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Disaster as an Opportunity to Enhance Community Resilience: Lesson Learnt from Chilean Coast

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Abstract

Coastal communities in Chile are at risk to tsunamis like other coastal communities around the world. The Dichato community is one of the most affected communities by the 27 February, 2010 earthquake and following tsunami. More than seventy percent of infrastructure was washed away. The livelihood of the local people is severely damaged. The disaster recovery process was slower than expected. The concept of resilience is normally understood as the opposite of vulnerability. This means that where vulnerability is high, the level of resilience tends to be low, and vice versa. As vulnerability is the opposite of resilience, it is very much important to build a resilient community to reduce the disaster risk. This paper focuses on how a disaster can be an opportunity to enhance community resilience to disasters. Qualitative data are collected through key informant interview. Key informants are community leaders, high officials at local and regional office and also from non-government organizations. After this devastating tsunami, Dichato community gets special attention from the government and other agencies. As a result, disaster brings opportunity for the community in the form of new vision, new relation and new idea, which may enhance community resilience in the future. Findings of this paper will open a new horizon that can help to find the strength and weakness of disaster preparedness at community level. It will also help to learn about new approach to build community capacities against disaster.

Introduction

It was February 27, 2010 very early in the morning and 3:34 am local time, an earthquake of 8.8 magnitudes, the fifth largest instrumentally recorded, struck the central south zone of Chile (Madariaga et al, 2010). Major tsunami waves hit the coast in the following14min–2h (SHOA, 2010), devastating coastal villages and fishing coves along 600 km of coastline (331360S–381280S). The most severely affected regions were O'Higgins, Maule and Bío Bío by the tsunami,, which are the home of more than 13 million people, or 80 percent of the Chilean population (Bárcena et al., 2010). From this disaster, 521 people had died and 56 persons were still missing. The earthquake and tsunami destroyed over 81,000 houses, and another 109,000 were severely damaged (EERI, 2010). In Dichato community, 26 persons died and the community virtually disappeared with 70 percent of homes being washed away by the tsunami (USAID, 2010). Along with this, the tsunami has an impact on livelihood and economy in the long run. Local economy in Dichato which basically depends on fishing and tourism is destroyed severely.

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Natural hazard is not a new phenomenon in the human history. Coastal area is prone to different types of natural hazards. Objectively, societal risk from natural hazards is constantly increasing. Even if the probability and intensity of hazard activity remain constant, continuing population growth and economic and infrastructure development results in a concomitant increase in the potential magnitude and significance of loss and disruption associated with hazard activity, and consequently, risk.

Coastal communities around the world, big and small, are increasingly at risk from tsunamis and many other coastal hazards including severe storms, floods, and shoreline erosion. On the other hand, much of the economic, infrastructure and social development has already taken place in areas in which risk has been recognized. Coastal communities in Chile are not the exception indeed since natural disaster is unavoidable and settlements and economic activities have already been placed in risk area. Therefore, it is important to build resilient community to adapt and cope with the disaster like tsunami. An important outcome of increasing the resilience of coastal communities is to reduce or avoid the impact of tsunami by reducing hazard risk and vulnerability. Understanding and assessing risk is fundamental to enhancing the resilience of coastal communities. The main aim of this paper is to examine the activities taken after disaster as recovery process at the community level. This recovery process has short run as well as long run impact which will make community more resilient for disaster than before.

Study Area

The study area of Dichato is a medium-sized coastal town, in region VIII Bio Bio of Chile, the longest country of the world. This town located in the Bay of Coliumo, 10 kilometres north of the communal capital of Tome, and 37 kilometres north of the regional capital of Concepcion (Figure 1). Geographically, the study area is situated between 36°32'56.10" South and 72°55'58.30" West, with a land area of 122 hectors. Dichato is surrounded by the small hills of Coliumo Pingueral on three sides of the town, and the west side is open to the Pacific Ocean. Dichato situated on the bank of horse-shaped bay which is referred as Coliumo bay and sometimes Dichato bay separately.

