Coordinating Administrators, Citizens and Scientists: Lessons Learned from Qinglong Country, China And CSCAN, the Philippines 2001+

A Case of Early Warning Success in Qinglong County for the Magnitude 7.8 Tangshan Earthquake (1976) And Mitigation Strategies in the Philippines (2001)

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I. INTRODUCTION

Disasters can be mitigated if sufficient knowledge, information, and experience are embedded in public administration institutions, scientific and education organizations, and citizen communities. Even disasters of catastrophic magnitude can be anticipated and mitigated with measured planning and response. Indeed, the act of planning, if sufficiently participatory, increases citizen sense of control and reduces the degree of panic if an actual disaster occurs. Several issues are addressed in this case study of China and the follow-up study of the Philippines: (1) there is a continuum of conditions (before, during and after disaster), (2) responses can be measured by degrees of alertness and degrees of information and preparation, (3) coordination is important for actual events and for "sense of control" in communities, and (4) distribution of information and action needs to be wide in order for inclusive preparation and response. Fundamental to all these actions is an educated and informed citizenry. With globalization of information, technology and disasters, there is increasing need to learn about disaster preparation and mitigation in many countries and many cultural settings.

Public administrators of Qinglong County were able to combine scientific information, public education, extensive preparation, and speedy countywide communications to prevent human tragedy during the Great Tangshan Earthquake (GTE) of 1976. Many of the 470,000 residents of Qinglong County evacuated from their homes just before the magnitude 7.8 Tangshan earthquake hit (United Nations, 1996: Li and Mervis, 1996; Wang, 1991; Qian, 1986, 1989). No one in that county died from the destruction caused by GTE. In the counties surrounding Qinglong, however, nearly a quarter of a million people were crushed to death (Wang, 1998; Qian, 1986, 1989; Chen et al., 1988).

The remarkable experience of Qinglong County, unknown to the world and China for over 20 years, was discovered through a cooperative effort between the United Nations and the government of China in the last few years. An examination of the devastation of and response to the GTE (Qian, 1986, 1989) led to the discovery that one county in the area had successfully prepared for and mitigated the impact of the earthquake. Qinglong County utilized it extensive scientific citizen-based precursor monitoring system, along with exemplary administrative procedures and community spirit, to prepare for the possibility of a major earthquake. Qinglong County established an earthquake office, organized procedures for preparation and response, trained officials, set up a precursor-monitoring network that involved communities and neighbors, and, in July 1976, activated their county earthquake plan to maximize citizen safety. In 1995, UN and Chinese government officials visited the county, found documents that confirmed the historic action, and interviewed officials and villagers who explained the July 1976 events.

The Qinglong County experience shows how collaboration and coordination among public administrators, citizens, and scientists led to the identification of natural disaster risk and effective mitigation. Specifically, [1] public administrators not only had sound public policy but also followed the policy guidelines; [2] citizens were not only knowledgeable but also felt empowered to act; and [3] scientists, cooperating with public administrators and citizens, collected, shared, and disseminated their multidisciplinary data to make joint predictions. When public administrators, citizens, and scientists all work together, they strengthen the ability of their communities to survive disastrous earthquakes and other large and destructive natural events.

The successful early-warning experience of Qinglong County for the 20th century's most destructive natural disaster in terms of loss of life, provides useful clues as to how large communities can reduce the impact of catastrophic natural disasters. This chapter analyses the lessons learned from data gathered over the last few years, which are presented in the case study summary and the events chronology of Appendix 1.

II. CASE STUDY SUMMARY

More than 20 years ago, on July 28, 1976, a magnitude (M) 7.8 earthquake destroyed the city of Tangshan in Hebei Province, China, killing 240,000 people. Two weeks prior this large earthquake, Chunqing Wang, the official in charge of earthquake disaster management for Qinglong County (located 115 km from the city of Tangshan), had attended a regional conference organized by the State Seismological Bureau (SSB in 1976; now CSB, China Seismological Bureau, as of 1998). During that five-day conference that began on July 14, 1976, the Qinglong official listened carefully to the speakers at the seminars, panel discussions, and exhibitions. He took detailed notes on techniques of earthquake monitoring by the lay public and precautionary work for large earthquakes.

