Disaster Impact and Mitigating Measures at the Household and Community Levels: The Case of the Earthquake-affected Areas in Northern Luzon, Philippines

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INTRODUCTION

The Philippines is in an area highly vulnerable to natural disasters. Among the 53 countries surveyed between 1960 and 1981, the country ranked second as having the most number of natural disasters.[1] Furthermore, while these countries had an average of only one disaster per year, the Philippines had four. But it was the twin earthquakes which occurred in the Luzon Island in the Philippines on 16 July 1990 which made the entire country realized its high vulnerability to natural disasters.[2] The earthquake which registered at magnitude 7.8 in the Richter Scale dramatized such vulnerability by producing various forms of physical hazards (such as liquefaction, landslides and parallel and subparallel ruptures). These hazards claimed 1,283 deaths (plus 2,786 injured and 321 missing) and 15 billion pesos worth of destroyed infrastructure.[3] The resulting long-term dislocation partially cost the country 2.5 billion pesos in terms of unrealized production.[4] For a country which recovery from a 20-year systematic plunder of a dictatorial regime had just started, the earthquake was indeed a sobering event.

The gross indicators (such as the number of deaths, amount of damaged properties and cost to the economy) measuring the impact of the earthquake may jolt the entire country from complacency but these do not suffice to serve as basis for a disaster preparedness and mitigation plan. Such a plan needs information sets on the impact of the disaster at the household and the community levels as well as on their capability and constraints to handle such impact. A workable plan has to be anchored on these information sets to ensure not only the optimum use of limited government resources but also to generate an assistance effort which is appropriate to the needs of those affected by a disaster. To provide said information sets, a study was conducted among households and communities most-heavily hit by the earthquake. These households and communities are in the cities and municipalities in three provinces (Benguet, La Union and Pangasinan) where the earthquake registered at intensity of 8.0 in the Modified Rossi-Forel Scale. The study presents the impact of the earthquake on the households and their communities and the mitigating measures they employed. From such impact and mitigating measures, the study culled the lessons to serve as guide in formulating a plan to prepare for and mitigate the impact of in-coming natural disasters.

SITE AND SAMPLE OF THE STUDY

The study site is in the northern portion of Luzon Island in the Philippines where the epicenters of the twin earthquakes were located (Fig. 1). It is approximately 15° 5' latitude in the North and 120° 5' longitude in the East. The study site covered three provinces situated adjacent to each other. Benguet straddles on the southeast side of the Cordillera Mountain Range while La Union and Pangasinan nestle in the southeastern part of the undulating plain in the foot of the range. The varying topography and geology mainly explained the differences of the physical hazards borne out by the earthquake in these provinces.[5] It triggered landslides in Benguet, liquefaction in some areas of La Union and Pangasinan, and parallel and subparallel ruptures in other areas of Pangasinan. The two cities included in the study were Baguio City of Benguet and Dagupan City of Pangasinan. The municipalities included were as follows: La Trinidad of Benguet, Agoo and Aringay of La Union, and Calasiao and Malasiqui of Pangasinan.

The study site was a densely populated area. The three provinces had 303 persons per square kilometer in 1990 while the entire country had only 204 persons.[6] The population was particularly dense in the two cities. The 1990 population of Baguio City was 183,102 persons while that of Dagupan City was 122,247 persons. Both cities had an average of 3,300 persons per square kilometer although Baguio City was denser than Dagupan City (3,744 vs. 2,801 persons per square kilometer). The municipalities were sparser with an average population of 55,845 persons per municipality. Their average population density was 648 persons per square kilometer or 2,652 persons less than that of the cities. The two cities and five municipalities composing the study site had 167,464 households, 109 of which were randomly selected to compose the sample of the study. The sample households were from 52 communities or barangays. From among these communities, 48 individually serve as case studies which experience during the earthquake was reconstructed through in-depth individual and group interviews of key informants.

IMPACT OF THE EARTHQUAKE ON HOUSEHOLDS AND COMMUNITIES

The earthquake generated a series of interrelated impacts on the households in the study sites. These were seen in the four impacts covered by the study, namely: widespread fear of the sample respondents, problems which their households encountered immediately after the earthquake, damage on their housing structures and damage on the operation of their livelihood sources. These impacts worked together to create the post-earthquake condition of the sample households. If an impact was beyond the capacity of the household to handle and/or was shared by a relatively considerable number of households, it became a community concern. Thus, the initiative to deal with the impact was being planned and implemented at the community level.

