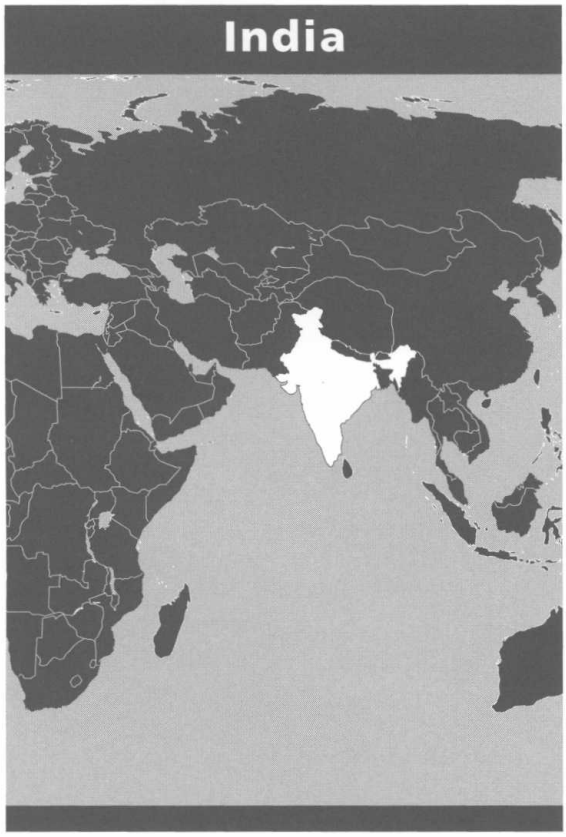

Indicators for disaster preparedness

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SYMPOSIUM NOTES

The project aims at building an instrument to assess disaster preparedness for a set of hazards (earthquake, drought, cyclone, flood, fire and epidemics) at a community level. Such instrument is expected to be highly useful for funding agencies and policy makers in making objective evaluation and monitoring of preparedness programs It would also provide feedbacks for designing appropriate programs and be useful as guidelines for implementing agencies The specific objectives of the project are a) to identify the key parameters involved in community preparedness b) to select a set of appropriate indicators for measuring such parameters c) to design an indexing method for combining these indicators together d) to test-trial the instrument (i.e. the set of selected indicators together with the indexing technique) adequately in different communities for verifying its reliability and e) to disseminate assessment results among those communities for their opinion and awareness. The most important feature of this above instrument is its representation of social, economic and cultural condition of people in the selection of indicators and thereby providing direct link between poverty and risk reduction.

Methodology

The project methodology can be described to be consisting of five stages In the first stage, comprehensive literature review was undertaken to define community preparedness and suggest a conceptual framework that explains community preparedness on the basis of ten parameters To measure these parameters, total of eighty-five indicators were identified as possible candidates. In stage-II, Delphi Analysis was carried out where a panel of twenty experts were constituted and presented with these set of indicators to select the most appropriate ones among them. Based on their opinion, total of thirty-five indicators (i.e. if all the six hazards are applicable) were finalized In stage- III, an indexing method was developed This method while combining various quantitative and qualitative indicators also tried to be simple and make minimum use of statistical tools. In stage-IV, the designed instrument (i.e. the set of selected indicators together with the indexing technique) was put into practical use for assessing preparedness in six communities located in three different states of India. These communities are among the most disaster prone in the country and differ considerably in terms of hazards they face and their cultural practices etc. Data collected from such communities were fed into the designed instrument for measuring preparedness. In stage V, the findings from such assessment were disseminated among the same communities for member's opinion about such assessment and also to create awareness among people about probable hazards and their present state of preparedness.

Stage-I

What is preparedness?

Preparedness as a core concept in disaster studies lacks consensus in its conceptualization.[1] It is defined in different ways ranging from action oriented steps to education. The various approaches to preparedness can be classified under three broad categories[2] *a)* on the basis of attributes e.g. existence of warning system, awareness, availability of resources etc *b)* preparedness as scenario planning e.g. drawing possible disaster case scenarios and making plans for it[3] and *c)* preparedness as psycho-social processes which emphasizes individual decision making processes[4] Preparedness can also be thought of at different levels e.g. individual, household, organization, community, country etc.[5] For example, Cottrell et al. (2001) have found that within a community even if individuals are reasonably well prepared, the community as a whole may not be prepared Thus it is important to recognize the difference that exists between these levels as procedures for assessment can vary depending on such levels[6]. The objective of preparedness is often described to be "to enhance the ability to respond well."[7] In such conceptualization, preparedness activities are mostly oriented towards good response (e g warning dissemination, evacuation plan, stockpiling of essential supplies etc.) and fails to emphasize post- disaster recovery aspects. In the context of developing countries where majority of people live under poverty, post-disaster recovery however is as important as surviving the initial impact.[8] Thus preparedness for such societies must look beyond the response stage and need to include post-disaster recovery as one of its important objective [9]