On the evening of July 16, 1976, scientist Chengmin Wang of the SSB's Analysis and Prediction Department, speaking to a session of 60 attendees, explained that professional earthquake monitoring groups and lay detection centers had reported abnormal signals for the Beijing-Tianjin-Tangshan-Bohai-Zhangjiakou region relating to a possible earthquake. The analysis of scientific data acquired by seven major techniques, including crustal stress and electrical measurements, indicated that there was a good possibility that this region would be struck by a significant earthquake between July 22 and August 5, 1976. Session attendees listened to preliminary cautionary advice, and were encouraged to examine readings of county level earthquake precursor monitoring equipment managed by the lay public. Furthermore, the officials were encouraged to enhance earthquake preparation measures such as examining buildings in critical condition, intensifying public education, and promoting general awareness of possible approaching earthquakes.

Qinglong official Chunqing Wang returned to his county. He reported on the Tangshan conference, particularly on the talk given by scientist Chengmin Wang of the SSB, and included updated information from the county's lay monitoring stations. The county committee took the report very seriously. More than 800 officials of Qinglong County's administrative system listened to Chunqing Wang's report. A flood was also predicted at the time. It was decided that the associate secretaries of each community in the county should return, with a county-level official, to their communities immediately, without seeing their families first, to teach the people about earthquake and flood preparation. In a countywide telephone conference on July 24, 1976, County Secretary Guangqi Ran discussed earthquake and flood preparations.

During the days of July 25 and 26, 1976, each community in Qinglong County held an emergency meeting to prepare and instruct villagers in disaster damage reduction. Examinations of buildings in critical condition were made. Special attention was given to prepare reservoirs. Most villages had overnight watch guards on duty. County and village broadcasts instructed people not to close their doors and windows at night so that they could leave their houses immediately as soon as they felt shaking at the beginning of an earthquake. They were also told to avoid being close to tall buildings and power lines. On July 27, 1976, a leading county official gave a major talk at the county's agricultural meeting on the earthquake situation and on mitigation measures for the area. At 3:42 AM on July 28, 1976, the Great Tangshan Earthquake (GTE) struck.

More than 180,000 buildings in the county were destroyed by the GTE; over 7000 of these totally collapsed. However, only one person died, and he died of a heart attack. Meanwhile, in the city of Tangshan and in all of its other surrounding counties, at least 240,000 people were crushed to death and 600,000 were seriously injured.

Five hours after the earthquake, Qinglong County dispatched the first medical team to the disaster zone. Within a few more hours, the county organized and sent relief teams to Tangshan to help with rescue work and the transport of the injured.

Dr. Wu Dong of Qinglong's Dazhangzi Hospital happened to travel to Tangshan City on the day of July 27, 1976. That night, lodging in his relatives' house, Dr. Wu told them that Qinglong County was preparing for the possibility of an earthquake, kept his clothes by his bedside, and deliberately opened the windows and doors. When the earthquake struck, he left the building after arousing his relatives' family of four. Except for one injury from a falling object, the whole family escaped unhurt, although they were only a few kilometres away from the M7.8 earthquake epicenter in the heart of Tangshan City. Families in surrounding houses suffered enormous numbers of deaths and casualties.

The difference between preparedness and lack of preparedness in the GTE is measured in life and death. The county's top administrators issued the official early-warning document alerting Qinglong County residents of a possible large earthquake four days before the GTE (Fig. 1) (United Nations, 1996; UNGP-IPASD Website). This early-warning document came to light during a UN research mission to Qinglong County in September 1995 to verify the facts surrounding the county's historic actions. The United Nations has subsequently compiled, based on numerous documentation obtained during its research effort, a detailed reconstruction of the Qinglong County experience during the 1976 Tangshan earthquake (United Nations, 1996). This account details a dramatic example of a “best practice in public administration” and is attached as Appendix 1.

