="list-style-type: none"> - Metro Manila - Floods - Survey data - General Systems - Dynamic Model, household resilience index 	Preliminary results indicated that the household resilience index decreased as response to shocks followed by slow recovery.	Once the household resilience model has been finalized, it will be combined with models of other sectors into an overall resilience model with an aggregated resilience index.

⁷ Only those undertaken since 2010 up to this writing were covered. There may have been other studies missed due to time and access limitations.

Francisco (2014)	<ul style="list-style-type: none"> - Marikina City - Floods - Household survey - Descriptive and regression analyses 	Many households learned from their recent experience of flooding, and that more households have now implemented measures in preparation for the next rainy season.	Proactive adaptation measures should be encouraged and enhanced by providing vulnerable households with better access to information, training on disaster management and adaptation, and other important forms of support.
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The study found that past studies on adaptation and coping strategies point to the negative effects of natural disasters to household income and subsequently to household poverty. Specifically, poor households in both urban and rural areas are the most affected because their asset base, livelihood opportunities and incomes are diminished as a result of disasters. This consequently worsens the poverty situation and overall welfare of households. The study also found that occurrence and frequency of typhoon/flood in Pasay City have significant and negative effects on household per capita income. Households that were affected by flood/typhoon lost 7 percent of their per capita income.

The study recommended Government can be more accurate in the level of financial assistance to be provided to households affected by natural disasters. It also suggested that the government consider the collection of natural disaster-related data and information through national household surveys in the Philippines. This would greatly help the conduct of future studies on natural disasters and resilience as it will provide a more comprehensive understanding of the financial, economic, social and demographic factors affecting resilience to natural disasters.

Gotangco et al. (2014) studied how the systems resilience approach can be applied to describe the interaction between households and local governments in the Philippines (Table 4). The main objective was to develop a tool that will capture the physical, socio-economic and organizational factors that affect resilience and how it changes over time for the local governments, particularly in National Capital Region (NCR). It used the system dynamics (SD) modeling which allow for a system to be built virtually in terms of stocks, flows, input information and feedback loops. The authors explained that the purpose of SD modeling is to explore the behavior of a particular system structure and provide insight into the underlying causes of such behavior.

In the household model used by the study, household assets are the key stock while adverse impacts and adaptive capacities are quantified in terms of losses and income, respectively. Preliminary results of the model using household data from an earlier survey indicated that the household resilience index decreased as response to shocks followed by slow recovery. To conclude, the study suggested that once the household resilience model has been finalized, these can be combined with models of other sectors which are being developed

separately (e.g. Local government unit (LGU), health sector) into an overall resilience model with an aggregated resilience index for a specific city.

Francisco (2014) studied the coping strategies of households in Marikina City in response to extreme floods (Table 4). The main objective was to understand the kinds of coping strategies that households used. The study surveyed 402 households to identify the measures they took in preparation for the rainy season of 2012 and the preparations they had made for the monsoon season of 2013. Finding of the study revealed that the most commonly adapted measure in 2012 was to check weather updates and flood warnings regularly (88%) followed by the preparation of an evacuation plan for the family (73%). The percentage of respondents who adapted these measures further increased to 97% and 79% respectively in 2013. The author argued that these changes suggest that many households learned from their recent experience of flooding, and that more households have now implemented measures in preparation for the next rainy season.

The study suggested that pro-active adaptation measures be encouraged and enhanced by providing vulnerable households with better access to information, training on disaster management and adaptation, livelihood support to enhance their economic capability, opportunities for higher education, and financial support to enable them to build stronger and more resilient housing units. Government should also expand the reach and availability of low-interest rate calamity loans as most households rely on loans to address their immediate needs after being struck by a disaster.

Resilience of firms

Mendoza, Francisco and Lau (2014) assessed the resilience of the Philippine SMEs during economic and environmental shocks by analyzing their coping strategies (Table 5). This study used data on firms' crisis coping strategies drawn from the 2012 AIM-ADB Enterprise survey which covered 2,037 micro, small and medium firms in 34 cities in the Philippines. The calamities considered include typhoon, flood, drought, earthquake, volcanic eruption, armed conflict, fire, and others.

Table 5: Natural Disaster Resilience-Related Studies on Urban Firms in the Philippines

Authors/ Year	Methodology	Main Finding	Main Recommendation
Mendoza, Francisco and Lau (2014)	<ul style="list-style-type: none"> - Marikina City, Iligan City and Cagayan de Oro City - Floods - 2012 AIM-ADB Enterprise Survey 	Larger and more productive firms are better able to cope, and might even see crises as opportunities for expansion and finding new markets. Firms that are smaller and less productive may face	Stronger urban planning is necessary and it should not discriminate across firms. Financing mechanisms to invest in resilience and innovative risk management mechanisms could be useful

	<ul style="list-style-type: none"> - Descriptive and regression analyses 	<p>additional challenges to survive, and they may turn to crisis coping mechanisms that have negative implications on their long run competitiveness.</p>	
<p>Ballesteros and Domingo (2015)</p>	<ul style="list-style-type: none"> - Philippines - Typhoons - Secondary data - Descriptive analysis 	<p>There is apparent lack of disaggregation or sectoral focus on the policy framework that drives DRRM among the different stakeholders. There is no single policy that details SMEs disaster mitigation, preparedness, response and recovery</p>	<p>There is a need to review and translate national frameworks and development plans into workable subnational and sectoral action plans. Disaster risk reduction and management strategies should be targeted specifically for business resiliency among SMEs.</p>
<p>Asian Disaster Preparedness Center (2016)</p>	<ul style="list-style-type: none"> - Philippines - Natural and man-made hazards - 2015 SME Resilience Survey - Descriptive analysis 	<p>There is low awareness of Business Continuity Management (BCM) as a risk reduction mechanism, and a low uptake of external risk financing or other formal coping mechanisms.</p>	<p>A key challenge for an MSME disaster-resilience roadmap, is to disaggregate the global question of “MSME disaster-resilience” into a series of policy bundles or activities that are implementable.</p>

The study found that the most common coping mechanisms employed were reducing research and development spending (R&D) spending (29.11%), asking suppliers for credits on transaction (25.45%), diversifying or introducing new products or services (17.59%), stopping operations for a period (17.23%) and laying off employees (14.11%). Further, the findings suggest that larger and more productive firms are much able to cope, and even see crises as opportunities for expansion and finding new markets. On the other hand, firms that are smaller and less productive face additional challenges to survive, and they may turn to crisis coping mechanisms that have negative implications on their long run competitiveness. The study concluded that policies could be vastly improved with more evidence on how to strengthen firm level competitiveness and resilience over time.

