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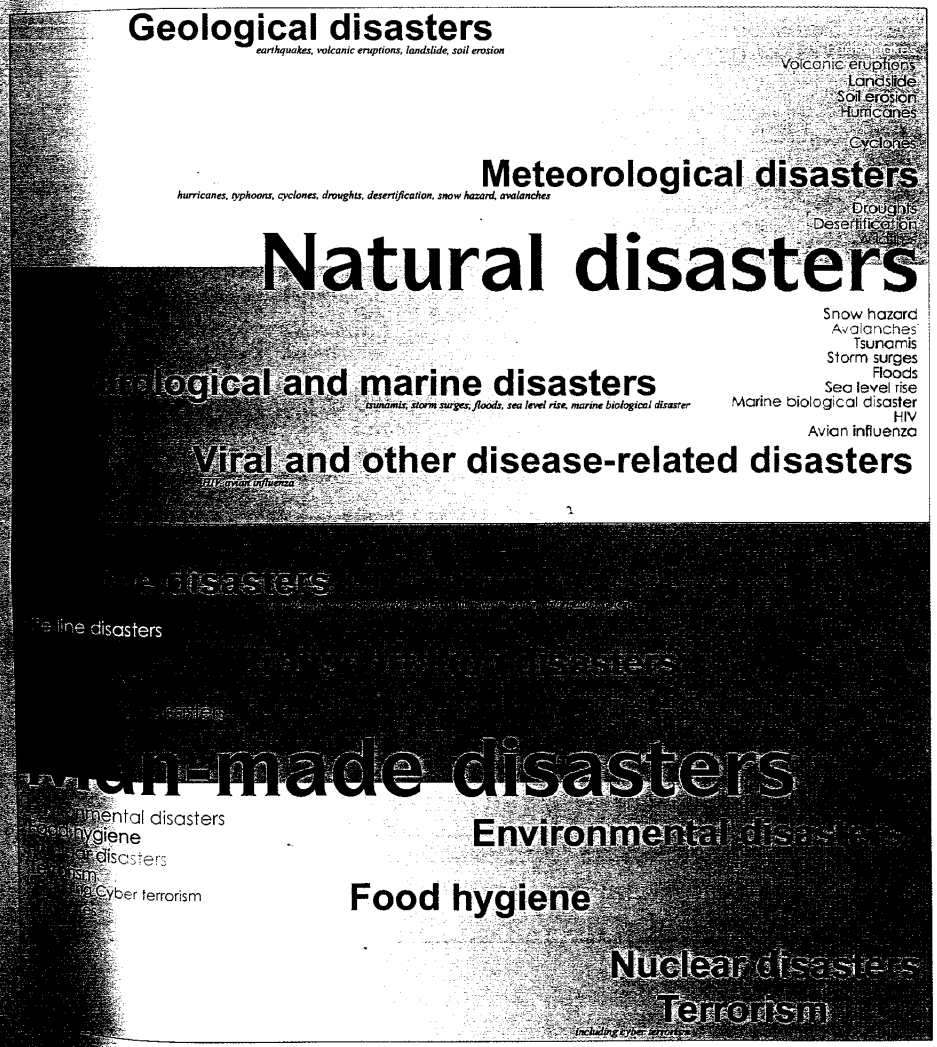
■ **Special Issue on "Building Local Capacity for Long-term Disaster Resilience"**

Part I



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Paper:

Building Community Capacity for Disaster Resilience in Taiwan

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In the face of large-scale, high intensity, and continuously occurring disasters, the concept of community resilience in disaster management has gradually developed and drawn significant attention. This paper focuses on how to build community disaster resilience, based on practical experiences of disaster recovery in Taiwan, for the purpose of increasing community resilience. In order to build community disaster resilience, the Taiwanese central government has designed a community-based process for disaster adaptation. Since 2004, the process has been applied to more than one hundred communities in Taiwan, not only by our research team but also by the Taiwanese government. Two successful cases are used to illustrate our framework for community disaster resilience, which should include the two major components of emergency adjustment and long-term adaptive capacity. Significant factors for making the process operational are clarified so as to form a long-term framework for building community disaster resilience.