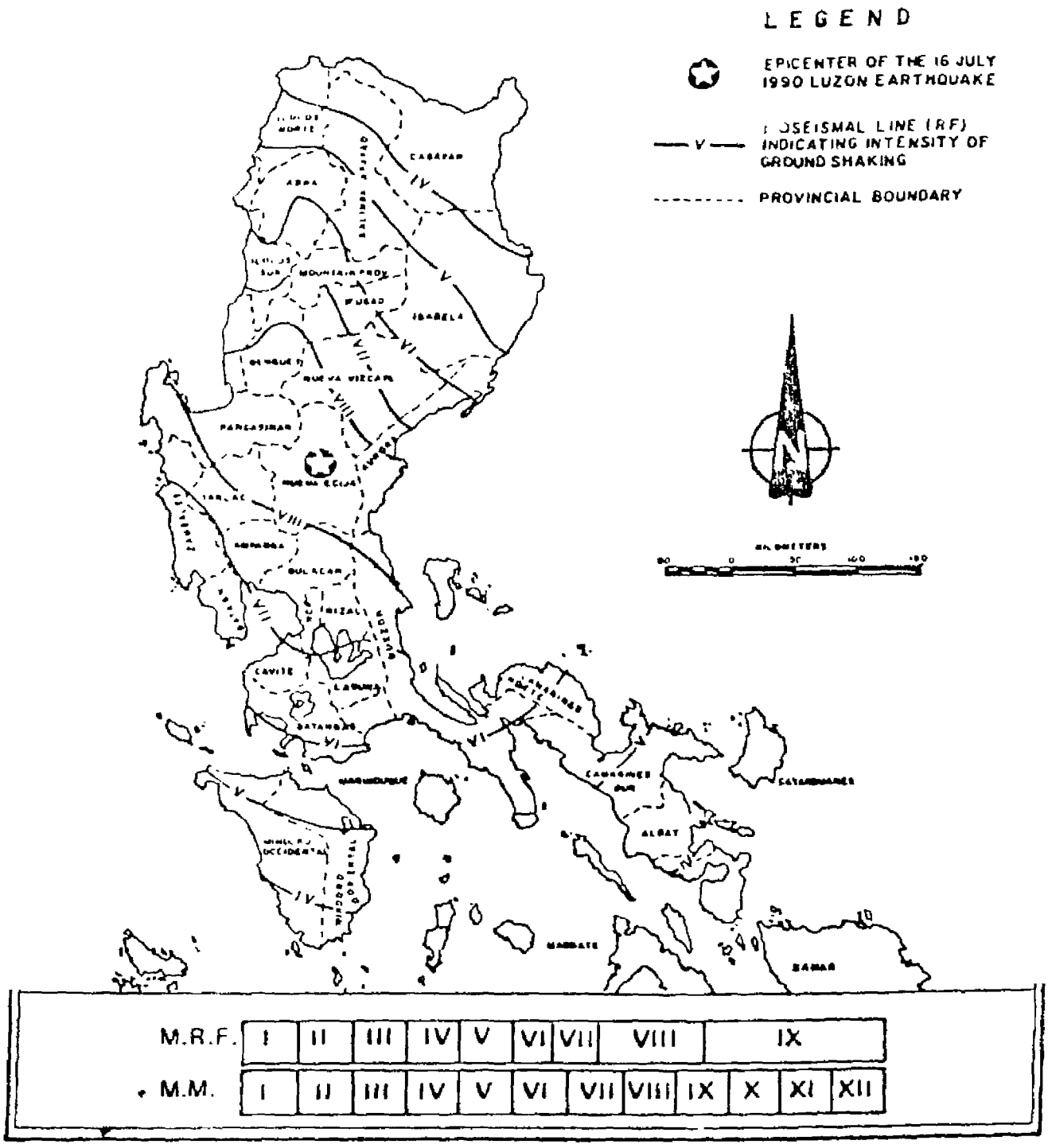

Fig.1. Generalized isoseismal map (Rossi-Forel Scale) of the 16 July 1990 Luzon Earthquake (from PHIVOLCS,1990)

Household-level Impacts

Widespread Fear of the Sample Respondents. The earthquake struck at 4 :26 (DST) in the afternoon when the residents in the study site were winding up their activities for the day. The earthquake caught 82 percent of the respondents indoors and 18 percent outdoors (Table 1). Among those caught indoors, 71 percent were already inside their houses. The rest were

Table 1 Selected Data on the Outright Reaction of the Sample Respondents to the July 1990 Earthquake in Northern Luzon, Philippines: January 1991

Item	Percentage
Location of the respondents during the earthquake	
Indoors	82 percent
Outdoors	18
Reaction to the earthquake among those indoors	
Run somewhere	57 percent
Stayed put	43
Reaction to the earthquake among those outdoors	
Run somewhere	4 percent
Stayed put	96
Respondents who were unaware that their residence was located in an earthquake-prone area	92 percent

either in their work places or in some public buildings. Those outdoors were in their yards, farms or in a street. While all respondents experienced extreme fear, only about half (47 percent) dashed towards somewhere. The other half (53 percent) stayed where they were. This reaction appeared to be mainly conditioned by their location when they felt the earthquake. About 57 percent of those indoors ran mostly outside from where they were but only 4 percent did the same among those who were outdoors. Among the respondents who were outdoors during the earthquake, 96 percent stayed put. Only 43 percent acted similarly among those caught indoors.