Dichato has a population of 4046 (PRBC 18, 2010). However it recorded a population of 3956 people by the census of 2002, of which 3488 correspond to urban population, while 468 would correspond to rural population. Dichato is mostly an urban area containing civic facilities (water, electricity, health and education). The economic activity of this area is mainly based on fishing and tourism. Because of the sharp growth of the tourism sector in this area, the service sector is also becoming dominant day by day.

Community Resilience

Before going to discuss community resilience, it is important to understand resilience. Resilience is not a new terminology in research arena, rather pertinent to the diversity of contemporary aboriginal contexts. Resilience is a term derived from the physics of materials that has been applied in ecology, developmental psychology, psychiatry etc. The root of this term is in the sciences of physics and mathematics and the term originally was used to describe the capacity of a material or system to return to original position after a displacement (Norris et al. 2007). In Psychology, resilience have often portrayed individual trait. Kirmayer et al. (2009) define resilience as a person's ability to overcome stress and adversity. Holling (1973) refers ecological resilience as the capacity of an ecosystem to recover from environmental stresses like fires,

drought, climate change, or pollution. In the social science, Bruneau et al. (2003) describe resilience as the ability of social units to mitigate hazards, contain the effects of disasters when they occur, and carry out recovery activities in ways that minimize social disruption and mitigate the effects in future. Summing up the discussion, the concept of resilience has since been applied to describe the adaptive capacities of individuals (e.g., Bonanno 2004; Butler et al. 2007; Rutter 1993; Werner and Smith 1982), human communities (e.g., Brown and Kulig 1996/97; Sonn and Fisher 1998), and larger societies (e.g., Adger 2000; Godschalk 2003). So, the concept of resilience is a technical term that has had vast prevalence in developmental psychology as well as in ecology and organizational studies.

Source: Author's own construction based on images from PRBC 18, 2010 and Descubre Bio Bio

Fig. 1: Location Map of the Study Area

Community resilience is the concept that raises the same concerns as the concept of resilience per se, but may further complicate by variation in the meaning of community. A community is an entity that has geographic boundaries and shared fate. If many individuals in a community exhibit individual resilience, this can contribute to making the whole community resilient since they work together more easily to respond to stresses and challenges (Kirmayer et al. 2009). The link may also work the other way: a community that has resilient characteristics may increase the resilience of its individual members. Communities are composed of natural, social, and economic environments that influence one another in complex ways. Norris et al. (2007) describes that this is not inappropriate, as resilience can be understood and addressed at different levels of analysis and he strongly argued that discussions of community resilience often note that the ‘‘whole is more than the sum of its parts,’’ meaning that a collection of resilient individuals does not guarantee a resilient community (e.g., Pfefferbaum et al. 2005; Rose 2004). As Brown and Kulig (1996/97, p. 43) observed, ‘‘People in communities are resilient together, not merely in similar ways.’’ Therefore, individual, family, community and some larger extent of the society like regional or local government are interacted and contributed from their part in the process that can counter stress and adversity. This perspective is shifting resilience research towards emphasis on collective processes, strengths and assets (Richardson, 2002).

Community resilience can be seen in two standpoints. One is relatively more concerned with community resilience as it prevents disaster-related health or mental health problems of community members. The other is relatively more concerned with community resilience as it describes effective organizational behaviour and disaster management. These two points sometimes, but not always, informed each other. This paper follows the second statement and accepting two general definitions of community resilience. One is given by Paton (2000) who defines community resilience as the capability to bounce back and to use physical and economic resources effectively to aid recovery following exposure to hazards. Where, Coles (2004) refers community resilience as a community’s capacities, skills, and knowledge that allow it to participate fully in recovery from disasters. Therefore, community resilience is understood as the capacity of the community to bounce back in original state after disaster (in the case of this paper) with their knowledge, resource, skill and planning as preparation.