Keywords: disaster resilience, community, vulnerability, disaster adaptation

1. Introduction

Building community disaster resilience is recognized as a necessary and useful strategy for disaster management [1]. However, the debate over the concept of disaster resilience is ongoing. From our point of view, the best way to substantiate what "community disaster resilience" means is to find important clues in the field, where local communities are building their own forms of disaster resilience. The clues can be classified according to their main factors to help us to discover the proper meaning of community disaster resilience and how to build it most effectively. In this paper, we try to organize these main factors in order to develop a framework from which to generalize from these valuable experiences as well as to be able to share the outcomes of real experiences in Taiwan. The main contents of this paper include: 1) discussion and definition of the concept of disaster resilience, 2) two cases based on practical experiences in Taiwan, illustrated for the purpose of analyzing the objectives of strengthening community disaster resilience and reducing vulnerability, 3) induction of the main factors for strengthening community disaster resilience, 4) development of a proper framework for community disaster resilience, and 5) primary conclusions.

2. Discussion and Definition of the Concept of Community Disaster Resilience

2.1. Vulnerability vs. Resilience

Generally speaking, vulnerability means potential losses of natural environment, society, economy, life or property in specific disaster conditions [2–5]. Furthermore, vulnerability has been recognized as having three major dimensions – exposure, sensitivity, and capacity of response [6–9]. For example, a specific area or community suffers a natural disaster or social perturbation, forcing it into a stressful situation. The community becomes sensitive, due to the disaster or perturbation, to both their socioeconomic and ecological conditions. It is necessary for the community to respond to the emergency situation as well as to develop its capacity for response and adjustment. Therefore, the community's capacity to respond should include the two main components of emergency adjustment and long-term adaptation. These two components can each increase a community's resilience [10–12], so we can infer that disaster resilience should be an important dimension for the reduction of vulnerability. In other words, a specific area or community must find it useful to increase its disaster resilience, which will in turn lead to a reduction in its vulnerability.

2.2. Definition of the Concept of Community Disaster Resilience

Based on the discussion above, disaster resilience means the capacity for recovery, emergency adjustment, and long-term adaptation in a specific area or community after experiencing a disaster or perturbation. The concept of disaster resilience emphasizes the strengthening of the capacity for recovery in a specific area, in a community in particular, so that the community is capable of quick response, adjustment, and adaptation. It is hard to avoid disasters, as the environment and society have become more and more vulnerable. Therefore, the community needs a clear and feasible operational process for increasing its disaster resilience. Although the community's disaster resilience is also influenced by its given social, economic, political, or environmental conditions, it is possible to improve its resilience through the proper process of disaster adaptation. In addition, the proper process of increasing disaster resilience could be treated as a useful learning process by which the people in the local community may raise their disaster risk awareness.

3. Two Case Studies Highlighting Community Disaster Resilience

One of the main purposes of this paper is to understand the community resilience building process in Taiwan. Two case studies demonstrate that the more capacity for emergency adjustment and adaptation a community has, the more the disaster resilience of the community is built. First, we want to introduce the community of Shang-An as a case study, because it was one of the communities involved in the Integrated Community-Based Disaster Management Program (ICBDM) launched in 2001 by the central government to achieve the goal of strengthening community resilience after the 1999 Chi-Chi Earthquake and the 2001 Typhoon Toraji [13]. Since suffering a catastrophic disaster, the community of Shang-An has developed a community-based process for disaster adaptation, in order to increase its disaster adaptation capacity. Second, we present a second case focused on community-based debris flow evacuation in the 2009 Typhoon Morakot, which, according to official statistics, saved 1,046 people. These two cases illustrate the importance of emergency response for community disaster resilience.

3.1. Community-Based Project for Disaster adaption: Shang-An Community

Shang-An is a community of only about 1,500 people with 354 households in an area of about 7.6 km^2 in Nantou County, central Taiwan. The Shang-An community is defined in this paper as a specific geographic area of local residents who live in the same neighborhood and share psychological ties and social interaction. Lindell, Prater and Perry [14] indicated that a community is commonly understood to be a specific geographic area and is considered to be equivalent to a political jurisidiction. However, the community in Taiwan is not a formal administrative organization with political jurisdiction, so it does not receive revenue from annual taxes. The community can only apply for government subsidies for specific projects. The Shang-An community is operated by the Shang-An development Association, which is an NGO. Since Shang-An has experienced disasters many times, the residents are aware that it is difficult to avoid participating in the community recovery process after disasters. For example, the 7.3 magnitude Chi-Chi earthquake in central Taiwan damaged 157 households, about half of the community. Then Typhoon Toraji hit the small village, resulting in 19 deaths and 80 damaged households. Living in a highly vulnerable environment, the people in Shang-An have been forced to learn to avoid danger and to push for more resilience by reducing the risks from natural hazards.