Both reactions indicate the surprise of the respondents over the event. Only one respondent reported a purposive behavior: putting off the main electrical switch in his house. The main reason behind the behavior of most respondents was their unpreparedness for such an event. Exactly 92 percent of the respondents were not aware that their respective communities were located in an earthquake-prone area. The extremely high level of unawareness among the respondents was the same regardless of their place of residence, income status, degree of mass media exposure and frequency of attendance in community meetings. The 8 percent who were aware of the environmental risk present in the area learned this from informal (such as from the old folks in their communities) rather than from formal (such as from the school and the mass media) sources. Fortunately, only two households reported a member who was physically injured in the panic that ensued in spite of their haphazard handling of the event.

Immediate Problems After the Earthquake. Due to their lack of awareness and preparation, the problems which most households contended with within the next two days after the earthquake, pertained to basic necessities. The extent of the damage brought about by the earthquake on the buildings and the peril in staying inside as the aftershock occurred every now and then made shelter the principal problem of 50 percent of the sample households (Table 2). The problem of shelter was more severe in the cities than in the municipalities (60 vs. 39 percent of the sample households). However, in areas of Pangasinan and La Union where liquefaction occurred, looking for a place to stay was more of a predicament than a problem. In these areas, a stable ground was not enough to assure one of a safe temporary shelter because of the flooding induced by the earthquake.

Next to shelter, two problems were mentioned by the sample households with most and almost equal frequency: water and food. Water was a problem of 49 percent of the sample households and food was a problem of 47 percent. Water became a problem mainly due to the discontinuance of the normal service rendered by the city or municipal water supply systems. Because more households were dependent on such systems in the cities than in the municipalities, the problem was felt by more city than municipal households (66 vs. 32 percent). In the municipalities, many households depended on such traditional sources as communal faucets, springs, piped wells and dug wells for water. The percentage of the sample households who had problem on food supply in the cities was about of the same as in the municipalities (49 vs. 45 percent). The earthquake disconnected the network of food distribution that operated within cities and municipalities and between cities and municipalities. The destruction sustained by farms, factories, and storage facilities and the closure of roads, airports and banks put the entire economy in the sample site at a standstill immediately after the earthquake.

Table 2 Problems Encountered by the Sample Households Within Two Days Immediately After the Earthquake in Northern Luzon: January 1991

Problem	Cities	Municipalities	Total
Shelter	60 percent	39 percent	50 percent
Water	66	32	49
Food	49	45	47
Lighting	45	23	34
Flooding	6	18	12
Money supply	13	5	9
Transportation	8	2	5
Missing/Injured Relatives	2	4	3

Note: The total of the percentages of the responses does not add to 100 because the respondents mentioned more than one problem.

The situation in the economy indicated the breakdown of the system which moved goods and services among and within sectors in the cities and municipalities. Such breakdown was reflected by the rest of the problems (lighting, flooding, money supply, transportation and missing or injured relatives) encumbering the sample households. Because the earthquake occurred in late afternoon, lighting became a problem of 34 percent of the sample households immediately upon the coming of darkness. Like the water problem, securing a source of lighting was a problem of more city than municipal households (45 vs. 23 percent). The absence of the electrical services on which most city households relied on for lighting made the problem more widespread. In the municipalities where many households used kerosene lamps for lighting, the problem was realized only when the supply of kerosene ran out.

The flooding in low-lying areas was a problem of 12 percent of the sample households. This resulted from two physical processes triggered by the earthquake: the landslides which blocked both the natural and man-made drainage systems and the liquefaction which did not only bring water up from underground but also extended the parameters of existing water bodies such as the sea and rivers into formerly dry areas. The flooding spurred by these processes was exacerbated by the continual monsoon rains. Because more of the sample municipalities were located in the flatlands which were flood-prone, there were more municipal than city households who had to deal with flooding (18 vs. 6 percent).

Smaller percentages of the sample households endured the problems of shortage of money supply (9 percent), inadequacy of transportation facilities (5 percent) and the anxiety over missing or injured relatives (3 percent). The shortage of money supply was a result of the closure of places of employment and banks. Because the economy in the municipalities was not as monetized as in the cities, the problem was felt by more city than municipal households (13 vs. 5 percent). Likewise, the inadequacy of transportation facilities due to the insufficiency of gasoline supply and the cut-off of the normal access network was borne by more city than municipal households (8 vs. 2 percent). Being food-producing areas, food in the municipalities was not necessarily scoured in the market and the usual travel destinations (such as farmlands, health centers and the sea) of the households were normally traversed either by foot or non-motorized transport modes (animals, bicycles and dinghy). The very small proportion of households who reported missing and injured relatives indicated that the fatality caused by the earthquake was not very widespread and may have concentrated in certain locations (such as collapsed hotels and schools).