III. EARTHQUAKE EARLY WARNING: THE QINGLONG COUNTY EXPERIENCE

The discovery of the early-warning success of Qinglong County galvanized the United Nations to establish a Global Programme for the Integration of Public Administration and the Science of Disasters (UNGP-IPASD) (Appendix 2). Since 1996, this UN Global Programme has researched several Chinese early warning successes for large earthquakes (M7.3 Haicheng in 1975 and M7.3 Menglian in 1995 (Li and Mervis, 1996); M6.3 to M6.6 Jiashi in 1997 (Li and Kerr, 1997)), all of which share common elements of success. The experience of Qinglong County, however, is especially useful, for it is in the marked contrast of the Qinglong County experience to that of its surrounding neighbors that we discover clues on how modern urban communities can better protect themselves against large and sudden disasters such as earthquakes. Figure 2 illustrates some basic concepts that arise from these clues, with expanding details in the text below.

A. Public Administrators Take Initiative

What brought about the proactive strategies of the Qinglong County administrators for the catastrophic Tangshan earthquake? Appendix I points out that the county benefited from a unique combination of good public policy, a countywide public-awareness campaign, establishment of responsible offices, leaders who trained themselves to be both sensitive and efficient, deployment of earthquake precursor equipment, and training of citizen monitors. Not one of these elements, in isolation, could have led to the complete success of Qinglong County. The key elements of "science policy," citizen awareness, public administration alert, and citizen participation in scientific monitoring combined to create a compelling dynamism that moved the county along the continuum of mitigation success.

1. Science Policy
The national State Council policy Document 69 (Appendix 4) announced to seven municipalities and provinces in Northeast China that a major earthquake was likely and that preparation and mitigation were advisable. This policy document outlined actions to be taken by public administrators and citizens in response to an intermediate-term warning of anticipated earthquake activity as outlined by national-level scientists, based on precursor activity measured through professional and lay monitoring. The policy document warned of the likelihood of an M6 earthquake and the possibility of an M7-8 earthquake.

2. Implementation: Medium-Term Preparedness
The Qinglong County public administrators implemented this national policy in the cities and rural areas of the county. Like many similar jurisdictions, the public officials set up an earthquake office for earthquake preparedness activities, including precursor monitoring, public education, and strengthening of physical structures such as buildings and water reservoirs.

3. Preparation for Decision Making in an Emergency Situation
The head of the Qinglong County Communist Party leadership strengthened his ability to interpret data for declaring earthquake alerts, without knowing if he would ever need to use this skill. Lacking access to sophisticated geological materials in the county, the head of Qinglong travelled to Beijing where he bought an academic book on earthquake dynamics. His readings of this book helped him to understand the relevance of various precursor events, thus improving his ability to interpret data related to earthquakes.

4. Delegation, Initiative, and Communications for Speedy Action
When Qinglong County established its earthquake office in June 1976, the leadership appointed a 21-year-old recent graduate as head, delegating to him responsibility for preparatory activities. Based on the suggestions of Document 69, the young administrator increased the number of precursor monitoring stations from 6 to 16, with nine of these lay monitoring stations at schools. Further, he intensified public education, distributing thousands of copies of booklets and posters, and presenting slide shows and movies in villages, towns, and cities.

When he attended a meeting in Chengde in July 1976, he heard about a larger, regional meeting about to take place in Tangshan, and proceeded to

Tangshan immediately. At the Tangshan meeting, he learned that some precursor data indicated a M5-6 earthquake soon and an M7-8 within one or two years (major points of the scientific presentation in Appendix 1 for 16 July 1976).

On returning to Qinglong County, he discovered that the latest county-based precursor data indicated a possible imminent earthquake. Informally, he checked with earthquake precursor monitoring stations in neighboring counties and learned that they were also recording significant anomalies. He quickly prepared a report to the county's science committee. The deputy director of the science committee, who had been empowered by his director to take action when the director was away, realized the relevance and importance of the report and arranged for a meeting with the county's top leadership.

5. Teamwork and Responsibility for "Action and Inaction"

Realizing the relevance of the data and the importance of rapid and comprehensive mobilization, the county head decided that the report should be made not only to him but also to the entire CCP Standing Committee of Qinglong County. This act of inclusion brought the main implementation team into the decision-making situation, thereby facilitating timely and effective teamwork. When the head of the earthquake office reported on the strong possibility of an M5 earthquake between 22 July and 5 August, the county CCP adopted and promulgated an action plan (details in Appendix 1 for 24 July 1976). Although the CCP realized that their county's plan might be considered controversial, they concluded that the national State Council Document 69 contained sufficient instruction to cover their action plan. Thus, Qinglong County issued an earthquake alert on 24 July 1976 at 20:30 p.m. (Fig. 1). Immediately, institutions were notified by telephone and the earthquake office worked 24 hours nonstop on detailed instructions to county officials and the general public on the earthquake situation and preparation measures. The county officials used an already-planned conference on agricultural issues to publicize the urgent earthquake situation. The county officials emphasized that every official would be responsible for preparing people in their areas and held accountable for their actions or inactions (details in Appendix 1 for 24 July 1976).