3.1.1. Shang-An Community-Based Project

The Taiwanese central government, the Executive Yuan, launched a community-based project for disaster management, the Integrated Community-Based Disaster Management (ICBDM), at the end of 2001 [15]. The project focused on strengthening pre-disaster planning, increasing disaster resistance capacity, and encouraging the people of the community to participate in disaster management efforts so as to move toward a sustainable future. The major goal of the project, proposed mainly by the government, was to support the local people in learning how to protect themselves against natural hazards in a collaborative way. In 2001, ICBDM recruited Shang-An as a pilot community in their efforts to enhance community disaster resistance levels. There were six project goals:

1 Autonomy of community disaster resistance

2 Integrated planning for disaster mitigation

3 Transparent public disaster information

4 Facilitation of participation by the local people

5 Encouragement of teamwork in disaster resistance

6 Institutional management of disaster resilience.

A disaster is a crisis for Shang-An; however, it is also an opportunity to make it a more sustainable community. The ICBDM, under the central government, had provided many necessary resources for a resilient community, such as financial subsidies, human resources, professional knowledge, skills, and feasible operational processes. For instance, Shang-An secured the help of a professional team, the Graduate Institute of Building and Planning of National Taiwan University, in order to receive their abundant professional knowledge on disaster adaptation and community planning.

In addition, we should note that the ICBDM was not the only community-based project to facilitate community development during that time period. After the Chi-Chi earthquake, the Taiwanese government initiated several public projects following the concept of community-based progress, such as the project of Community Industrial Revivification proposed by the Ministry of Economy Affairs, the project of Building New Villages from the Council of Agriculture, and the project of Community

Culture Cultivation by the Council for Cultural Affairs. Therefore, the community had access to many resources from the official system to help build their capacity and accountability on different dimensions: community planning, industrial development, cultural innovation, etc.

3.1.2. Learning from the Recovery Experiences of Shang-An

After the Chi-Chi earthquake, Shang-An had to deal with the recovery of private housing and public facilities within the physical environment, such as lifelines, transportation systems, flood prevention engineering, irrigation canals, geological engineering, etc. In addition, the community had to revive the agricultural livelihood of the local people as part of its non-physical recovery. Shang-An was an agricultural village, and the occupation of most of its inhabitants was farming. The agriculture of the community was severely damaged by the earthquake, and the livelihood of the farmers was nearly lost. Several community-based projects brought abundant resources from the central government and the community took full advantage of them.

The 3-P's, including *Partnership building, Participation in recovery,* and *Professional assistance*, are considered to be the major factors in the building of Shang-An's resilience to disaster.

1 *Partnership building*: The local leaders of Shang-An applied the resources of both the central and local governments to disaster recovery. The 921 Earthquake Post-disaster Recovery Commission of the Council of Agriculture and Council of Cultural Affairs, set up by the central government, provided financial and institutional incentives for the community. Meanwhile, local governments, such as Nantou County and Shili Township, and local emergency agencies like the fire brigade and the public health center, offered necessary administrative and human resource aid. In addition, experts in various hazard mitigation fields (flooding, landslides, and architecture), and academic teams (National Science and Technology Center for Disaster Reduction and the Institute of Building and Planning, of National Taiwan University), brought their professional knowledge and techniques to the community. The community leaders' mobilization of the local people, as well as their cooperation with non-governmental organizations (NGOs), such as the Community Recovery Association and Farmers Association, contributed to the recovery of public affairs. All of the above-mentioned public, private, and academic institutions, as well as NGOs joined together for the recovery. Because of the complexity of the recovery process, it was necessary for these participants to build their own partnerships in order for the recovery to go smoothly. Obviously, the local leaders had to play very important roles in the coordination of each participant so that they could contribute what the community really needed for maximum benefit.

2 *Participation in recovery*: Paton and Johnston [16] indicated that community empowerment strategies should be based on community participation, which could facilitate problem identification and solution, as well as the development and implementation of strategies. According to our previous research [12], the local people of Shang-An learned how to analyze vulnerable conditions, find proper methods of recovery, and develop strategies for disaster adaptation through a workshop process, which took more than a 5-month period.