Their immediate problems indicated that the impact of the earthquake among households could either be across-sites or site- specific. The problems of food and of missing or injured relatives were experienced by an almost equal proportion of city and municipal households. But except for flooding, the other problems (such as shelter, water, and lighting) were felt by more city than municipal households. These problems arose from the disturbance brought upon by the earthquake on the system of mass distribution and consumption on which city households relied for goods and services. Their lack of control over the system which governed their lives made the city households more vulnerable to the immediate impact of disaster than the municipal households. The flooding which affected more municipal households was not a result of the similar system in the municipalities but rather induced by the topography and geology of the sample municipalities.

Damage on Housing Structures. The sample households lived in houses which location and construction may not have fully consider the seismic strain these may undergo because the earthquake damaged 84 percent of their houses (Table 3). The percentage of houses destroyed in the municipalities (84 percent) was about the same as in the cities (85 percent). The earthquake also hit equally the houses of both the rich (earning more than the average

Table 3 Selected Data on the Impact of the July 1990 Earthquake on the Housing Structures of the Sample Households in Northern Luzon, Philippines: January 1991.

Item	Percentage
Households whose houses were damaged by the earthquake	84 percent
Damaged houses by location:	
Cities	85 percent
Municipalities	84
Highland	82 percent
Lowland	86
Damaged houses by status of the resident:	
Rich	83 percent
Poor	84
Damaged houses by type of predominant material	
Durable	88 percent
Light	67
Households by type of housing damaged sustained	
Cracks on walls and floor	18 percent
Partial collapse	57
Total collapse	11
Dislocation of the house	14
Totally collapsed houses by location:	
Cities	15 percent
Municipalities	6
Lowland	14 percent
Highland	7

income of the sample households) and the the poor (earning less than the average income of the sample households). at 83 and 84 percent, respectively. There was also no strong indication that the degree of destruction varied according to topographic location. The percentage of houses destroyed in the highland (Benguet) where landslides occurred was only slightly lower (82 vs. 86 percent) than that in the lowland (Pangasinan and La Union) where there was liquefaction. However, more houses made of durable materials (such as cement, galvanized iron and wood) succumbed to the earthquake than those of light materials (such as bamboo, grass and palm leaves). The earthquake destroyed 88 percent of the houses made of durable materials but only 67 percent of those made of light materials.

The degree of destruction wrought by the earthquake on the housing structures varied. Close to 57 percent of the houses has at least a portion (from a wall to entire kitchen) which collapsed while 14 percent moved (downward and/or sideways) from their original positions although these stayed more or less intact. The remaining 18 percent sustained cracks of various numbers and sizes in their walls and floors. Only 11 percent of the houses were entirely destroyed. The impact of the earthquake on the housing structures entailed damage on the household items. This concomitant effect was incidentally reported by 26 percent of the sample households. The destruction slightly varied according to the administrative unit where the sample households resided. In the cities where 91 percent of the houses where made of durable materials, 15 percent of the destroyed houses totally collapsed but only 6 percent went the same way in the municipalities where houses made of durable materials constitute a mere 70 percent. More houses also totally collapsed in the lowland (14 percent) than in the highland (7 percent).

Damage on Livelihood Sources. The destruction of housing structures represented only one of the long-term impacts of the earthquake on households. The other impact which may be considered more crucial was on their livelihood sources. The earthquake halted the operation of at least one livelihood source of 56 percent of the respondents (Table 4). The variation of the percentage of households whose livelihood sources were affected was defined more by location rather than by income status. The earthquake upset the livelihood sources of more city than municipal households (63 vs. 49 percent) and more highland than lowland households (77 vs. 44 percent). The percentage of rich and poor households with an affected livelihood source differed by only 6 percentage points (60 vs. 54 percent).

The earthquake hit hardest the places of employment where household members derived their salaries and wages. The earthquake ceased the operation of the places of employment of 66 percent of the sample households. The cessation of such operation was critical because 81 percent of the sample households derived part or whole of their income from salary or wage employment. Salary or wage employment was the only source of income of 30 percent of these households and a main component of the portfolio of income sources of the remaining 70 percent. Its contribution to the total amount earned by the wage-and-salary earning households amounted to 55 percent of their average income while those of other sources (such as proceeds from business and remittances from relatives) composed the rest.

Table 4 Selected Data on the Impact of the July 1990 Earthquake on the Livelihood Sources of the Sample Households in Northern Luzon: January 1991

Item	Percentage
Households whose livelihood sources were affected by the earthquake	56 percent
Households with affected livelihood by location	
Cities	63 percent
Municipalities	49
Highland	77 percent
Lowland	44
Households with affected livelihood by status	
Rich	60 percent
Poor	54
Households with affected livelihood by source	
Place of employment	66 percent
Farmland	52
Livestock and poultry	100
Leased-off properties	83

However, the percentage of households whose livelihood sources were disturbed by the earthquake varied according to location. More households in the cities lost a livelihood source than in the municipalities (63 vs. 49 percent). This was because more city than municipal households (94 vs. 68 percent) derived their income from salary or wage employment and its contribution to the city households' average income was greater compared to that of the municipal households (60 vs. 41 percent). There were also more highland than lowland households (77 vs. 44 percent) who lost a livelihood source because more of the former (90 vs. 65 percent) depended on salary or wage employment. The amount earned from this source also composed a greater part of the average income in the highland than in the lowland (64 vs. 56 percent). Indeed, more households dependent on this income source lost their livelihood from the earthquake than those who relied on other sources because its requirements (such as concrete buildings and public transport system) were more vulnerable to earthquake-generated impacts.