Defining community preparedness

The way preparedness is conceptualized in this study is viewing it as a state of readiness (that may be at an individual, household or community level) to face hazards at a given point of time. It is a constantly changing process. The dynamic nature of the concept can be seen from the way preparedness varies even during different times of a day e.g. people receiving warning at night are relatively less prepared for

evacuation. Similarly such change can also occur due to variety of other reasons such as an official's visit, a game of football or a local festival. Community preparedness is thus defined as the state of readiness of the community to face probable hazards so that minimum of losses occur from it and smooth recovery takes place. This view of preparedness relates it to the concept of mitigation as; preparedness providing measure of effectiveness of various mitigation efforts. To illustrate further, existence of a cyclone shelter (structural mitigation) in a community if not located properly or awareness campaigns (i.e. non-structural mitigation measure) similarly if not well planned do not contribute to the overall preparedness of the community. In other words, effectiveness of these mitigational measures determines to a large extent the level of community preparedness.

Measuring community preparedness

There have been several previous attempts to measure disaster preparedness of a community with indicators though, most of such attempts are limited to specific hazard only e.g. for earthquake[10], wildfire[11], terrorism[12] etc. Cottrell et al. (2001) in their attempt have tried to assess community-preparedness for multi-hazards and have identified four parameters as important; a) population characteristics e.g. number of children, squatter settlement etc. b) building and critical infrastructures such as road, drinking water, communication network, health, sanitation etc. c) physical environment and d) social environment e.g. ethnic groups.

The framework suggested here for measuring preparedness tries to build on this work of Cottrell et al. (2001). It views community preparedness to be an umbrella construct made of ten parameters (Fig.1) which are; *a)* Physical safety i.e. how safe are the community members in view of the physical danger from these hazards? The parameter essentially tries to measure how effective structural mitigation measures are e.g. availability of cyclone shelter, its capacity, resistance of building structures for earthquakes etc. *b)* Hazard awareness i.e. awareness level about hazards which have reasonable probability of occurrence *c)* Organizational preparedness i.e. how far the community is organized to face disaster e.g. existence of disaster committee, plans, volunteers etc. *d)* Infrastructures and Services which tries to measure current state of these services and how well plans and procedures have been developed for restoring critical services as and when disruptions occur *e)* Recovery ability i.e. ability of the community members to recover from the impact of the hazard *f)* Physical environment i.e. state of environment to face hazards e.g. condition of sub-surface aquifers, vegetation cover etc. *g)* Social capital i.e. degree to which social networking and cooperation exists among community members *h)* Psychological preparedness i.e. how safe and prepared do community members feel in view of these hazards? *i)* Cultural capital i.e. cultural richness such as