The study argued that stronger urban planning be implemented to enhance the resilience of firms and that key business districts or firms be located away from flood-prone areas. In

addition, it argued that financing mechanisms to invest in resilience and innovative risk management mechanisms could be very useful in supporting the climate change adaptation and resilience-building programs.

Ballesteros and Domingo (2015) assessed SME resilience in the Philippines by reviewing the policy frameworks on Philippine disaster risk reduction and management (DRRM) and SMEs (Table 5). It used secondary data and information from the existing literature on resilience in its analysis and the development of conceptual framework already discussed here earlier. The study found that there is apparent lack of disaggregation or sectoral focus on the policy framework that drives DRRM among the different stakeholders. There is no single policy that details SMEs disaster mitigation, preparedness, response and recovery. Furthermore, Philippine DRRM framework is more inclined on household resilience than on economic resilience. There is no program or specific centers that would respond to the immediate needs of business sector. The study also emphasized that the socioeconomic role of SMEs in a community must be recognized. Particularly in times of disasters, the immediate recovery of communities heavily relies on the ability of businesses like SMEs to provide products/services, employment opportunities and local revenue.

The study recommended that national frameworks and development plans should be reviewed and translated into workable subnational and sectoral action plans. A good approach to assessing the needs and providing DRRM interventions for SMEs would be a disaggregated or sectoral approach. In addition, improving business continuity and resilience requires the joint effort and cooperation between the government, private sector and local communities. Government would be responsible on defining the appropriate policy framework and invest climate which will lay the groundwork for building resilience. Meanwhile, private sector and local community participation would entail a sense of ownership among them and therefore encourages participation and enhances the adaptive capacity among the various stakeholders involved.

Asian Disaster Preparedness Center (2016) analyzed the current framework for disaster resilience of micro, small and medium enterprises (MSMEs) in the Philippines in order to propose issues for consideration in the development of a roadmap for MSME disaster resilience. The study presented the results of the Philippine SME Resilience Survey which was conducted among 513 MSME respondents from 17 of 18 regions in 2015. The survey aimed to identify MSMEs' perceptions of disaster risk, their experience of disasters that disrupted business, and their exposure to and practice concerning Business Continuity Management (BCM), including use of Business Continuity Plans (BCP).

The results of the study indicated that MSMEs have a high awareness of disaster risk and a significant degree of engagement to DRRM at the local level. In addition, a great deal of respondents (74%) also said they would be interested in participating in a national planning process to support SMEs to prepare for and recover from hazards and disasters. However, MSMEs have a low awareness of BCM and BCP as a risk reduction mechanism. Majority of the respondents (77%) did not have a written BCP, and only 6 percent already had a BCP. The findings also suggested that MSMEs have a self-reliant approach to disaster risk, with low uptake of

insurance accompanied by the use of personal savings, working more and using networks of family and friends to recover from disaster losses.

The study argued that there is a need for continuing effort to awareness-raising and policy support for MSME disaster resilience in the Philippines. Specifically, government can provide training on BCM and BCP that includes natural hazard risk assessments as well as the development of emergency procedures for the enterprises. MSMEs should also be included in legal, institutional and policy frameworks for climate and disaster risk reduction and management.

Resilience of communities

Climate and Disaster Resilience Initiative (2010) examined disaster resilience in Metro Manila using the Climate Disaster Resilience Index (CDRI) (Table 6). This study covered 16 cities and 1 municipality in Metro Manila wherein survey respondents were the Planning Officers for each locality. In this CDRI, five dimensions were considered: physical, social, economic, institutional and natural. Resilience dimensions were scored between 0 and 5 and the value for each dimension was calculated by summing the index of each variable and dividing the whole by the number of variables in each dimension. The overall CDRI values are then obtained after averaging each of the five dimensions’ resilience values. Higher CDRI values generated indicate high resilience meaning better preparedness to cope with climate and disasters and vice versa.

Table 6: Natural Disaster Resilience-Related Studies on Urban Communities in the Philippines

Authors/ Year	Methodology	Main Finding	Main Recommendation
Climate and Disaster Resilience Initiative (2010)	<ul style="list-style-type: none"> - Metro Manila - Climate Change - CDRI - Questionnaire Surveys - Descriptive analysis - Climate Disaster Resilience Index 	Metro Manila has a high physical, institutional, and social resilience and moderate natural economic resilience. Its overall resilience index is 3.77 out of a perfect 5.0.	Metro Manila cities must have a stake in protecting themselves and not just leave the job to the national government.