6. Developing Shared Perception of Risk

Meetings were held at town and village levels, as well as in all institutions. The head of the county CCP took up residence in a makeshift tent made of poles and a plastic sheet in order to communicate the seriousness of the situation. The associate head of the CCP visited 23 towns, examining earthquake preparations. County engineers and other officials maintained a 24-hour watch at "lifeline" services, such as reservoirs and power generation sites. The earthquake alert and follow-up actions created a shared perception of the emergency. (Comfort, 1999).

B. Citizens Self-Mobilize

Citizens in the towns and villages of Qinglong County were active participants in the preparatory and mitigation activities for the possible earthquake in 1976. While it is normal for citizens to be motivated to help neighbors and victims' in the aftermath of a major disaster, it is unusual for citizens to participate directly in preparatory activities. Some recent and successful examples include evacuations from volcanoes that are beginning to erupt (Mount Pinatubo in 1991) and from coastal areas that are apparently in the path of typhoons (Hurricane Floyd in 1999). Even with these more visible signs of approaching disaster, observers often note considerable panic among some citizens. But in the case of Qinglong County in 1976, while precursors for the approaching disaster were more subtle, local citizens enthusiastically engaged in preparations with little sign of panic. What explains this quiet vigilance and determination?

1. Community Awareness Through Widespread and Intensive Public Campaign
From 1974, when the county was first notified about the possibility of earthquake(s) over the next few years, the citizens of Qinglong County received pamphlets, watched movies, observed posters, participated in drills, and held community discussions about earthquake dynamics. People in the cities, towns, and rural areas learned about ways to watch for earthquake precursors, and accepted the responsibility and challenge to heighten their awareness of their environment over the coming years. They created measured response plans geared to prepare the community for possible disaster(s) while minimizing the economic impact of such preparations.

2. Lay Monitoring of Earthquake Precursors by Ordinary Citizens
When the Qinglong County earthquake office promoted the monitoring of earthquake precursors, many institutions became involved. Employees in factories and mines were trained to monitor for earthquake precursors using instrument readings or observational data. Likewise, students in schools became involved in operating simple scientific equipment and in interviewing neighbors on observable earthquake-related phenomena.

3. Response to Earthquake Alert on 24 July 1976
Local residents remained calm and focused as they organized themselves to carry on their daily lives under the earthquake alert:

Schools moved furniture outside and held classes in the open air.
Merchants quickly constructed shelving outdoors under plastic sheets, and continued selling their goods.
Where land was available, people built makeshift tents and camped outdoors.
In the more densely populated areas, people practiced exiting their homes and offices quickly, and slept near exits during the night.
Citizen assemblies to share earthquake preparedness strategies were held in all institutions and communities.

During the days before the earthquake, communities established patrols to monitor preparatory activities.

4. Confirmation of Sense Data Observations

Local people in their communities combined the official earthquake warning with sense data perceived in their local neighborhoods, to conclude that the warning was legitimate and should be heeded. In the cities, towns, and villages, people noticed changes in water, weather, and animal behavior.

Despite the lack of foreshocks, every single person in Qinglong County was prepared for the earthquake and escaped death from the ensuing destruction. During the preparatory period, people had secured their families and their livestock. Even their animals escaped death from the earthquake.

Official county documents and personal written testimonies (translated from Chinese into English) describe the preparations at county, town, and village levels. Based at 16 monitoring stations, the county's lay methods of detecting precursors included anomalies in the level, color, temperature, chemistry, and quality of the water, release of gases, strange animal behavior, and changing weather. Depending on data from a wide variety of methods, the county administrator combined information from several methods, all indicating unusual tendencies. In each and every neighbourhood and village, all county residents had taken precautions against a possible earthquake.