Because the participants were the local people, the workshop needed to have a relaxed and flexible style in order to encourage the residents to speak out and form their ideas from their real disaster experiences and the disaster problems of their community. The workshop was an important instrument in gathering local residents for their participation in public recovery tasks. During the course of the workshops, participating residents had the opportunity to talk with people from other communities who were also interested in the public recovery affairs of their own neighborhoods. The participants had common memories of their disaster experiences. Through exchanging and sharing their experiences, the participants were able to obtain sufficient hazard information so as to identify Shang-An's most threatening disasters. Since the personal disaster experiences of the local people alone were not sufficient, various experts from professions related to disasters, such as hydrologists or geologists, needed to join and help the local people to assess the vulnerability of the community. Operationally, these experts needed to accompany the local people in conducting a community site survey through direct observations of the community's environment. Local residents were able to consult the experts if they had any inquiries about disaster risk or problems on the site. Then, Shang-An community hazard map was developed with the consensus of the local people. Generally, community-based hazard maps, besides the natural environment, include many pieces of information related to disasters. For instance, they include the locations of past disasters, such as areas of debris flow or flooding, the scope and impact of these disasters, and potential future disaster areas. The map should also present evacuation routes and sites, and the accurate addresses of disadvantaged local residents. In addition, the necessary rescue resources, such as hospitals, shelters and fire stations were also shown for emergency response. **Fig. 1** is an example of a community-based hazard map.

The participation process was like a glue that brought local people together to address potential disaster problems and find appropriate solutions for their own community. With the encouragement of the facilitator of the workshop, the people of Shang-An decided to form a community organization to deal with important community disaster issues, as well as with disaster adaptation.

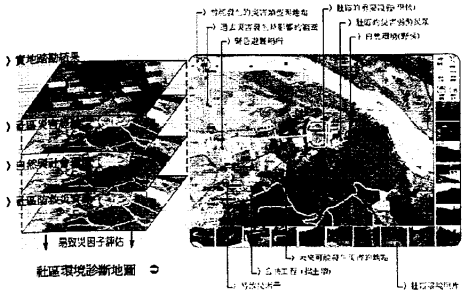

Fig. 1. Community-based hazard map.

During the participation process, through discussions with the professional planning team of Shang-An, a package of useful learning courses was provided for local people so that they could learn the basic skills for emergency rescue, or how to bounce back from disasters through better production and marketing skills. The participation process made the Shang-An residents understand that the community could move toward a learning-oriented community and increase its resilience to disaster.

3 *Professional assistance*: Through the above-mentioned participation process, Shang-An's residents learned to recognize what disaster related problems were their first priority and to develop a package of adaptation strategies with the assistance of the professional planning team. At the same time, Shang-An's residents needed to plan for the future of the community, not only for the reconstruction of their damaged homes, but also the sustainability of their livelihoods. The mechanism proposed by the Council of Cultural Affairs, namely the Community Empowerment Center (CEC), was a very useful and innovative policy instrument that helped the local people in an integrated way [17]. The CEC invited a professional team, professors, instructors, and escort-community to work together to assist residents, ensuring that the community was empowered through the building of its capacity for autonomy. In courses provided by the CEC, the local people learned how to write a planning project, attended many training courses, and acquired the know-how to coordinate a planning project. Worthy of mention is the fact that the CEC mechanism integrated for planning all of the government departments related to agriculture, social welfare, labor, education, urban development, and environmental protection. (refer to **Fig. 2**).

This not only shortened the administrative process, but also made it easier for the local leader to get the necessary resources for community planning, including financial, human, and professional aids. The main purpose of the CEC was to cultivate the local people and empower them so that they would actively participate in public affairs. Supported by the CEC, Shang-An transferred its livelihood from farming to leisure-tourism. The local people, assisted by the CEC, used community activities that combined education, marketing to a mechanism, and a cooperative unit, and integrated a productive and marketing chain so as to increase their profits. For instance, the local people used plum branches to produce unique, hand-made pencils. Most people, including elderly farmers, children, and women could take part in the production process. They also sold plum branch pencils to the cooperative unit and sold directly to tourists themselves. In addition, some of the well-trained farmers became tourism guides, introducing their community as well as marketing their products [18].

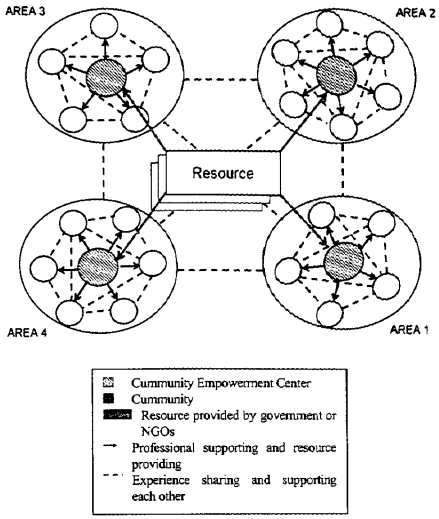

Fig. 2. Operational system of Community Empowerment Center.