<p>Pellini et al. (2013)</p>	<ul style="list-style-type: none"> - Tabaco City, Baguio City, Marikina City in Luzon; Iloilo City and Cebu City in Central Visayas; and Davao City and Cagayan de Oro City in Mindanao - Typhoons, floods, landslides, volcanic eruptions - Focus group discussion and semi-structured interviews - Descriptive analysis 	<p>A history of being a disaster-prone area means a higher level of awareness among people of the risks associated with natural disasters. On the other hand, perception of low risk could lead to the absence of policy action</p>	<p>LGUs must engage academic institutions in natural disasters and disaster risk management policy research. This will greatly improve the creation of policies and programs on disaster management as the data employed be research-based.</p>
<p>Florano (2014)</p>	<ul style="list-style-type: none"> - Tacloban City, Iligan City, Dagupan City, Marikina City - Typhoons, floods - Key informant interviews, focus group discussions - Descriptive analysis - Disaster-Resilient Community Index 	<p>Community governance for disaster recovery seems to be stuck in the pre-National Disaster Risk Reduction and Management (NDRRMC) years because recovery planning is still passive and reactive. There is no early recovery planning and government has been relying on post-disaster needs assessment.</p>	<p>RA 10121 (Philippine Disaster Risk Reduction and Management Act of 2010) should be amended to include pre-disaster recovery planning (PDRP). In addition, relocation from dangerous areas to safer places and provision of alternative source of livelihood for the poor most affected during disasters.</p>

Results of the study showed that Metro Manila has high physical (4.35), institutional (4.20) and social (4.01) resilience; and a moderate natural (3.15) and economic (3.14) resilience. The overall CDRI is 3.77 out of a perfect score of 5. In particular, it was observed that access to potable water supply, access to electricity and waste management was highly rated by the Planning Officers thus can be considered the strengths of cities. On the other hand, urban morphology, urban population density, and frequency of floods and typhoons were rated low indicating these are the weaknesses of the cities.

The study recommended policy implications in five key areas on how to enhance resilience which was based on the Hyogo Framework. Specific recommendations were provided per city but in general, the study suggested that Metro Manila cities must have a stake in protecting themselves and not just leave the job to the national government. It further recommended the following: (1) making disaster risk reduction a priority, (2) improving risk information and early warning, (3) building a culture of safety and resilience, (4) reducing the risks in key sectors and (5) strengthening preparedness for response.

Pellini et al. (2013) studied the initiatives of LGUs to reduce the negative effects of natural disasters, as well as the use of knowledge and research evidence in the design of urban resilience policies in urban areas (Table 6). It examined whether the processes in policy and decision-making on resilience to natural disaster use scientific knowledge and research evidence in the design and implementation of urban resilience measures. The study adopted a political economy analysis to create an analytical framework that focuses on policy-decision making processes. Data were gathered through focus group discussion and semi-structured interviews in seven local government units: Albay, Baguio City, Marikina City, Iloilo City, Cebu City, Davao City and Cagayan de Oro.

The study found that a history of being a disaster-prone area means a higher level of awareness among people of the risks associated with natural disasters. For example, there was a culture of disaster preparedness among the people of Tabaco, Albay, which has a history of being exposed to typhoons and eruptions of Volcano Mayon. On the other hand, perception of low risk could lead to the absence of policy action. For example, western part of Mindanao has been traditionally considered a typhoon-free part of the country. The study also found that there may be negative perception on the information and service provided by weather forecasting agencies. Due to this, some LGUs may rely on community knowledge which may not be scientifically tested but has been validated by experience. In conclusion, the study suggested that local government units engage academic institutions in natural disasters and disaster risk management policy research. This will greatly improve the creation of policies and programs on disaster management as the data employed be research-based.

Florano (2014) examined the role of community governance in disaster recovery and resilience by looking into selected barangays in Tacloban, Iligan, Dagupan and Marikina Cities (Table 6). The study conducted several key-informant interviews and focus group discussions and used a Disaster-Resilient Community Index (DRCI) to measure resilience of the affected communities. This index covers five thematic areas: governance, knowledge and education, risk

assessment, risk management and vulnerability reduction, and disaster preparedness and response. The study sites were chosen based on three criteria: (1) they had been hit by strong typhoons or tropical storms within the last five years, (2) they are major cities/urban areas, and (3) for geographical representation, there must be representative cities from Luzon, Visayas and Mindanao.

Findings of the study revealed that community governance for disaster recovery seems to be stuck in the pre-National Disaster Risk Reduction and Management (NDRRMC) years because recovery planning is still passive and reactive. There is no early recovery planning and government has been relying on post-disaster needs assessment. Another finding of the study was that faster recovery time from a disaster is directly related with resilience. This is supported by the fact that the ones who got a higher DRCI value (Marikina and Dagupan) took only a short period of time to recover compared to the ones who got a lower DRCI value (Tacloban and Iligan). In addition, building resilience in a community takes time and this can be delayed if important recovery sectors such as housing and livelihood are neglected. The study argued that addressing the needs on housing and livelihood reduces the exposure of households to hazards and vulnerabilities. The study adds that aside from the lack of allocated funds for disaster rehabilitation and recovery, recovery planning is still passive and reactive. There is no early recovery planning, and for the past years, the government has been relying on post-disaster needs assessment after every disaster. Barangays and LGUs also rely heavily on the national government and just wait for directives to assess damages and losses and propose recovery and reconstruction plans from National Disaster Risk Reduction Management Council (NDRRMC) and member-agencies.

To address the issues in disaster recovery and resilience, the study suggested, among others, to amend RA 10121 (Philippine Disaster Risk Reduction and Management Act of 2010) to include pre-disaster recovery planning (PDRP). In addition, it suggested relocating from dangerous areas to safer places and providing an alternative source of livelihood for the poor as they are the most affected during disasters. Also, they should also be provided with alternative livelihood so they do not return to disaster-prone areas.