But the earthquake also affected the households whose livelihood sources were not wage-and-salary employment. Close to 24 percent of the households derived part or whole of their income from farming and the farms of half of them were ruined. The households who earned from livestock and poultry composed only 5 percent but they all lost their animals during the earthquake. Those who earned from leasing out properties (such as houses and land) composed 6 percent and only one of them saved its leased-off properties from destruction.

Community-level Impacts

The effects of the earthquake on the households were linked to the impact it generated on the communities. Among the 48 communities studied, 46 sustained either complete or partial destruction of water sources resulting to water shortage (Table 5). The destruction included the drying up of springs, the disconnection of underground water pipes and the diversion of waterways (such as streams and irrigation canals). Some 30 communities were either completely or partially isolated due to the closure of roads. Because the closure caused by flooding, ruptures or landslides made the transport of supplies difficult or impossible, food shortage ensued. In three communities, public utility vehicles were not available at that time even though the roads remained passable.

Table 5 Impact of the July 1990 Earthquake on Forty-eight Communities in the Study Site

Impact	Number of Affected Communities
Destruction of water sources	46
Disruption of electric supply	46
Closure of roads	30
Flooding	16
Cessation of transport services	3
Death, injury and sickness of some community members	5
Deterioration of level of sanitation	3

The earthquake also disrupted the flow of electric supply to 46 communities for a duration ranging from 3 to 60 days. The disruption caused by the non-operation of power stations and the cut of power lines plunged these communities into darkness. The restoration of electric power particularly took long in the 16 flooded communities. In these communities, flooding did not only cut electric supply but also generated problems related to food procurement, drinking water, shelter, access to social services and sanitation. Sanitation also became a problem in the evacuation areas in three communities. In another three communities which were isolated by roadblocks, sickness among community members became a problem. But such problem was not as grave as that of the two communities which had to take care of a number of their injured and dead members.

MITIGATING MEASURES AT THE HOUSEHOLD AND COMMUNITY LEVELS

The earthquake successfully disrupted the day-to-day living patterns of the sample households. However, the situation did not impede them from working towards the resumption and normalization of said patterns. Among the sample households who sustained damage and injuries from the earthquake, 81 percent took steps to mitigate the various impacts of the earthquake. These measures indicated that those who were affected by the earthquake were not immobilized by the situation. Close to one-third of the sample households even managed to extend help to others. Far from being helpless, creative measures were devised at the household and community levels to put together again the pieces of their former lives. The assistance provided by the governmental and non-governmental organizations simply complemented these measures although not always in the most effective manner.

Mitigating Measures at the Household Level

Measures to Solve the Problem of Shelter. Half of the sample households deemed their houses as unsafe for habitation immediately after the earthquake. To ensure their safety, 32 percent put up temporary dwelling units in areas considered stable enough to stand seismic movements. But this was more commonly practiced in the cities than in the municipalities (40 vs. 17 percent; Table 6). Because earthquake-induced flooding, made the pitching up of tents or lean-tos impossible, 44 percent of the municipal households opted to move into the houses of their relatives or neighbors. More city than municipal households also transferred to designated evacuation areas (34 vs. 11 percent). However, there were about the same percentage of city and municipal households who immediately repaired their damaged houses to ensure their continued stay (26 vs. 28 percent). This occurred in spite of the fact that many houses in the cities were made of concrete materials and as such, more difficult to repair.

The repair of their houses to serve as temporary refuge was easier than rebuilding these for normal living. Six months after the occurrence of the earthquake, only 36 percent of the sample households were able to rebuild their homes (Table 7). More city than municipal households completed such rebuilding (47 vs. 25 percent) mainly because of the former's higher income. Close to 73 percent of the rich households were in the cities and only 27 percent in the municipalities. Among the rich households, 56 percent had rebuilt their homes but only 29 of the poor households did the same. The variation in the capability of the sample households to rebuild their houses was also seen in the average amount they spent for it: P 51,949 by the rich and P6,125 by the poor. The average rebuilding cost of all the households whose houses sustained damage was P 36,674. The concentration of the rich households in the cities and the poor households in the municipalities also explained the higher average rebuilding cost in the cities (P 40,930) than in the municipalities (P 25,625).