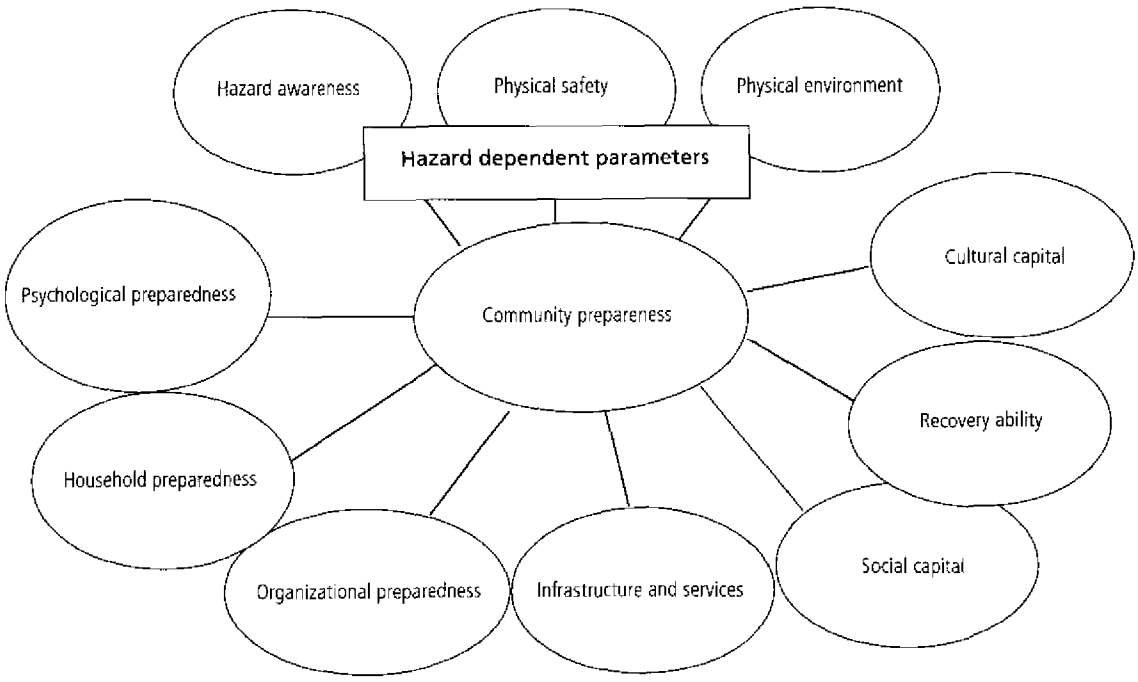

Figure-1: Community Preparedness (Suggested framework)

existence, recognition and use of traditional coping mechanisms *j)* Household preparedness i.e. preparedness at a household level. Three of the above ten parameters (i.e. physical safety, hazard awareness and physical environment) can be seen to be hazard dependant which, means to measure these parameters one needs to consider the specific hazards which are applicable for the community and based on it select indicators. The hazard independent nature of most of the parameters in community preparedness emphasize that preparedness programs should focus as much on the disaster agent as it should try and reduce existing structural vulnerabilities.

Stage-II

Delphi analysis

The framework as suggested in Fig.1 views that measuring community preparedness requires measuring the parameters involved in it and then combine them for getting overall preparedness. Literature search was conducted, resulting in the identification of eighty-five indicators (complete list of these indicators are given in project report, appendix-B) considered as potential candidates for measuring the ten parameters. Preliminary review e.g. modification and reformulation of these indicators reduced its total number to fifty-eight. To select the most appropriate ones from these fifty-eight, a panel of twenty experts were constituted drawn from different backgrounds[1] and were presented these indicators in questionnaire form for their evaluation. The exercise was completed in two phases over a period of three weeks. (Delphi Analysis) The expert's selections were subsequently tabulated to rank these indicators and determine their suitability to measure individual parameters. Subsequent review and analysis provides the following list of thirty-five indicators presented under the corresponding parameter as the most suitable ones for measuring. The numerical figures given at the end of each indicator represents its relative score (in the Delphi Analysis) i.e. number of experts choosing the indicator for its suitability.

Physical safety: The following five indicators are selected (one of which is a composite indicator) to measure the parameter though exact selection would also depend on the specific hazards applicable for the community.

- Earthquake: Percentage of houses in the community that are earthquake-resistant (20)
- Cyclone: Adequacy of the cyclone shelter i.e. maximum accommodation capacity of the shelters as a percentage of total population (20)
- Drought: Public works program i.e. readiness of concerned agencies to initiate such programs which includes response time for implementing the programs (15)
- Flood: Percentage of population with flood protection that includes non-structural measures such as flood proofing etc. (14)
- Health Care Services i.e. for all hazards: The indicator is a composite one which takes three sub indicators for its value. (20)
  - Distance of the hospital from the community
  - Structural resistance of the hospital building for probable hazards
  - Kind of hospital i.e. the category should be indicative of available facilities

Hazard awareness: Three indicators have been selected to measure hazard awareness.

- Percentage of population which attended awareness campaigns in last five years (15)
- School curriculum and adult literacy materials containing hazard information (12)
- Awareness about probable hazards (awareness here is to be considered as knowing about protection measures and how to reduce the hazard impact) (10)

Organizational preparedness: Six indicators are selected to measure the parameter.