3.2. Community-Based Debris Flow Evacuation

The case of Typhoon Morakot is also very meaningful in terms of demonstrating that building community capacity improves the community's emergency response to impending disaster. In 2009, Typhoon Morakot struck Taiwan, causing extremely devastating floods that resulted from the almost 3000 mm of rain that fell from August 6 to 10. Although the typhoon resulted in more than 758 dead or missing and has displaced 24,950, it could have caused more serious casualties had there been no evacua-

tion plan. According to official statistics (from the Council of Agriculture), the flood evacuation action reduced the number of casualties by about 1,046.

3.2.1. Debris Flow Evacuation Plan

The central government (e.g. Council of Agriculture, the Soil and Water Conservation Bureau; SWCB) launched a plan for community-based disaster emergency response to debris flow in 2002 so as to reduce the threat of disaster. The major goal of the community-based Debris Flow Evacuation Plan was to build a safer community. The plan emphasized debris flow evacuation in particular, which enhanced the capacity for emergency disaster response by members of the community. The plan has now become one of the most important policies for managing potential debris flow and encouraging the community to implement automatic disaster management and evacuation plans. Local residents are recruited to participate in the Debris Flow Evacuation Plan by attending a package of training courses or workshops. The SWCB has designed 4 packages of free training courses or workshops for various attendees, including children, evacuation liaison specialists, volunteer lecturers and local residents. In these training courses and workshops, local people receive abundant knowledge about debris flow response and are encouraged to participate in community disaster management.

3.2.2. Learning from the Community-Based Debris Flow Evacuation Plan

Here, 4-S's, namely *Specifying the potential debris flow area, Safe alliance by organizing, Solid mechanism for training, and Support system*, have proved to be very effective in the reduction of casualties by building the community's capacity for emergency response. For instance, when Typhoon Morakot struck, according to statistics of the SWCB, 9,100 people were evacuated from the debris flow disaster area, saving 1,046 from becoming casualties.

1 *Specifying the potential debris flow area*: Each community has an area that has the potential for disaster, and that area should be defined. How to identify the potential area is a very important issue for disaster management. Local people need professional advice from experts, such as geologists and structural engineers, to assist them in identifying vulnerable areas. In addition, local residents familiar with the geographic environment of the community can map the potential disaster areas accurately. In other words, the areas with the potential for disaster from debris flow are indicated on a hazard map based on a community unit so as to show the proper evacuation routes for local people. **Fig. 3**[1] shows one such evacuation map.

1. The debris flow evacuation map was downloaded from: http://tsn.taitung.gov.tw/swccd/menu.htm

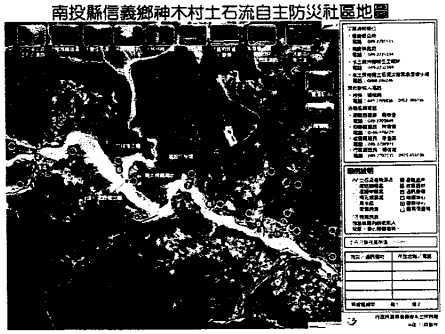

Fig. 3. Community debris flow evacuation plan.

2 *Safe alliance by organizing*: The Debris Flow Evacuation Plan set the major goals for community emergency response. There were several policy instruments for achieving the goals. For instance, the SWCB publically announced the debris-flow evacuation risk areas, so as to keep an eye on these regions. The SWCB also recorded information on these areas, including the names of all residents and disadvantaged people, and emergency telephone numbers in the evacuation risk areas of each community. Residents were then called "secured householders." Each community with a debris-flow evacuation risk area is in the care of several "evacuation liaison specialists," who may be village heads, volunteers, local opinion leaders, etc. These evacuation liaison specialists in debris flow are trained by the SWCB for evacuation response. Local people living in the community with the potential for debris flow disaster are organized as alliances for community safety against debris flow.

3 *Solid mechanism for training*: The liaison specialists were trained on debris flow disasters by the SWCB. In addition to basic professional knowledge regarding debris flow, they learn many skills, including how to gather disaster related information, how to observe a rain gauge and judge it, how to send emergency messages to the SWCB, and how to evacuate the local people during emergencies. Local people were also trained using disaster scenario exercises based on the physical and social characteristics of the community. Similar to Community Emergency Response Training (CERTs) [19] in the United States, the training courses tend to be structured in modules and standardization, which are coordinated by the staff of the SWCB. These training courses formed a solid package for debris flow evacuation. In addition, through various workshops held by professional teams as associated agencies of the SWCB, focus was placed on risk management information related to community debris flow evacuation plans for local residents.