C. Scientists Share Information

There were more than seven methods used by professional earth scientists in China to monitor for earthquake precursors at the time (Wang, 1991; Mei, 1982; Chen, 1988; Qian, 1989). At the SSB Conference held in Tangshan two weeks before the great earthquake, a government scientist informally shared with the administrators attending the meeting the most recent update on the regional earthquake situation based on information from professional and lay observers (Li and Mervis, 1996). It was at this session that public administrator Chunqing Wang noted the work of two methods in particular – crustal stress and geoelectric (United Nations, 1996). Chu et al. (1996) discuss geoelectric, geologic, seismic, meteorologic, and hydrologic data related to the 1976 Tangshan earthquake. The crustal stress method is introduced here.

In the 1960s, Chinese earth scientists developed a method to monitor variations in crustal stress over time (Huang et al., 1982, 1991). This method was based on a concept proposed by Swedish scientist Nils Hast (1958). The physical principle underlying the method is inverse magnetostriction: the dependence of magnetization (susceptibility or remanence) on applied stress (Sheriff, 1984), or, equivalently, changes in magnetization caused by an application of mechanical stress (Chikazumi and Charap, 1964; Tremolet de Lacheisserie, 1993). Many ferromagnetic materials have magnetic properties that are highly sensitive to applied stress; in fact, stress may be ranked with field strength and temperature as a primary factor affecting magnetic change (Tremolet de Lachesserie, 1993). Chinese earthquake scientists use ferromagnetic sensors to measure changes in crustal stress via changes in magnetization.

By 1972, the Seismo-Geological Brigade (Beijing Sanhe team) of the SSB had established a national network of more than 100 professional crustal stress-monitoring stations, of which 24 were located in North China. Each station was equipped with three crustal stress sensors oriented horizontally in three different directions (Huang et al., 1982). The depth of placement of these three sensors was no less than 20 m, to avoid the effects of seasonal changes in temperature, and no greater than 100 m owing to technical costs; the average depth was 50 to 60 m. Crustal stress measurements were taken every two hours and the averages of the 12 readings per day per sensor were transmitted daily, by telephone or telegraph, for official record at the Office of Analysis and Prediction of the Seismogeological Brigade in Beijing. For further details on the crustal stress method, see Huang et al. (1982) and Huang et al. (1991).

Crustal stress data taken before, during, and after the 1976 Great Tangshan Earthquake came from stations that were separated by distances of as much as 1000 km. The early-warning document of 24 July 1976 cites the period of 22 July to 5 August 1976 for a possible earthquake in the Tangshan region. These dates, carefully noted by public administrator Chunqing Wang, were given at the SSB Tangshan Conference during an informal science lecture 12 days before the GTE (United Nations, 1996). Set by the Beijing Sanhe team, these dates were established using imminent precursory signals from a total of sixteen crustal stress stations in the North China region.

Imminent signals from twelve crustal stress stations in the North China network were used to compile the map of Figure 3. This figure shows the principal stress directions (straight lines) of those stations (triangles) with accelerated changes in anomalous stress just before the 28 July 1976, M7.8 Tangshan earthquake (Huang et al., 1982).

Note that the intersection of these lines includes the city of Tangshan and much of the eventual rupture region (crosshatched area) (Chen et al., 1988; Chu et al., 1996). It is indeed by the intersection of such lines that the crustal stress method is able to locate where an earthquake may eventually strike. A map similar to Figure 3, based on precursory signals from seven stations, located Haicheng as a site for a possible earthquake several weeks before the 1975 M7.3 Haicheng earthquake (Huang et al., 1991).

Though the crustal stress team was successful in determining the location and timing of the 1975 Haicheng and 1976 Tangshan earthquakes, lack of familiarity with some important aspects of precursory signals (e.g., amplitude vs. length of time of signal) resulted in earthquake predictions of M5.

Through its 30 years of applied research, over 175 earthquake predictions have been officially recorded using the crustal stress method. The accuracy of these predictions has been evaluated using ESTAPE (Appendix 3).

IV. THE PRESENT GLOBAL SITUATION AND SUSTAINABLE HUMAN DEVELOPMENT

The present world view assumes that scientists are responsible for disaster forecasting, and that the role of public administrators is to take the conclusion of scientists and then mobilize their communities appropriately. Everything is compartmentalized and there is no flow of information until a firm assessment is made. This sequence of actions would be fine if disaster prediction were a mature science and predictions were 100% accurate. However, as is generally known, even the prediction of weather is not totally accurate, and prediction of earthquakes lags most seriously behind. In fact, it is generally believed that earthquake prediction is not possible, at least in the near future (*Economist*, 1997).