VI. Research Gaps

While the above-review may not be comprehensive, some gaps can already be identified in the socioeconomic research on urban resilience of households, firms, and communities in the Philippines. These are: 1) Related researches conducted in recent years have been limited with those undertaken in the 2000s numbering less than ten; 2) the studies centered mainly on climate change and natural disasters as the issues of interest and exclude man-made and other disasters; 3) the studies are site-specific and cover selected cities and urban areas; 4) the studies used cross-section data and information and excluded time-series analysis; 5) the locally developed frameworks in general can still stand further development and refinement; 6) the analyses conducted can also be made more detailed to look into specific issues of interests; and 7) there is not much work done on the valuation of the socioeconomic costs of specific disasters (including the cost of relief and rehabilitation) and the expected benefits that can be generated from resilience-related activities.

VII. Summary and recommendations

This paper has reviewed the frameworks, methodologies and empirical studies already available on the urban resilience of households, firms, and communities in the Philippines. It showed that there are foreign and locally- developed analytical frameworks and methodologies on the urban resilience that have been used in research. Furthermore, it found that there are already a number of empirical studies covering resilience of households, firms and communities particularly to natural disasters than have been conducted in specific urban areas like Metro Manila and other Philippine cities. From the review, the paper has identified some gaps in the current research. Based on this, the recommended studies and related activities that can be undertaken in the future are as follow:

Studies on households:

- 1 resilience between types of poor urban households and environments, e.g., below and above poverty line households; coastal and upland households; riverine and non-riverine households; and other relevant comparisons;
- 2 resilience between types of natural disasters individually and as a whole among poor urban households, e.g. typhoons, floods, earthquakes, landslides, and even epidemic diseases;
- 3 efficiency and effectiveness of different types of relief and recovery operations for poor households to determine the most desirable cost-effective programs that should be implemented;
- 4 Efficiency and effectiveness of different types of formal and informal financial services which can be made accessible to poor urban households during times of natural calamities;
- 5 Average durations and livelihood losses of disaster-affected households and their determinants, by type of livelihood, household, and disaster;

Studies on firms:

1. resilience of SMEs across different stages of their supply chain to determine specifically which points in the chain are most vulnerable and needing the most attention;
2. identification and cost-benefit analysis of potential resilience-oriented public-private projects which the government can promote and implement not only with SMEs but the whole business sector;
3. identification and detailed analysis of resilience-related best practices among firms that can be disseminated among the entire business sector and identification of industry champions that can serve as example;
4. Analysis of the appropriate financial and other incentives that can be provided to SMEs in order to motivate them to practice resilience-oriented practices in their business operations; and

5. Average durations of shutdown of disaster affected MSMEs and their determinants, by type of entrepreneur, sector, and disaster.

Studies on communities:

1. Analysis of how social capital and multi-sectoral partnerships can be enhanced among and between urban communities to improve their resilience to natural disasters;
2. Study of the appropriate infrastructure that the national and local governments can put up in order to enhance natural disaster resilience among the most vulnerable urban communities;
3. Identification and analysis of best practices and champion communities that can be disseminated and promoted to improve resilience to natural disasters at the community level; and
4. Roles of community support in facilitating disaster relief and recovery and their determinants.

Other research-related activities:

1. Firming up the frameworks and methodologies that are appropriate for the study of resilience of urban households, firms, and communities in the case of the Philippines;
2. Inclusion of the collection of critical resilience-related data and information in relevant annual or periodic socioeconomic surveys conducted by both the national government;
3. Expansion of research attention from just covering natural disasters to also include man-made and other forms of risks, shocks and disasters which significantly affect the lives particularly of the poor members of the population; and
4. Development in government-funded research institutions of formal research programs on resilience that identify and conduct critical resilience-related studies, including cost-benefit analysis.

VIII. References

Asian Development Bank (ADB). (2013). *Investing in resilience: ensuring a disaster-resistant future*. Mandaluyong: Asian Development Bank.
<http://www.adb.org/sites/default/files/publication/30119/investing-resilience.pdf>.
Accessed on 02 July 2015.

Asian Disaster Preparedness Center. (2016). *Disaster-Resilience of Micro, Small and Medium (MSME) in the Philippines: Policy Environment and SME Survey Results*. Bangkok: Asian Disaster Preparedness Center.

Asia Pacific Economic Cooperation (APEC). (2010). *Public-Private Partnerships and Disaster Resilience. Workshop Report*. Bangkok: APEC Emergency Preparedness Working Group.

- http://www.csr-asia.com/report/APECFinalOutcomesReport_201103.pdf. Accessed on 8 February 2016.
- Ballesteros, M. F. & Domingo, S. N. (2015). *Building Philippine SMEs Resilience to Natural Disasters (Discussion Paper Series No. 2015-20)*. Makati: Philippine Institute for Development Studies.
<http://dirp3.pids.gov.ph/webportal/CDN/PUBLICATIONS/pidsdps1520.pdf>. Accessed on 22 January 2016.
- Bernardo, A. V., Rodriguez, A. Z., Fuentebella, V. A., Lee, A., Gulfo, R. L., Maghacot, J., & Banaguas, G. (2014). Creating Climate-Disaster Resiliency on the Indigenous People, "Tagbanuas", in Coron, Palawan. *DLSU Research Congress 2014*. Manila: De La Salle University.
http://www.dlsu.edu.ph/conferences/dlsu_research_congress/2014/_pdf/proceedings/SEE-IV-035-FT.pdf. Accessed on 02 July 2015.
- Bollettino, V., Dy, P., Alcayna, T., & Vinck, P. (2016). *DisasterNet Philippines Scoping Study Report*. Harvard Humanitarian Initiative.
http://reliefweb.int/sites/reliefweb.int/files/resources/disasternet_philippines_scoping_study.pdf. Accessed on 28 July 2016.
- Care Philippines (CP). (2015). *Household Cash Transfer Assessment Typhoon Haiyan Recovery Response - Promoting Resilient and Sustainable Livelihoods*.
<http://reliefweb.int/sites/reliefweb.int/files/resources/household-cash-transfer-report-care.pdf>. Accessed on 30 June 2016.
- Climate and Disaster Resilience Initiative (CDRI). (2010). *Metro Manila city profile: Climate and disaster resilience*. Kyoto: Kyoto University.
http://www.preventionweb.net/files/16576_16576metromanilacityprofile1.pdf. Accessed on 08 September 2015.
- De Silva, S. & Burton, C. (2008). *Building resilient communities: Risk management and response to natural disasters through social funds and community-driven development operations*. Washington, DC: World Bank.
<http://documents.worldbank.org/curated/en/844751468148503609/pdf/487230WP0B0x331Communities1Complete.pdf>. Accessed on 02 July 2015.
- Department for International Development (DFID). (2011). *Defining disaster resilience: A DFID approach paper*. London.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/186874/defining-disaster-resilience-approach-paper.pdf. Accessed on 23 June 2015.
- Florano, E. R. (2014). *Community Governance for Disaster Recovery and Resilience: Four Case Studies in the Philippines (Discussion Paper Series No. 2014-38)*. Makati: Philippine