4 *Support system*: The central government's support system for the Debris Flow Evacuation Plan provided the local community with the necessary resources in terms of emergency evacuation information, financial aid, and professional training. For instance, the SWCB established an information platform[2] to provide community-based mitigation information, real-time rainfall accumulation, and debris flow warning information to the local people via the Internet.

4. Framework for Building Community-Based Resilience

Based on the above case studies, we tried to deduce the main factors in analyzing how to build community-based resilience in terms of adaptations for long-term disaster recovery and emergency evacuation response. Great efforts, and various pre-conditions, are needed to strengthen community disaster resilience. We have proposed a framework with seven main factors for facilitating the building of community disaster resilience:

- Identifying key community issues
- Resource supporting system
- Creating community consensus
- Active participation process
- Constructing an organizational alliance
- Long-term community operation
- Empowerment through learning

The strengthening of community disaster resilience is an integrated, long-term, and supportable task. In order to be successful, bottom-up efforts from the community are needed, along with the top-down resources of the government. In addition, the experts and professional teams also play important roles in training local people and aiding them in their learning.

The seven main factors are essential for the building of community disaster resilience. We try to put these main factors together into a framework to explain our complete idea in detail. See **Fig. 4**.

Fostering consensus is the key to building community capacity. This core needs to be supported by external resources, including financial aid, information and institutional incentives from various governmental departments, experts with wide-ranging, disaster-related knowledge, and professionals well-experienced in community operation and planning. The community itself should be equipped with four major abilities, including how to identify key community issues, facilitate active participation,

2. The information platform designed by the SWCB for community against the debris flow disaster is the following : http://246.swcb.gov.tw/default-1.asp

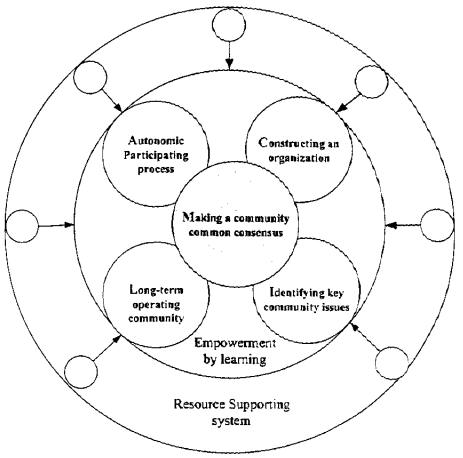

Fig. 4. Framework for building community disaster resilience.

design a suitable organization, and manage the community properly. All of these four major community abilities are fostered by a systematic learning process so that local residents can be empowered and well qualified to sustain the community.

4.1. Identifying Key Community Issues

Community affairs are quite complex, so it will most likely take time and intensive discussion for the local residents to identify and prioritize key community issues. This is an important step in the building of community resilience regardless of whether the issue is disaster recovery or a disaster emergency. In Shang-An's case, the issues related to earthquake recovery were quite complex, not only those involving reconstruction of the physical environmental but also those related to a sustainable livelihood. Identifying the key issues in the recovery of the community was not an easy task. However, regarding emergency disaster adjustment and debris flow evacuation, the issue was simple and focused on the plan, and local residents could follow the ideas given on evacuation in order to avoid tragedies.

4.2. Resource Support System

To successfully build community disaster resilience, it is necessary to have supporting resources from outsiders during the initial phase. In Shang-An's case, support from

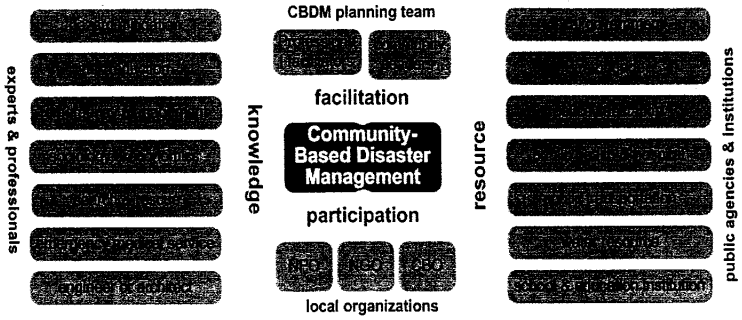

Fig. 5. Building partnership for community-based disaster management.

the various departments of the central government, which provided institutional incentives, was necessary for their disaster management. Support was also provided by the local government, experts, and professionals in the building of the community's capacity for adaptation. In the case of the Debris Flow Evacuation Plan, the SWCB, in conjunction with associated professionals, offered local residents the needed disaster warning equipment and training courses for a more effective evacuation. The resources provided by the government are essential, but they are a double-edged sword. If the autonomy of the community does not come into bloom, it will wither on the vine due to a lack of financial aid from the government.