Meanwhile, what can communities do to protect themselves from the tragic consequences of earthquakes? While it may be a long time yet before the regularities common to each earthquake are discovered and universally accepted, the experience of Qinglong County provides us with directions of action that can strengthen the mitigation capacity of today's ever expanding urban settlements.

It is clear from the description above and in the chronology of events outlined in Appendix 1 that the open flow and exchange of disaster-related knowledge and information through all levels of society promotes disaster mitigation. Of equal importance is the active participation of every sector of society in preparing communities for possible natural hazards. Figure 4 analyzes in tabular form the actions various sectors of society can choose to take to bring about the consequent protection against natural disasters.

Key elements for success lie in the attitude and level of participation of community members to protect their community against the impact of natural disasters. For such disasters, the degree of environmental and social awareness and willingness of individuals to participate and communicate can make the difference between tragedy and survival. From the natural disaster mitigation perspective, communities are composed of three broad categories of individuals: citizens, public administrators and scientists. For each category, there can be a continuum of involvement. Indeed, this continuum represents a differentiation among levels of participation, from passive to active (Almond and Verba, 1989):

1. Where community members are mostly passive and only occasionally read about disasters and what to do to keep safe for such events, they are ill-prepared to take action against the evolving natural phenomenon and are subject to rumors and panic.

2. Partial citizen action involves those who read about natural disasters and respond to warnings. Such citizens are aware that natural disasters can be anticipated and even forecast. Indeed, these individuals are aware of the community's interest in being protected, and expect the government to warn them of danger from natural disasters.

3. At the most active end of the continuum is the "participant" who is attuned to risk and vulnerability to natural disasters and also participates in disaster mitigation activities. In the case of earthquake prediction, the participant may even be a "lay monitor"; that is, he or she may be responsible for recording the

readings of one or more instruments that are designed to record evidence of earthquake precursors. The “participant” political culture characterizes the people of Qinglong County, where they participated in lay monitoring, were sensitized to noticing local precursors, and launched preparatory mitigation activities upon their own confirmation of the early warning.

Although these levels of involvement represent three points on an “activism” continuum, the categories are not static. People can learn to be more active through experience of natural disasters and through focused learning, e.g., public disaster education campaigns during a warning (prepare) or an alert (evacuate or take cover) period. The occurrence of dramatic natural disasters can make a lasting impression on community members. If such experiences are also shared via media with others in regions of potential danger, even more people can be educated to safeguard themselves during a destructive earthquake. With the sharing of experiences and perspectives, learning can be not only comprehensive and coordinated but also effective.

Natural disasters also present opportunities for public administrators to be more or less active on behalf of their communities. At their most passive, officials provide assistance to victims: food, shelter, loans, raw materials, etc. A moderate level of activity would involve developing a disaster management plan and gathering various statistics on the community and its disaster relief needs. A high level of activity would involve disaster education programs for the public, upgrading and enforcing building codes (Survivors, 1999; Shaking, 1995), practice drills to simulate natural disaster situations, and investment to install precursor-monitoring equipment and to organize some staff and/or citizens to record the reading of these instruments.

Among scientists, the various levels of activity can be described as first, studying phenomena without considering the possible consequences for natural disasters. On a higher level, a scientist can notice and record correlation between natural disasters and certain natural phenomena. Most actively, a scientist can discuss the phenomena with scientists of other disciplines, among lay persons and citizens, and especially among public administrators who can translate scientific observations into programs and actions likely to protect communities from natural disasters.

For each category – administrator, scientist, and citizen – there are degrees of commitment and activity. When they explain their specialties and perspectives to each other, they establish a basis for taking joint action. When all three types of people are participating actively, strong synergies can grow among the three types and can weave action networks throughout communities. Participants sensitize their partners to the nuances of their own specialties. Public officials come to understand some dynamics of the Earth. Scientists discover actions relevant to various population groups. Citizens become more aware of their immediate natural environments and its subtle shifts. When all three groups intensify their activities, the pulse of the community quickens and the sense of self-reliance, well-being, and future orientation are all enhanced. Indeed, the chances of community survival and even thriving are enhanced when the categories of individuals are in tune with each other and also with shifts in the natural environment.