- Institute for Development Studies.
<http://dirp3.pids.gov.ph/webportal/CDN/PUBLICATIONS/pidsdps1438.pdf>. Accessed on 08 September 2015.
- FM Global. (2016). *Resilience Index Annual Report 2016*. Oxford Metrica.
http://www.fmglobal.com/~media/Files/FMGlobal/Resilience%20Index/Resilience_Methodology.pdf?la=en. Accessed on 28 July 2016
- Francisco, J. P. (2013). *Property Damage Recovery and Coping Behavior of Households Affected by an Extreme Flood Event in Marikina City, Metro Manila, Philippines EADN WORKING PAPER No. 81*. Retrieved from East Asian Development Network:
http://www.eadn.org/working%20papers/WP_81_Francisco.pdf. Accessed on 02 July 2015.
- Frankenberger, T., Mueller, M., Spangler, T., & Alexander, S. (2013). *Community resilience: conceptual framework and measurement feed the future learning agenda*. Rockville, MD: Westat.
https://agrilinks.org/sites/default/files/resource/files/Feed_the_Future_Learning_Agenda_Resilience_Literature_Review_July_2013.pdf. Accessed on 23 June 2015.
- Galderisi, A. (2014). *Urban Resilience: a framework for empowering cities in face of heterogeneous risk factors*. A| Z Journal-Cities at risk, 11(2).
<http://www.az.itu.edu.tr/azvol11no1web/06-Galderisi-1101.pdf>. Accessed on 10 September 2015.
- Global Footprint Network (GFN). (2012). *A Measure for Resilience: 2012 Report on the Ecological Footprint of the Philippines*. California: Global Footprint Network.
http://www.footprintnetwork.org/images/article_uploads/Philippines_Footprint_Report_2012.pdf. Accessed on 30 June 2016.
- Gotangco C.K., See, J., Dalupang, J. P., Ortiz, M., Porio, E., Dator-Bercilla, J., Yulo-Loyzaga, A. & Narisma, G. (2014). *Quantifying resilience to flooding among households and local government units using system dynamics: The case of Metro Manila*. Presented during the 6th International Conference on Flood Management. September 2014. Brazil.
<http://www.abrh.org.br/icfm6/proceedings/papers/PAP016240.pdf>. Accessed on 02 July 2015.
- GSMA Intelligence. (2014). *Country overview: Philippines growth through innovation*. London: GSMA Intelligence. <https://www.gsmaintelligence.com/research/?file=141201-philippines.pdf&download>. Accessed on 8 February 2016.
- Hiwasaki, L., Luna, E., Syamsidik, & Shaw, R. (2014). *Local & indigenous knowledge for community resilience: Hydro-meteorological disaster*. Jakarta: United Nations

- Educational Scientific and Cultural Organization (UNESCO).
<http://unesdoc.unesco.org/images/0022/002287/228711E.pdf>. Accessed on 15 July 2015.
- Hudner, D., & Kurtz, J. (2015). *Do Financial Services Build Disaster Resilience?: Examining the Determinants of Recovery from Typhoon Yolanda in the Philippines*.
https://www.mercycorps.org/sites/default/files/MercyCorps_FinancialServicesDRRStudy_2015.pdf. Accessed on 12 August 2015.
- Hudner, D., Harter, G., Van Asselt, J. & Kummings, M. (2015). *What Matters for Household Resilience: Lessons from Recovery in Western Leyte After Typhoon Yolanda*. Mercy Corps and John Hopkins University of School of Advance International Studies.
<http://www.sais-jhu.edu/sites/default/files/Mercy%20Corps%20Deliverable.pdf>. Accessed on 30 June 2016.
- IBM. (2007). *A comprehensive, best-practices approach to business resilience and risk mitigation*. White paper. IBM Governance and Risk Management. http://www-935.ibm.com/services/us/cio/pdf/wp_best_practices_risk_mitigation.pdf. Accessed on 23 June 2015.
- Irajifar, L., Alizadeh, T., & Sipe, N. (2013). *Disaster resiliency measurement frameworks: State of the art*. Presented at the World Building Congress, Brisbane, Australia.
http://www.irbnet.de/daten/iconda/CIB_DC27349.pdf. Accessed on 22 January 2016.
- Israel, D. C., & Briones, R. M. (2014). *Disasters, Poverty, and Coping Strategies: The Framework and Empirical Evidence from Micro/Household Data-Philippine Case (Discussion Paper Series 2014-06)*. Makati: Philippine Institute for Development Studies.
<http://dirp3.pids.gov.ph/webportal/CDN/PUBLICATIONS/pidsdps1406.pdf>. Accessed on 08 September 2015.
- Israel, D. C., & Briones, R. M. (2013). *The impact of natural disasters on income and poverty: framework and some evidence from Philippine household (Policy Note 2013-14)*. Makati: Philippine Institute for Development Studies.
<http://dirp3.pids.gov.ph/webportal/CDN/PUBLICATIONS/pidspn1314.pdf>. Accessed on 08 September 2015.
- Jabareen, Y. (2013). *Planning the resilient city: Concepts and strategies for coping with climate change and environmental risk*. *Cities*, 31, 220-229.
https://www.researchgate.net/profile/Yosef_Jabareen/publication/266735023_1-s20-S0264275112000832-main/links/543926e50cf2d6698be13c73.pdf. Accessed on 10 September 2015.
- Jeffers, R., Fogleman, W., Grazier, E., Walsh, S., Rothman, S., Shaneyfelt, C., Munaf, A., Gibson, J., Vargas, V., Vugrin, E., Conrad, S. & Passell, H. (2016). *Development of an Urban*