Methodology

The survey for this research was conducted applying qualitative methods through in-depth interview, field observation and literature review. Two sets of key informants were identified for the interview. One set of key informants are mainly community leaders and other set of key informants are high officials from different government and non-government organizations responsible for community development, disaster management and resource management. The key informants are identified through snow ball method. Therefore, interview is continued to key informants to key informant until there is no variation of information. This process starts with local municipality office. In this process directorate of community development (DIDECO), secretariat of community planning (SECOLAN), secretariats and sub-secretariats of the ministry of housing and urbanization, the ministry of public works and ministry of internal affairs are identified at local and regional levels. Moreover, the national emergency office (ONEMI), fire brigade and local police are important key informants. In addition, community leaders, such as seven presidents of neighbourhoods, president of chambers and commerce, presidents of fishermen association, school teacher, journalists, social worker and president of emergency

shelter are identified as key informants. Two sets of questionnaire were prepared for interview, one for community level and another for institutional level. The questions were open ended and the respondents have flexibility to speak in details on specific issues. Project documents on recovery process and other related documents were the main source of secondary information. Direct observation in reconstruction and rehabilitation process is helped to identity the improvement of the community towards the enhancement of community resilience after tsunami. Participation in community meeting was also important to understand the community views towards rebuilding process.

Community Resilience Enhanced after Disaster

The destructive tsunami made the local people of Dichato aware of some opportunities that they could create for community resilience against disaster. The heavily destroyed tourist town is not only seen as a disaster, but also as an opportunity for building a resilient community and to shift to a new structure of the community**.** From this look, rehabilitation and recovery process is the transition phase of community resilience, because community will be more resilient than before after the implementation of rebuilding programs. Community resilience to tsunami will take shape little by little with projects and programs, which are taken after tsunami. Community has the new vision, which is expressed in plans and policies. There are new projects that are initiated after tsunami can be considered as the new ideas. Tsunami creates some platforms, where government organizations, NGOs and community can work together. Therefore, these new visions, new ideas and new relations can be seen as an opportunity to enhance community resilience.

Fig. 2: New vision, new relation and new idea enhance community resilience to tsunami.

From Figure 2, new relation, new idea and new vision can be considered as the cornerstone of pyramid which creates the base of pyramid. This base provides the main strength to grow the pyramid in vertical direction which represents the enhancement of community resilience to tsunami.

New vision

Community has the new vision and goals which they set after the tsunami. Community learnt from the disaster and set these visions for a better life that enhance the community resilience in many dimension. Some important new visions are discussed below.

Housing for All: After tsunami, government is giving house for all affected people who had house before and who do not have before. Government is buying land for the affected people who do not have land. To support this vision, there are four types of subsidies for housing. Additionally, special type of subsidy is introduced for housing in tsunami risk area with special housing design (See fig: 5)

Improving Urban Resilience: The reconstruction work is undertaken to promote maximum standard of security for residents and housing stock in the coastal urban zone. Tsunami risk factor is considered and includes safety factor as a variable in organization and design of urban structure. This variable of planning will mitigate the level of vulnerability by which coastal community will improve the resilience to cope with the similar tsunami event in the future.

Promote Urban Sustainability: The integration of indicators of urban sustainability will include efficient use of resources with the consideration of environmental sustainability. This sustainability is visionary and will be achieved by limiting occupancy in environmentally sensitive area and systematic implementation of energy sensitive habitation.

Enhancing Socio-economic Resilience: To strengthen the identity, recognition of tangible and intangible local values will be give due importance. A vision is to desire community participation in reconstruction process. The objective of recovery process is to provide a platform for diversified economic activities. In this platform, economic development can be accelerated through new production and service activities according to potential of the community. This vision is to ensure coordinated actions of public actors with the private sector.

Integrated Action to Disaster Response: After tsunami last year, community set new vision for the effective and integrated emergency response. This vision with the objectives is to ensure the coordination of related institutions and emergency management at local level with defined institutional powers and responsibilities. This coordination will enhance community resilience through timely and effective disaster response.

New Idea

The community brings new ideas for resilient development after tsunami. These new ideas can be implemented through different projects and programs to achieve new visions of the community. Figure 3 shows the relationship of these ideas surrounding the community resilience.

Source: Authors' own construction based on plans, policies and projects after tsunami.
Fig. 3: Determinants of community resilience set by the community.