V. ANALYSIS

A. From Social Dilemma to Social Change

The world is in a quandary where earthquake disasters are concerned. There is no consensus among scientists that earthquake prediction is possible. Public administrators demand that scientists give them a clear signal when a disaster will happen, a demand that scientists cannot fulfill (Normile, 1996). The public expects that scientists will tell community officials when a disaster will hit and these same officials will then act to protect their respective communities. Reality tells us otherwise, as things are not so simple and straightforward.

Earthquake tragedies such as Tangshan in 1976, Kobe in 1995, and Turkey and Taiwan in 1999 point to a social dilemma that, until recognized for its immense danger and addressed, will continue to produce huge human and economic tolls in our megacities. The social message of the Tangshan tragedy and the Qinglong County success is that where large metropolises are concerned, there will hardly ever be consensus amongst scientists and/or public administrators to mobilize for devastating earthquakes.

The challenge that humanity now faces is to rethink, along the lines of the Qinglong County experience, how we can reorganize ourselves and our communities, in light of Figure 4, to strengthen our disaster mitigation capacities. By educating ourselves and creating new avenues of information sharing and networking for disaster mitigation, we may find that, as Qinglong County did, the economic, social, and psychological concerns usually associated with disaster preparedness are minimized and even transformed.

B. Multidisciplinary Approach

The prediction of earthquakes is a multifaceted process. For three decades, Chinese earthquake scientists have based their prediction work on intense monitoring and analysis with a spectrum of multidisciplinary methods (Chu et al., 1996). They have found that, while no single method records precursory signals for all events, a multidisciplinary approach will often yield some precursory signals for most, especially large, earthquakes. The inter-linking of professional and lay observation methodologies has also helped to define the location and timing of earthquakes.

C. Shared Risk and Shared Responsibility

Given the uncertainties associated with earthquake prediction, anticipation and preparation for an earthquake are possible provided that information on the potential disaster is shared with the public at large, preferably through public administrators with training in disaster management. Successful warning for earthquakes will become possible when information from earthquake scientists is openly communicated to local public administrators who then, understanding and accepting the uncertainties involved, can choose to act upon the information and to educate and empower their local communities to mitigate the potential disaster. The ultimate decision for taking any action based on available information rests first with the public administrators, and then with each individual. Hence the consequences of such action involve responsibility at the most fundamental level, i.e., shared risk and shared responsibility taken on by the community's citizens. Successful early warning can best be achieved through avenues of disaster-related communications that are open and transparent.

D. Concept of Probability

One difficulty of using earthquake prediction information within a community involves the need to widely cultivate an appreciation for the concept of probability. Both public administrators and citizens need to understand that, like hurricanes and typhoons, earthquakes occur occasionally. It is difficult to predict the three main aspects of earthquakes -- time, location, and magnitude. Various cultures have differing tolerances for uncertainty (Hofstede, 1984). But just as communities can prepare for the possibility of hurricanes, they can prepare for the possibility of earthquakes. In line with the concept of probability, a community can plan a range of preparedness responses taking into account the likelihood of the earthquake's occurrence as well as the economic impact of a particular preparedness activity. For example, if individual householders know that an earthquake is probable over the next two weeks, and they have direct access to their gas lines, they can choose to shut off their lines when they retire to bed, thus reducing their injury from fires which are often associated with earthquakes. Acceptance of uncertainty makes possible the planning of "measured" responses. Willingness to work with uncertainties allows communities to prepare for potential disaster with the minimum of psychological, social and economic impact on the community's daily routine. As difficult as it is psychologically to prepare for an earthquake, the possibility of earthquakes requires calm preparation.