- Resilience Analysis Framework with Application to Norfolk, VA*. New Mexico: Sandia Laboratories.
<https://pdfs.semanticscholar.org/9cb1/5acba9fad00c665ca85ed4d2ce176e34f28a.pdf>.
 Accessed on 10 September 2015.
- Kim, D., & Lim, U. (2016). *Urban Resilience in Climate Change Adaptation: A Conceptual Framework*. *Sustainability* 2016, 8, 405. <http://www.mdpi.com/2071-1050/8/4/405/htm>. Accessed on 10 September 2015.
- Llanto, G. M. (2016). *Risks, Shocks, Building Resilience: Philippines (Discussion Paper Series 2016-09)*. Quezon City: Philippine Institute for Development Studies.
<http://dirp3.pids.gov.ph/websitcms/CDN/PUBLICATIONS/pidsdps1609.pdf>. Accessed on 30 June 2016.
- Mendoza, R. U. , Francisco, J. P., & Lau, A. S. (2014). *Resilience of Firms to Economic and Climate Shocks: Initial Insights from Philippine SMEs*. Working Paper 14-013. Makati, Philippines: Asian Institute of Management.
- Nolan, M. & Smith, B. (2015). *Becoming Climate Resilient: An executive business case for climate resilience*. AECOM. http://www.aecom.com/content/wp-content/uploads/sites/2/2015/10/Becoming_Climate_Resilient_Guide_JUNE2015_final_low-rez_a4.pdf. Accessed on 8 February 2016.
- Orencio, P. M. (2014). *Developing and applying composite indicators for assessing and characterizing vulnerability and resilience of coastal communities to environmental and social change*. Doctoral dissertation. Sapporo, Japan: Hokkaido University.
http://eprints.lib.hokudai.ac.jp/dspace/bitstream/2115/57133/1/Orencio_Pedcris_Miralles.pdf. Accessed on 12 August 2015.
- Pellini, A., Contreras, A., Jabar, M., Guzman, M. T., Era, M., Erasga, D., & Jr., R. J. (2013). *Towards policy-relevant science and scientifically informed policy: Political economy of the use of knowledge and research evidence in urban resilience interventions in the Philippines*. London: Overseas Development Institute.
http://www.researchgate.net/profile/Arnaldo_Pellini/publication/267512175_Towards_policy-relevant_science_and_scientificallly_informed_policy._Political_economy_of_the_use_of_knowledge_and_research_evidence_in_urban_resilience_interventions_in_the_Philippines/links/5451c3460cf285a067c69aa5.pdf. Accessed on 23 June 2015.
- PricewaterhouseCoopers (PwC). (2011). *Philippine businesses' response to climate change*. <http://www.pwc.com/ph/en/thinktank/assets/2014/pwcfa-climate-change-survey-2011.pdf>. Accessed on 22 January 2016.

- Quero, R. (2012). *Framework for building skills in disaster risk management for businesses*. *Journal for Business Conference Volume 1 (No. 1)*, pp. 66-76. http://atiftap.org/assets/e-journal/jgbv1n1/v1n1_2.pdf. Accessed on 8 February 2016.
- Rockefeller Foundation. (2014). *City Resilience Framework*. Ove Arup & Partners International Limited 2014. <https://www.rockefellerfoundation.org/app/uploads/City-Resilience-Framework1.pdf>. Accessed on 10 September 2015.
- Thorbecke, W. (2016). *Increasing the Resilience of Asian Supply Chains to Natural Disasters: The Role of the Financial Sector* (No. DP-2016-08). Economic Research Institute for ASEAN and East Asia (ERIA). <http://www.eria.org/ERIA-DP-2016-08.pdf>. Accessed on 28 July 2016.
- Twigg, J. (2001). *Corporate social responsibility and disaster reduction: A global overview*. London: Benfield Greig Hazard Research Centre. http://r4d.dfid.gov.uk/pdf/outputs/mis_spc/r7893csroverview.pdf. Accessed on 8 February 2016.
- Tyler, S., & Moench, M. (2012). *A framework for urban climate resilience*. *Climate and Development*, pp. 311-326. <http://www.tandfonline.com/doi/pdf/10.1080/17565529.2012.745389>. Accessed on 12 August 2015.
- Tyler, S., Reed, S. O., MacClune, K., & Chopde, S. (2010). *Planning for Urban Climate Resilience: Framework and Examples from the Asian Cities Climate Change Resilience Network*. *Climate Resilience in Concept and Practice Working Paper Series*. Colorado. <http://www.alnap.org/pool/files/isetpaper3-2010.pdf>. Accessed on 22 January 2016.
- United Nations Global Compact (UNGC). (2012). *Business and climate change adaptation: toward resilient companies and communities*. UNGC and UNEP. http://caringforclimate.org/wp-content/uploads/Business_and_Climate_Change_Adaptation.pdf. Accessed on 8 February 2016.
- UNDP Drylands Development Centre (UNDP-DDC). (2013). *Community based resilience assessment (CoBRA) conceptual framework and methodology*. http://www.fao.org/fileadmin/user_upload/drought/docs/CoBRRA%20Conceptual%20Framework.pdf. Accessed on 12 August 2015.
- UNEP Finance Initiative (UNEPFI). (2014). *The PSI global resilience project: Building disaster-resilient communities and economies*. Geneva: United Nations Environment Programme. http://www.unepfi.org/fileadmin/documents/building_disaster-resilient_communities_economies_01.pdf. Accessed on 22 January 2016.