Coastal line protection is the new concept in the context of Dichato community through retaining wall along the coast. This wall will protect the community not only from the coastal line land erosion but also from the tsunami wave. This wall will work as the wave breaker in the coast where tsunami wave will lose the energy. This coastal protection did not exist before the tsunami last year. This wall will reduce future potential tsunami impacts on the community life.

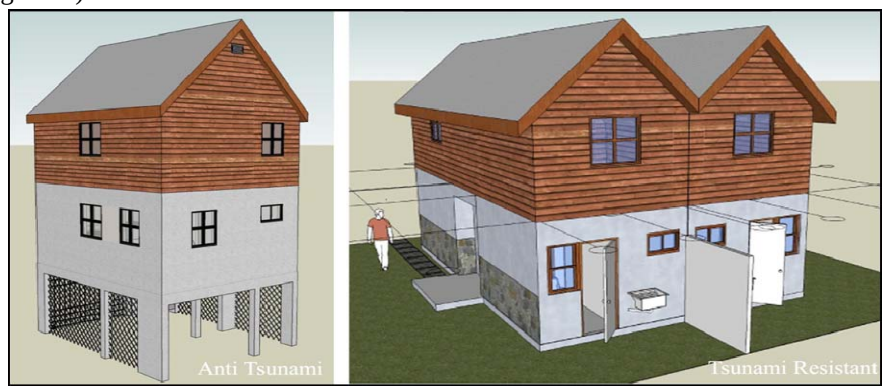
After tsunami, local and regional governments understood that community needs to establish land use policy and building standards to reduce the tsunami risk. Therefore, a tsunami vulnerability assessment has been done by the regional government as an input to master plan. Master Plan of Dichato is published in 2010, which includes an effective land use zoning considering tsunami risk. This master plan divided whole Dichato in two zones primarily, which are tsunami risk zone and risk free zone. Tsunami risk zone are divided into three categories which are no habitable zone, anti tsunami housing zone and tsunami resistant housing zone.

This is a new approach in this community, which is to live with disaster through the structural solutions. Structural solutions include the protection wall in the coast and a tsunami mitigation green belt (recreational park) along the coast. Mitigation Park along the coast is another new thing for Dichato community. This is actually a green belt between settlement and the ocean. The depth of the park is more, where tsunami hazard risk is high. Big trees in the mitigation park will work as the barrier for the tsunami wave before it hit the community. This park will break the tsunami wave which will pass above the protection wall. Mitigation Park with protection wall together is the structural solution to protect the community from the tsunami in future. Figure 4 shows the model of future mitigation park and coastal protection wall in the coast of Dichato.

Source: Ministry of housing and urbanization, Chile, 2010
Fig. 4: Perspective view of Mitigation Park and coastal protection wall.

Coastal livelihood is depending on the coast, therefore it is almost impossible for the coastal people to live away from the coast. Living with the disaster is the right approach then to protect livelihood and living near the coast. The new idea here is to build tsunami resistant house and anti tsunami house in hazard risk zone in Dichato. Two types of houses are introduced where anti tsunami house for relatively high-risk zone and tsunami resistant house for relatively low-risk

zone (Figure: 5).



Source: Ministry of housing and urbanization, Chile, 2011
Fig. 5: Housing type of tsunami risk zone in Dichato.

Building standard and codes are also adapted after tsunami, which were very general for all coastal zones before. That means, after tsunami area specific construction code and standard are adopted. Each sector has different standard of construction depending on the risks of flooding by tsunami, height of the tsunami wave and type of soil. For example, sector Miramar need to construct house above one-meter soil filling. Some sectors in risk zone adapted concrete construction in ground floor and wooden construction in upper floor (Figure: 5). This is a structural solution with building code to enhance community resilience from the tsunami impact.

Before the tsunami, there was no evacuation route. Resilient coastal communities should also have evacuation plans in place well in advance of receiving any hazard warning. After tsunami in 2010, ONEMI made an evacuation plan in cooperation with the municipality for Dichato. Municipal risk prevention and emergency office is implementing the evacuation plan in Dichato. Different types of signs are installed in different locations in the community. This evacuation plan for tsunami includes signs for tsunami hazard zone, evacuation direction and safety zone (Figure: 6). New idea worked for enhancing the community resilience in the warning and evacuation dimension.