4.3. Finding Consensus in the Community

If a community intends to build disaster resilience, the first step is to raise the risk consciousness and disaster awareness of the residents. It means that the local people are encouraged to be more sensitive to their living environment, actively participate in the planning process, and have better communication in terms of information that will contribute to reaching a consensus on the sustainable development of the community. For instance, in Shang-An, the local people made a remarkable decision to change their traditional agricultural livelihood to leisure-tourism as their post-disaster common recovery goal. They then had a common commitment for their own community development, as well as for disaster management. The common commitment should be formed through a bottom-up orientation. In the case of debris flow evacuation, a top-down orientation only focuses on those who had previous risk awareness. Although the evacuation process was substantially implemented by the communities after being notified by central government agencies, the common consensus for evacuation was mostly based on the policy direction of the SWCB. Therefore, reaching a consensus is an essential step for the community to attain sustainable development.

4.4. Active Participation

Only when there is active participation can a community be sustained and build its capacity. Based on my previous research [20] (see **Fig. 5**), building partnerships is a substantial strategy for fostering community resilience through community-based disaster management. At the beginning of the disaster recovery process, the government should pave the way for the participation of local residents.. In the long run, however, the active spirit of participation among the residents of the community should be developed so that recovery issues are continually dealt with. In the case of emergency evacuation, the SWBC mobilized the local residents to participate in the plan by a designed process. It was a useful and effective participation process. Therefore, a key person, e.g. an evacuation liaison specialist in debris flow, should play an important role in encouraging participation among the local residents.

4.5. Constructing a Proper Organizational Alliance

Whether building long-term adaptation capacity or making emergency adjustments in case of disaster, a proper organization or organizational alliance is a key element in arranging community affairs. For a long-term strategy, a flexible organizational type would be more suitable for a complex recovery process. However, for the purpose of disaster evacuation, a rigid organization is more efficient.

4.6. Long-Term Community Operation

The institutional design is called the "escort-community," in which a well-experienced community assists and accompanies a novice community towards its improvement. In the case of Shang-An, the "escort-community" cultivated the local leaders in an effective way so that the local leaders had good information on which to base operations in their own community. In addition to knowledge on operations in their community, local leaders should supply the coordinating skills, mobilization abilities, planning techniques, etc., as well as the creativity for long-term community operations.

Table 1. The characteristics of building community disaster.

	Building community disaster resilience	
	Adaptation capacity	**Emergency adjustment**
Making a community consensus	long-term/bottom-up orientation	short-term/top-down orientation
Identifying key community issues	complex	simple
Resource support system	diverse/multiple	singular
Active participation process	self-activation process	mobilization process
Constructing an organizational alliance	flexible	well-deployed
Long-term community operation	well-experienced/creative	official
Empowerment through learning	discussed by participation	top-down orientation

4.7. Empowerment Through Learning

The best way to empower the local people is through education. There are plenty of ways for them to learn, such as through lectures, meetings, workshops, training courses, exercises, and drills. With the assistance of experts and local officials in the two cases above, these various methods constituted a useful approach to empowering the local people. The training courses were based off of the enthusiastic discussions of the local residents so that their visions of the community's future were fulfilled.

The initials of the seven main factors in the strengthening of community disaster resilience create the acronym **IRMACLE**, indicating that they are the most essential elements of community disaster resilience, and together they make it possible to create a miracle in the real world. In order to draw attention and make it easier to remember, the acronym, IRMACLE is reorganized as **MIRACLE**. Based on the seven factor criteria, we compared the respective long-term adaptation capacity and emergency disaster adjustment of the two cases described. See **Table 1**.

5. Conclusions

In this paper, we defined the concept of community disaster resilience in terms of two major elements: long-term adaptation capacity building after disaster and emergency adjustment. In other words, disaster adaptation should be treated as a long-term policy goal attained by building community disaster-adaptation capacity from the bottom up. Furthermore, facing an increase in disaster frequency and scale, the government should allocate more resources and design more solid emergency response institutions so that the local community can adjust to disasters.