- UNISDR. (2007). *Mainstreaming Community-Based Mitigation in City Governance*. In Building Disaster Resilient Communities: Good Practices and Lessons Learned A Publication of the “Global Network of NGOs” for Disaster Risk Reduction. pp. 46-48. United Nations Office for Disaster Risk Reduction. www.unisdr.org/files/596_10307.pdf. Accessed on 12 August 2015.
- Usamah, M. (2013). *Land Tenure Security and Resilience to Multiple Disasters: A Study of Camalig Municipality, Province of Alabay, the Philippines (Doctoral Dissertation)*. Royal Melbourne Institute of Technology University.
- Uy, N., Takeuchi, Y., & Shaw, R. (2011). Local adaptation for livelihood resilience in Albay, Philippines. *Environmental Hazards*, pp. 139-153.
<http://www.tandfonline.com/doi/pdf/10.1080/17477891.2011.579338>. Accessed on 12 August 2015.
- Winderl, T. (WEF). (2008). *Disaster Resilience Measurements: Stocktaking of Ongoing Efforts in Developing Systems for Measuring Resilience*. United Nations Development Programme. Geneva.
http://www.preventionweb.net/files/37916_disasterresiliencemeasurementsundpt.pdf
- World Bank (WB). (2014). *Safe and Resilient Infrastructure in the Philippines*. Washington, USA: World Bank.
<https://openknowledge.worldbank.org/bitstream/handle/10986/21732/ACS121820WP0Bo0B00P13104100PUBLIC00.pdf?sequence=1>. Accessed on 02 July 2015.
- World Economic Forum (WEF). (2008). *Building resilience to natural disasters: a framework for private sector engagement*. Geneva.
http://www.unisdr.org/files/1392_DisastersRepFINCopyright.pdf/. Accessed on 08 February 2016.

Appendix Table: Mapping of Disaster Resilience Measurements

MEASUREMENT	Developer/ Affiliation	Focus	Components	Smallest unit of analysis	Methodology	Participatory	Data sources	Stage of development
NATIONAL LEVEL								
Hyogo Framework for Action (HFA) Monitor	UNISDR (globally)	progress towards HFA using 31 indicators on three levels (outcomes, goals, priorities)	indicators for the outcome, three strategic goals and five priority areas	local government or country	self-assessment by governments on scale from 1 to 5; mostly input-related	yes (self-assessment)	primary (self-assessment)	IMPLEMENTATION; 2009, 2011 and 2013
WorldRiskIndex	UNU-EHS	disaster risk value for 173 countries	exposure, susceptibility, coping capacities, adaptation	country	quantitative; weighted composite index with 28 indicators	no	secondary data only	IMPLEMENTATION; annually since 2011
Global Focus Model (GFM)	UN OCHA & Maplecroft	hazards, vulnerabilities and response capacity at country-level	hazard, vulnerability, capacities, humanitarian need	country & region	quantitative; weighted composite index	no	secondary data only; some data from proprietary indices of Maplecroft	IMPLEMENTATION; annually since 2007
Socio-Economic Resilience Index	Maplecroft	socio-economic resilience as part of a set of natural hazards risk atlas	not known	country	not known	no	not known	IMPLEMENTATION; at least since 2011; only paid access
Risk Reduction Index (RRI)	DARA	measurement of underlying risks; so far Latin America and Western Africa	environment and natural resources, socio-economic conditions, land use and the built environment, governance	country	mostly qualitative; local perceptions about underlying risk using key informants	yes (perception surveys)	primary data (questionnaire, workshops)	IMPLEMENTATION; partially since 2010
Prevalent Vulnerability Index (PVI)	Inter-American Development Bank	part of a set of four indicators that measure the potential impact of natural hazards	exposure, susceptibility, socioeconomic fragility and resilience	country (but also sub-national)	composite index consisting of 3 sets of 8 high-level indicators	No	secondary data only	IMPLEMENTATION; partially in Latin America
Country Resilience Rating	World Economic Forum	resilience of countries to global risks	robustness, redundancy, resourcefulness, response and recovery	country	mix of quantitative (mostly existing indices) and perception data	yes (perception surveys)	secondary data and perception surveys	INDICATORS DEFINED
AGIR Results Framework	AGIR	food and nutrition resilience in Sahel and West Africa	4 impact indicators and a set of outcome indicators for 4 objectives	country	quantitative and qualitative set of individual indicators for each objective	No	secondary data; indicators drawn from existing programmes and initiatives	INDICATORS DEFINED
Post-2015 indicators for Disaster Risk Reduction	UNISDR	disaster Risk Reduction including economic resilience	not defined, but might refer to economy, capital stock, investment and saving levels, trade flows, insurance penetration, fiscal resilience, social protection etc.	not defined yet	not defined yet	no	secondary data only	PLANNING; indicators only partially defined