Among the households with earthquake-damaged houses, 64 percent had not rebuilt because of the cost. The average amount spent by those who completed their rebuilding represented a seven-to-eight months income of an average sample household who earned P 4,874 every month. With an average monthly income of P 9,248, the rich households had to save their entire income for six months to afford their average rebuilding cost (P51,949). The lower average rebuilding cost of the poor households (P 6,125) required their entire three-month income averaging P 2,182 per month. Nonetheless, 15 percent of the poor households based in the municipalities rebuilt their houses without any expense. Being made of light materials, these households undertook the rebuilding of their houses by scrounging these materials from nearby brushlands (for such materials as timber, bamboo and thatch grass) and swamplands (for such materials as palm leaves and mangrove timber). The household members and some relatives and neighbors provided the labor required.

Table 6 Short-term Measures Used by the Sample Households to Mitigate the Four Most Common Problems Generated by the July 1990 Earthquake: January 1991

Problems and Corresponding Mitigating Measures	Cities	Municipalities	Total
Shelter			
Construction of temporary shelter	40 percent	17 percent	32 percent
Repair of the damaged structure	26	28	27
Transfer to an evacuation area	34	11	26
Transfer to relative's or neighbor's house	_	44	16
Food			
Procurement of food from various sources	96 percent	100 percent	98 percent
Rationing of available food supply	4	_	2
Water			
Search for alternative water sources	46 percent	40 percent	43 percent
Collection of rainwater	37	40	38
Coordination with authorities for water supply	17	20	19
Lighting			
Use of alternative lighting source	78 percent	82 percent	79 percent
Coordination with authorities for restoration of electricity	22	18	21

Table 7 Selected Data on the Rebuilding of the Housing Structures of the Sample Households Damaged by the July 1990 Earthquake: January 1991

Item	Data
Percentage of restored houses by location:	
City	47 percent
Municipality	25
Total	36
Percentage of restored houses by status:	
Rich	56 percent
Poor	30
Total	36
Average amount spent for the restoration by location	
City	40,930 pesos
Municipality	25,625
General Average	36,674
Average amount spent for the restoration by status	
Rich	51,949 pesos
Poor	6,125
General Average	36,674

Measures to Solve the Problems of Food, Water and Light. The need for food and water were more urgent than the need for shelter. Food shortage occurred to 47 percent of the households and water shortage occurred to 49 percent. The step taken by 98 percent of those in need of food was to search for it. Many sought food from relatives and neighbors who had some stock while few brought or obtained credit from stores which were still opened. Some sought it from their community leaders who in turn solicited food from both governmental and non-governmental organizations. Other households directly secured food from non-governmental organizations. Only 2 percent of the sample households had some stock and managed to ration their consumption within the next two days after the earthquake.

The shortage of water was dealt with by the sample households mainly by making use of whatever water resource available. Close to 43 percent of the sample households obtained water from sources rendered useless by a water supply system providing individual house connection. These sources included springs, irrigation canals, dug wells and artesian wells. The 38 percent who did not have access to these water sources gathered rainwater which were abundant being a monsoon season. The remaining 19 percent coordinated with their community leaders for a water ration from such agencies as the city or municipal fire department. Likewise the breakdown down of electrical services was handled by the use of the traditional sources of lighting (such as candles, kerosene lamps and firewoods). This measure was adopted by 79 percent of the households. The remaining 21 percent coordinated with their community leaders to secure kerosene ration and to hasten the restoration of power supply.

Measures to Solve the Problems of Flooding, Money Supply, Transportation and Affected Relatives. For the 12 percent of the sample households whose surroundings were flooded after the earthquake, three fourth of them stayed in the upper portion of their houses. They also secured their household items in places which were not reached by water. To traverse from the house to outside and vice-versa, they either waded through the water or used dinghy or rafts made of bamboo or banana trunks. The rest of the households opted to move to their relatives who were residing in higher places. The 9 percent of the households who were caught with little money by the earthquake either obtained a loan or aid from their relatives. The money they secured from these sources tided them over the next few days.

The 5 percent of the households who lost their access to transportation had to walk. Those who owned vehicles reserved their use for emergency or for vital errands. The household who reported to have a missing relative located him by monitoring both radio and word-of-mouth reports. The two households with members who were hurt enlisted the assistance of their neighbors to rush the injured to a nearby hospital.

Measures to Rehabilitate Destroyed Livelihood Sources. The earthquake affected the various livelihood sources of 52 percent of the households. But six months after the earthquake, 62 percent of those who relied on salary and wage employment and 59 percent of those who farmed were already back to normal work. About 81 percent of the sample households depended on employment and 24 percent on farming. Among the livestock and poultry raisers and the lessors, less than half were back to business by that time. But they compose only 3 percent of the households and all of them have other sources of income.

The more rapid normalization of employment places and farmlands underscored the importance of both income sources. But the effort to rehabilitate employment places hinged on the employer rather than on the households. Having an average of two income sources, many households

relied on the other while their employment places were being rehabilitated. Those who were wholly dependent on employment either engaged in other income-generating activities (such as vending and undertaking a home-based industry) or resorted to credit. The farming households took a direct hand in starting anew their operation by clearing their lands for another cropping within one to two weeks after the earthquake. Those whose farmlands were flooded or covered by boulders looked for other areas suitable for farming. The two households whose fishstocks were decimated by the spurt of warm water from underneath reseeded their pond once the temperature of the water became normal. Measures such as these cut short the long-term impact of the earthquake.