Source: Photo taken by author, May 2011

Fig. 6: Signs for the evacuation during tsunami event

Last tsunami had severe impact on local police office and fire fighter office. Therefore, it is needed to place these critical facilities away from the risk zone. After tsunami, community is planning to place all critical facilities in safe places, which will enhance the emergency response capacity of the community.

Smooth accessibility is another factor which can enhance community resilience in the emergency response. Community has new access plan which will allow the outside help to emergency response during disaster. Community is also planning a new utility network in such a way that tsunami has less impact on these facilities. Therefore, considering all dimensions of new ideas, the community will be more resilient than before.

New Relation

New relations among stakeholders are established in horizontal and vertical levels after tsunami. Rehabilitation and reconstruction activities bring different institutions from local and regional governments to create effective network between communities and institutions. These activities also build an effective relationship among different institutions.

Donor organizations, NGOs and universities also came from outside in this relation network. The reconstruction creates a platform, where community, municipality, universities, regional government, private organizations, NGOs and public service agencies are working together to enhance the community resilience. Universities are working on hazard risk studies and feasibility studies for the different projects. NGOs are working with municipalities in socio economic dimension for the rehabilitation of the livelihood of the community people. SERCOTEC is channelizing resources from donors, for example, donation from the Mexican government and some other private organizations to provide assistance to rebuild fisheries and tourism sector. In disaster management, ONEMI established new relationship with different organizations to make the more effective coordination to disaster response. Among organizations with which ONEMI established a relation, Adventist Development and Relief, Chilean Association of United Nations, Guide and Scout Association of Chile and Association of Non-governmental Organizations is mentionable.

These relations allow local groups for self-organizing, learning and actively adapting to shape changes with social networks that connect institutions and organizations across levels and scales and that facilitate information flows. Relations among institutions also enable multi-level governance system that can enhance community resilience to cope with the uncertainty like tsunami. This broader perspective of community network enables effective coordination to release the obstacles to effective service delivery as well.

Application

This research has enhanced the knowledge on adaptation to disaster from a different, but an important planning perspective. The experience of Chile teaches us on how to live with disaster and cope with it. Thus findings of this paper can be useful learning for other coastal communities around the world. Coastal communities can enhance their protection and mitigation plans by the learning from the experience of Dichato. Coastal protection, Mitigation Park, tsunami resistant housing can be applied for tsunami vulnerable communities in any place of the globe. Governments and other agencies can have the better learning from this experience to build more

disaster resilient communities. There is lack of awareness on disaster in many developing countries, like Chile. Governments in developing countries generally do not pay much attention to make community resilient to different types of disasters. Another important learning from Dichato is that we should not wait for Disaster. These types of preparedness and mitigation measures should be taken before disaster to enhance community resilience in order to reduce community loss.

Conclusion

Coastal communities around the world whether big or small are vulnerable to natural disasters. Tsunamis are one of the most known disasters, due to their devastating and sudden impact. Chile is the most seismically active country in the world bordering the Pacific Ocean. Therefore, the Chilean coast is prone to tsunami. A large number of people in Chile live in the coastal areas and among the rest of the communities many people depend on coastal resources. A large number of settlements have already been placed in tsunami hazard zone along the Chilean coast. These settlements are vulnerable to tsunami due to high population density, infrastructure and economy. Tsunami hazard coupled with the vulnerability of coastal communities creates a particularly high risk. As it is not possible to stop the tsunami, the risk can be decreased by reducing the vulnerability of coastal communities. This paper focused on a medium sized coastal community in central Chile, one of the most affected areas by the Tsunami of 2010. The recovery process of this community is slower than expected.

Disaster can be seen as an opportunity for the community. After the tsunami in this area, the community is receiving more attention from local and regional governments than before. The community has new visions, which can be achieved through the implementation of new ideas. The recovery process also creates a platform, where the community and the government are working together which creates new relation among the stakeholders. It is expected that the findings of the research will help to enhance community resilience to tsunami for coastal communities around the world. Also this kind of research will open a new horizon for further research in disaster resilient community.

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