We analyzed two cases, adaptation in the community of Shang-An and the Debris Flow Evacuation Plan after Typhoon Morakot, as examples of disaster management in Taiwan. These cases represent two different approaches to disaster resilience, enabling us to gather more ideas and information for analysis. In Shang-An's case, we described the experiences as 3-P (*Partnership building, Participation in recovery,* and *Professional assistance*) in order to explain how to strengthen disaster resilience during the process of disaster recovery. In the case of the Debris Flow Evacuation Plan, we classified the experiences as 4-S (*Specifying the potential debris flow area, Safe alliance by organizing, Solid mechanism for training,* and *Support system*) to prove that the plan could be very effective in the reduction of casualties through the building of community capacity in terms of emergency response.

Based on the analyses above, we identified seven main factors as the most essential elements of community disaster resilience. Further, we proposed a framework for community disaster resilience incorporating these seven factors in order to create a more meaningful approach to future disaster management. According to this framework, both the bottom-up participation of local residents and the top-down policy incentives and support of professionals are essential, and their integration is necessary for the securing of community disaster resilience.

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Paper:

Lessons for Long-Term Residential Recovery: Factors of Community Resilience and Marginalization

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This paper examines conditions influencing reconstruction and recovery processes following a disaster. The Northridge Earthquake and Hurricane Katrina are illustrative of supra-regional political and economic changes and their effect on local communities during the recovery process. In addition, the paper argues that informal institutions can play an important role in shaping the recovery process and its outcomes.

Keywords: housing reconstruction, disaster recovery, Northridge earthquake, Hurricane Katrina

1. Introduction

This paper examines three factors that shape long-term post-disaster recovery outcomes and discusses how community resilience is affected by such factors. While some scholars have examined resilience as a place-based phenomenon [1], this study focuses more on the interdependence of local and external factors [2, 3]. Variations in the resilience of a community are understood here to be the product of local, regional, and supra-regional political, economic, and cultural practices that take place prior, during, and after the disaster [4, 5]. This paper focuses on housing recovery following the last two major disasters affecting large urban centers in the United States: the 1994 Northridge earthquake in Los Angeles and the 2005 Hurricane Katrina in New Orleans.

The paper extracts findings from long-term monitoring of housing recovery in these two cities and presents three main sets of factors that shape post-disaster outcomes and community resilience. The first set of factors has to do with supra-regional political and economic changes that take place during the recovery process and their effects on local communities. Second, the paper highlights the reproduction of uneven urban development in the aftermath of a disaster and how socially marginalized groups tend to face higher obstacles during the recovery process. Third, local informal arrangements can by-pass structural barriers to recovery and find creative ways to meet local needs that are not addressed through formal channels and programs. The paper concludes with a discussion of the implications of these factors on community resilience.

2. Background

On Monday, January 17, 1994, a moderate but damaging earthquake, of magnitude 6.7 on the Richter scale, hit the Los Angeles area. The earthquake lasted 10 to 20 sec and its epicenter was located beneath the San Fernando Valley, in Northridge, about 32 km west-northwest of downtown Los Angeles. Fortunately, the Northridge earthquake occurred during the early hours of the Martin Luther King holiday when freeways were almost deserted, thus greatly reducing the number of highway fatalities and injuries. Nevertheless, the earthquake left 58 people dead, about 1,500 people were admitted to hospitals with major injuries, and another 16,000 or so were treated and released [6]. Estimates of the number of people temporarily or permanently displaced because of damage to their houses or apartments ranged between 80,000 and 125,000 [7, 8]. As of early February 1994, over 400,000 people had registered for various types of federal disaster assistance [9, 10]. About 11 major roads and freeway interchanges and 12,500 housing units collapsed or were severely damaged. The effects of the earthquake on housing were both scattered and concentrated. Housing damage spread out almost 25 miles from the epicenter but was mostly concentrated in a few pockets of high damage. With over $20 billion in federal payments and $12.5 billion by private insurance made to compensate for earthquake damage, the Northridge earthquake became one of the costliest disasters in United States' history [9].

Hurricane Katrina, however, would prove significantly more deadly and expensive, and its recovery more problematic. On August 29, 2005, Hurricane Katrina hit several southern states along the Gulf of Mexico from Florida to Texas. Louisiana was the hardest hit and 1,577 of the 1,836 people who died in seven states were from Louisiana. Approximately 1.3 million people evacuated to shelters and 1.2 million homes were damaged. In Louisiana alone more than 500,000 homes were damaged, 106,651 of which were destroyed [11]. Particularly hard hit was the Greater New Orleans Metropolitan area, where levee breaches, storm surges, and heavy rain put 80% of the region under up to 6 meters of water for several days. Estimated material losses ranged between $100 and $170 billion [12, 13].