Receiving and Giving Out Assistance. The panoply of measures undertaken by the households was an indication that an earthquake-ravaged situation stimulated not only initiative but also self reliance. In fact, 46 percent of the sample households did not sought any assistance to help them through their problems. Upon acknowledging that their own resources may not suffice to handle the situation, 54 percent sought assistance from outside the household. The percentage of assistance-seekers did not vary by status (53 percent among the rich and 54 percent among the poor) but by the impact of the earthquake on their houses with more among those with damaged houses than among those without (58 vs. 38 percent; Table 8).

Close to 73 percent of the households sought the assistance of a non-government organization particularly, the Philippine National Red Cross. Those who went to their community leaders comprised 42 percent. National government agencies, most notably the Department of Social Welfare and Development (DSWD), was approached by 42 percent. There were relatively few who called upon their relatives (10 percent) and their municipal/city or provincial officials (8 percent). The type of assistance which were sought may explain for the low percentage of sample households who relied on their relatives in spite of the existence of strong kinship ties. Nearly all (97 percent) of the sample households were looking for food. Because their relatives were at that time just as bereft of food as they were, the sample households ran to entities (non-governmental and governmental organizations) whom they know were in the position to assist them. If they did not do this directly, they sought out the support of these entities through their community leaders.

However, the non-governmental and governmental organizations were not as fast as the relatives and the community leaders in responding to the call for assistance. It took an average of one week and 2 days for the non-governmental organizations to respond and one week and 5 days for the national government agencies. In contrast, the average response of their

Table 8 Selected Data on the Assistance Seeking Behavior of the Sample Households Affected by the 1990 Earthquake: January 1991

Item	Data
Percentage of households who sought assistance outside the household:	
Rich	53 percent
Poor	54
Total	54
With Damaged House	58 percent
With Undamaged House	38
Total	54
Percentage of households who sought assistance by the type of donor being approached:	
Relatives	10 percent
Community leaders	42
City/municipal/provincial officials	8
National government agencies	35
Non-governmental organizations	73
Percentage of households who sought assistance by type of assistance solicited:	
Food	97 percent
Shelter	7
Money	5
Medicine	5
Blankets	3
Water	2
Average length of time expended by the households to wait for the arrival of the assistance sought by type of donor:	
Relatives	2 days
Community leaders	3 days
City/municipal/provincial officials	2 weeks and 1 day
National government agencies	1 week and 5 days
Non-governmental organizations	1 week and 2 days
General Average	1 week and 1 day

relatives and community leaders came after two and three days, respectively. About 96 percent of the households received assistance although the assistance largely came in the form of relief goods. Among those whose houses were damaged, only 6 percent received assistance for repairs. Such assistance was either a loan from the Government Security and Insurance System (GSIS) or of an aid from DSWD. Among the affected farming households, none received any form of assistance for the rehabilitation of their farmlands.

In spite of their being in need, 30 percent of the sample households extended assistance to others. But this behavior varied by status and by the impact of the earthquake in their houses. There were more rich than poor households who provided assistance to others (38 vs. 25 percent). There were also more assistance-providers among households with undamaged houses than those with damaged houses (47 vs. 28 percent). The recipient of their goodwill were mostly the other members of their community (43 percent) and their relatives (37 percent). However, complete strangers (20 percent) likewise received it. Such goodwill was given in the form of food (62 percent), shelter (38 percent), money (11 percent), clothes (5 percent) and medicine (3 percent).

Mitigating Measures at the Community Level

Measures to Solve the Problem of Shelter. Because of the linkage between impacts on the community and household levels and the proportion of households affected, communities implemented measures to respond to the impacts at both levels. Their implementation involved community members and were coordinated by community leaders and/or by community organizations. The need for shelter after the earthquake was basically a household concern but a number of measures were implemented at the community level. In 13 communities, members contributed materials (such as canvass and galvanized iron sheets) and construct common shelter for the evacuees (Table 9). As that was done, work teams composed of community members roamed in 12 communities to assist in the repair of damaged houses. In 10 communities, the involvement of the community began in the selection of an evacuation site. One community raised funds from among its members to reconstruct damaged houses and in the other, the members arranged to temporarily share their houses with those who were left homeless by the earthquake.