MEASUREMENT	Developer/ Affiliation	Focus	Components	Smallest unit of analysis	Methodology	Participatory	Data sources	Stage of development
SUB-NATIONAL LEVEL								
Resilience Capacity Index (RCI)	Network on Building Resilient Regions (BBR)	single statistic summarizing a region's score on 12 equally weighted indicators in US	economic, socio-demographic, community connectivity capacities	communities in U.S.	numeric indicators; some use of existing composite indicators	no	secondary data only	IMPLEMENTATION; data for USA
Baseline Resilience Indicators for Communities (BRIC)	Hazards & Vulnerability Research Institute, Univ. of South Carolina	set of indicators based on the Disaster Resilience of Place (DROP) model	ecological, social, economic, infrastructure, Institutional, competencies	communities	numeric and yes/no indicators; use of existing composite indicators	no	secondary data only	IMPLEMENTATION; partially in South Carolina, USA
ResilUS	Huxley College of the Environment, Western Washington University	prototype simulation model of community resilience in U.S.	recovery module, loss estimation module	communities in U.S.	not known	probabilistic methods	secondary data only	IMPLEMENTATION; prototyping in 3 study areas
Tsunami Recovery Impact Assessment and Monitoring System (TRIAMS)	Indonesia, Sri Lanka, Maldives, Thailand, IFRC, WHO, UNDP	common approach to monitoring recovery efforts and assessing impact in four countries affected by the 2004 tsunami in Asia	vital needs, basic social services, infrastructure, livelihoods	Indonesia, Sri Lanka, Maldives, Thailand	28 quantitative output indicators, 20 outcome indicators and 3 impact indicators on recovery	includes qualitative tools in addition to indicators	secondary and primary data; qualitative data for triangulation	IMPLEMENTATION; (in Indonesia, Sri Lanka, Maldives, Thailand)
DRLA/UEH Evaluation Resilience Framework for Haiti	Tulane University / University of Haiti	model to measure the relationship between a shock, humanitarian assistance and resilience	wealth, debt and credit, coping behaviours, human capital, protection and security, community networks, and psychosocial status	households	quantitative composite indicators and qualitative tools	yes (surveys)	primary data (surveys & focus groups)	IMPLEMENTATION (in Haiti)
Indonesia Disaster Recovery Index (DRI)	Government of Indonesia	measurement of recovery after volcano eruption and floods in Indonesia	22 recovery variables	communities in Indonesia	Household survey and longitudinal data	not known	primary data (household surveys)	IMPLEMENTATION (in Indonesia)
FAO Resilience Tool	FAO	root causes of household vulnerability	assets, income and food access, access to basic services, social safety, adaptive capacity, stability	communities	Quantitative indicators combined into an overall 'resilience score'	No	secondary data only	IMPLEMENTATION (in selected areas)
Livelihoods Change Over Time (LCOT)	Tufts University, Mekelle University	ability to "bounce back" from major regional food security crises in Northern Ethiopia	three types of analysis: a) household welfare over time, b) food security dynamics, c) poverty traps	households	Quantitative indices; poverty traps framework from Carter & Barrett	Yes (self-reports)	secondary and primary data (four rounds of a household survey over two years)	IMPLEMENTATION (in selected areas)
PEOPLES Resilience Framework	Multidisciplinary Center for Earthquake Engineering Research	comprehensive measurement framework building upon MEERC R4 resilience framework	population & demographics, environmental/ ecosystem, services, infrastructure, lifestyle, economic, social-cultural	communities	mix of quantitative data; use of existing composite indicators	not known	secondary data only	POTENTIAL INDICATORS IDENTIFIED

Community Based Resilience Analysis (CoBRA)	UNDP Drylands Development Centre	universal and context-specific measurement framework for resilience	survival and livelihood protection threshold; physical, human, financial, natural and social	households (for meta-indicator), Communities	numeric and yes/no indicators; qualitative data	yes (interviews, focus group discussions)	primary data collection in combination with secondary data	POTENTIAL INDICATORS IDENTIFIED
Minimum characteristics of NRRC	Nepal Risk Reduction Consortium (NRRC)	suggested indicator framework on the output level	institutional, information, assessments, teams, plans, funding, infrastructure, warning systems	communities in Nepal	mostly yes/no and numeric indicators	no	primary data collection required in most cases	POTENTIAL INDICATORS IDENTIFIED
USAID resilience domain framework	USAID	results matrix with a set of indicators for 3 objectives and the goal	income & food access, assets, adaptive capacity, social capital and safety nets, governance, nutrition and health	communities	numeric indicators	yes (self-perception survey)	secondary and primary (surveys) data	POTENTIAL INDICATORS IDENTIFIED (piloted in Kenya and Ethiopia)
Expert Consultation on Resilience Measurement for Food Security	FAO/WFP	proposed framework for measuring food security resilience	four set of indicators for a) baseline well-being and basic conditions, disturbances, response, and end-line well-being	not known	numeric indicators	no	secondary data	INDICATORS DEFINED
ODI disaster risk management indicators	ODI	indicators and targets for disaster risk management in post-2015 development goals with an emphasis on economic impacts	indicators on impact, outcomes, outputs and inputs for international, national, sub-national and local level	individuals, households and community	numeric sets of individual indicators organized by levels in a matrix	no	secondary data only	INDICATORS DEFINED
Basket of indicators of economic resilience	London School of Economics and Political Science	economic lens to complement more direct humanitarian and poverty reduction goals	set of 10 economic indicators on input, output, outcome and impact level	communities	numeric indicators	no	secondary data only	INDICATORS DEFINED
Resilience costs approach	Institute of Development Studies (IDS)	measurement of costs of resilience (incl. social, psychological, ecological, etc).	ex-ante investments, cost of destruction, ex-post costs of recovery	households and communities	not known	not known	not known	NO MEASUREMENT FRAMEWORK
MEERC R4 Resilience Framework	Multidisciplinary Center for Earthquake Engineering Research	measurement framework with a focus on infrastructure	robustness, redundancy, resourcefulness, rapidity	communities	not known	not known	not known	NO MEASUREMENT FRAMEWORK
Network of Adaptive Capacities	Norries 2008	theory of community resilience	economic, social, information & communication, community competences	Communities	not known	not known	not known	NO MEASUREMENT FRAMEWORK

Source: Winderl (2014)