E. Multiple Communication Pathways

Although engineering solutions are practical in countries that can afford to construct very strong and resilient buildings, highways, and bridges, poorer countries need to include evacuation measures within their range of options. These evacuation measures can be set to correspond to a variety of earthquake strengths, with procedures for activating each degree of response before the earthquake hits. Speed, accuracy, efficiency, and complex coordination are often required, especially to prevent earthquakes from developing secondary and tertiary impacts, such as gas leaks and fires. Optimally, all levels of governments, scientific institutes, non-governmental organizations, and relevant private-sector units would be networked together, sharing data and information accurately and with minimum delay. Unfortunately, agencies seldom have multiple communication pathways, and those that do exist are generally fragile rather than robust. The few scientists in each disaster-prone country, challenged by the difficult demands of public administrators and citizens to issue accurate predictions (Normile, 1996), are usually unable to serve their publics as they face heavy consequences and responsibility from any decision that they make regarding earthquake prediction/early warning.

Vi. Follow-up in the Philippines: CSCAN

During 2000-2001, the Crustal Stress Community Awareness Network has been established in the Philippines. A joint effort of the Government of the Philippines, the UNGP-IPASD and ninePhilippine communities, this network collects, analyzes and uses information gathered from nine crustral stress monitoring sites and from the community-based monitoring teams. The crustal stress system is operated by local community residents, including public administrators, the lay public, young students, as well as scientists. The purpose of the network is to strengthen the preparedness and awareness of local communities to changes in the natural environment that are related to earthquakes and volcanic eruptions.

CSCAN was initiated through a Round Table Conference of Mayors, national officials from key ministries, representatives of civil society organizations and representatives from the League of Barangays. The Network was fully installed in nine different communities on Luzon by 24 October 2000, with cooperation from the Governors, Mayors, the Engineering Bridages of the Army, Navy and Air Force, PHIVOLCS, and the Search and Rescue Squadrons of the Philippine Air Force. The nine community sites report their data to PHIVOLCS, which has designated a full-time staff member to analyze the data and prepare summary reports on crustal stress signals from the communities—Aparri, Baler, Batangas City, Illagen, Infanta, Lingayen, Marikina City, Quezon City, Santa and Sorsgogon.

A two-day seminar trained participants on ways to recognize signals from the natural environment that relate to earthquake disasters. They also learned to plot their own data on graphs, giving them a visual tool to help them recognize earthquake precursory signals. Training sessions have now been held at each monitoring to engage more citizens in "seeing their environment" in their communities.

After only eight months of operation, there were already three cases where the CSCAN network provided signals for earthquakes of magnitude 5 to 7, weeks to days in advance of the natural events. The ESTAPE scores (see UNGP-IPASD Website: http://www.globalwatch.org/ungp/) for the most recent research results are above 70%. These scores indicate that the CSCAN system is functioning well and now has the capacity to forecast natural events. On 27 July 2001, the Regional Development Council (RDC) of the Philippines National Economic Development Authority (NEDA) in Region 2 (northern Luzon) unanimously passed document No. 02-30-3001: "A Resolution of Support to the Crustal Stress Community Awareness Network Project (CSCAN) and

Recommending for its Expansion in the Region." This resolution incorporates the CSCAN project into the national plan for this region. Further awareness-building activities are taking place in each of the nine communities, under the direction of Hon. Corazon Alma G. de Leon, former Chair of the Civil Service Commission and also of the Pount Pinatubo commission, as the UNDP Special Adviser on Social Technologies for the CSCAN project in the Philippines. Data on network signals and community observations are gathered and shared weekly and on an emergency basis.

VII. CONCLUSION

Just as microfinance is important to the economic health of a developing community, so is micropreparedness essential in the reduction of natural disasters. As each individual actively prepares, the family, community and urban metropolis become better protected against the devastation of natural disasters. The Qinglong County experience shows us that tragedies even from great earthquake disasters can be successfully prepared for. The main ingredient is awareness that [1] large earthquakes are preceded by numerous precursors; [2] there are a variety of disaster mitigation methodologies available to monitor for changes in the natural environment related to earthquakes; and [3] while today's urban metropolises are physically more than ever vulnerable to the devastation of natural events, it is through the networking of all levels of society and the open communication of disaster information that these megacommunities will achieve earthquake early warning successes. The Philippine experience shows that a network of urban and rural sites, organized and monitored by community participants can build awareness of community vulnerability and readiness. Just as Mounts Pinatubo and Mayon give out precursory signals for eruption, earthquakes and other natural disasters offer precursory signals, if only our communities are sensitized to perceive and act thoughtfully on these signals.

End note:

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