Measures to Solve the Problem of Food, Water and Light. While 45 communities procured food from government and non-government agencies through their leaders and local organizations, others

Table 9 Measures Implemented by Forty-eight Communities to Mitigate the Impact of the July 1990 Earthquake in Northern Luzon

Impact and Corresponding Mitigating Measures	Number of Communities Which Used the Measures
Demand for Shelter	
Pooling of materials for temporary shelter	13
Organization of reconstruction teams	12
Designation of evacuation areas	10
Collection of money contribution	1
Negotiation for house-sharing arrangement	1
Food Shortage	
Procurement of food relief	45
Operation of a communal kitchen	11
Arrangement for stores to stay open	6
Wholesale buying of foods stuff	3
Arrangement for credit from market vendors	1
Water Shortage	
Arrangement for sharing of water sources	13
Exploration for alternative water sources	9
Arrangement with agencies for water delivery	4
Lighting/Electric Power Shortage	
Pooling of fuel materials for bonfires	10
Creation of work teams for power restoration	5
Flooding	
Creation of drainage construction work teams	9
Construction of river embankment	1
Road Closure/ Transport Shortage	
Organization of work teams for road clearing	30
Designation of alternative routes	5
Creation of transport pool	2
Arrangement with transport groups	1
Health and Sanitation	
Use of medicinal plants	1
Use of lime for cadaver preservation	1
Construction of temporary toilets	3

implemented supplementary measures to reduce the shortage. Six communities arranged for the stores to remain open to the consumers until their stocks were exhausted. In one community, the market vendors were persuaded to provide those who were left homeless with long-term credit. Because prices generally rose during that time, two communities bought foodstuff at wholesale from suppliers through a fund raised among community members. To ensure that a limited relief food could be shared by everybody, 11 communities cooked the food in a communal kitchen and distributed this equally among their members.

The cessation of the operation of the water supply systems prompted nine communities to explore alternative water sources (such as springs and wells). In 13 communities where some faucets or deepwells were not affected, sharing of these water sources was arranged among community members. In four communities where all the water sources dried up, the community leaders negotiated with either the city/municipal fire department or a local water system office for a periodic water delivery. For lighting, the members in 10 communities pooled together materials (firewood and old tires) to make bonfires in evacuation areas. Five communities hasten the restoration of electric power supply by forming work teams who assisted in installing electric poles and clearing felled trees.

Measures to Solve the Problems of Flooding, Transportation, Health and Sanitation. Many communities extensively used work groups to handle reconstruction tasks. Flooded areas were drained by nine communities through work groups who dug canals. A river embankment constructed by work groups reduced flooding in one community. These work groups also cleared roadblocks (such as landslides and felled trees) in 30 communities to hasten the normalization of transport flow after the earthquake. While road clearing was going on in five communities, alternative routes were created by opening of private roads to public use and by clearing of old roads. The use of private roads was negotiated by community leaders while old roads were cleared by work groups. However in some areas, public utility vehicles stopped operating after the earthquake mainly due to the gasoline scarcity. In response, three communities created a motor pool out of private vehicles while one persuaded a public transport operators group to provide the community with a periodic service. Although most communities regained access to health services few days after the earthquake, one community did not and relied on medicinal plants for treatment of the injured and the sick. Another community which could not immediately avail of embalming and burial services preserved their dead using lime from a quarry nearby. In three communities where the evacuation sites were relatively far from the houses of the evacuees, waste disposal became a problem. To ensure certain level of sanitation, the community leaders mobilized work groups to construct temporary toilets.

The manner the communities responded to the impact of the earthquake varied: some did nothing more than receive relief goods but others employed a set of measures for every impact. Nonetheless, the experience of these communities in responding to said impact indicated that local initiative existed and even active under a disaster condition. The variation of responses depended on a number of factors such as the sense of responsibility of the community leaders, the income levels of the community members, the presence and participation level of community organizations, the political alignment of community leaders and the extent of the damage afflicted by the earthquake. However, these factors could be managed such that the full potential of the capability of the community to save itself from a disaster could be fully harnessed.

SOME CONCLUDING NOTES

An inventory of the effects of the earthquake among the sample households indicated that its impact varied according to duration (short-term or long-term), spatial extent (across sites or site-specific) and type of occurrence (direct or indirect). The duration of the impact depended on the measures which were taken within and outside the household to restore the normalcy of the situation. The spatial extent of the impact was defined by the magnitude of the disaster itself in interaction with the physical (such as susceptibility to liquefaction) and social (such as use on a market economy and mass distribution of services) characteristics of the site.

For instance, the shortage of food was experienced across sites because the earthquake was strong enough to paralyze the production, storage and distribution system regardless of location. However, there were impacts which were only be realized in a particular site (such as flooding). The impact on the sample households also occurred either directly or indirectly. A direct impact was produced when an entity was hit straight by the earthquake (such as a housing structure which collapsed). An indirect impact resulted when one entity ceased functioning (such as the lighting facilities of the household) because of the destruction of another (such as the electric power plant) by the earthquake.

But whatever be the duration, spatial extent and type of occurrence of the impact of the earthquake, the sample households were not cowered by it. Using the resources within their households (such as available food stuffs and kerosene) and their immediate environment (such as indigenous housing materials and tracitional water sources), they instead worked to restore the normalcy of their lives. When these resources were insufficient, they called out for outside assistance. Other than their own relatives, the community leaders proved to be more efficient in responding to this call than the governmental and the non-governmental organizations. Part of the reason was their proximity to and familiarity with, not only the needy, but also the need to which outside assistance must be addressed.