- No. of volunteer per hundred population (17)
- Average number of training days per volunteer (17)
- Existence of disaster committee and how well different social groups e.g. minorities and women etc. are represented in such committee (15)
- Acceptance of the disaster committee i.e. percentage of population who accept that the committee is representing their interests (15)
- Comprehensiveness of the disaster plan. The plan is to be measured against criteria such as hazard analysis, vulnerability analysis, resources inventory, provision for disabled, senior citizen and children etc. (15)
- Plan awareness i.e. percentage of population aware about the plan and its content (14)

Infrastructure and services: Five indicators are chosen to measure readiness of the community in terms of infrastructure and services.

- Emergency plan for hospital i.e. if such plan exists, it is to be evaluated against criteria such as disease surveillance, alternative power, triaging training etc. (16)
- Access to warning i.e. what percentage of population can access warning through radio and television or through any informal warning networks (14)
- Emergency plan for ensuring drinking water supply during disaster (12)
- Condition of the approach road to the community (12)
- Response time for Fire station i.e. time required to reach the community (10)

Recovery ability: Three indicators have been selected to capture the parameter.

- Per capita income per month (16)
- Access to insurance services i.e. percentage of population with insurance coverage such as personal, crop, house etc. (14)
- Access to formal credit services i.e. percentage of population with access to banks and other such institutions e.g. cooperative societies for getting credits (10)

Social capital: Three indicators are selected for measuring social capital and community cohesiveness.

- Number of operational community-based organizations (16)
- Joint hazard mitigation efforts undertaken by the community in last five years (14)
- Cooperation among community members i.e. percentage of population who expect to get help and cooperation from other members when needed (13)

Physical environment: The parameter being hazard dependant, selection of indicators for it would be based on specific hazards applicable for the community.

- Drought:
  - Awareness among farmers about sustainable farming practices (14)
  - Condition of the sub-surface aquifers (9)
- Flood: Area under vegetation cover i.e. as a percentage of total area (10)
- Epidemics: Availability and quality of drinking water, level of sanitation (7)

Psychological preparedness: Two indicators have been selected to measure psychological preparedness of community members.

- Perceived preparedness i.e. percentage of population who feel they are prepared (10)
- Recognition and provision for psycho-counselling in the disaster plan (7)

Cultural capital: The parameter is represented by only one indicator i.e.

- Percentage of population aware about traditional coping mechanism and recognize its usefulness. It tries to measure how such traditions are recognized and promoted. (12)

Household preparedness: The parameter is also measured by one indicator i.e.

- Percentage of households in the community who have family plans for disaster or have taken measures such as food grain reserve, purchase of insurance or any other. (12)

Stage-III

Indexing Method

The indicators described above when analyzed can be seen to be both quantitative and qualitative in nature and for making maximum use of such indicators; they need to be indexed together. The method suggested here for indexing while emphasizing internal and external consistency also tries to keep it simple and make minimum use of mathematical or statistical tools so that such method can ultimately be expected to be used by community member themselves. The method involves three stage of indexing for a parameter. In the first stage, all the indicators are rated on a four point scale (Bad, average, good and very good). The quantitative indicators (twenty-three selected indicators are quantitative) are rated on the basis of eight designed scales[2]. The remaining twelve indicators are qualitative and have been rated directly on the basis of specific criteria. In the second phase, rating of these indicators (made in the first phase) are converted into numerical scores as follows; bad: 0, average: 1, good: 2 and very good: 3. In the third phase, the arithmetic mean of these indicator scores are calculated for each parameter and converted into percentages for getting parameter

score. The average of all the ten parameters (all parameters are given equal weightage) provides the overall preparedness for the community measured in percentages.

Stage-IV

Field-testing of the instrument

The set of indicators selected and the indexing technique described above (henceforth the instrument) was put into practical application for assessment of community preparedness. To ensure that the instrument is robust and reliable under different condition, it was field-tested in six most highly disaster prone communities located in three states of India (Gujarat, Orissa and Andhra Pradesh). The selection of these communities was made on the basis of the following criteria; a) the communities should be facing different set of hazards so that findings can be generalized for all the six hazards b) they should differ from each other as much possible e.g. in their level of development, past disaster experience, cultural practices etc. c) one of these communities need to be relatively better prepared (control group) so that assessment results from other communities can be compared with it for validation. Taking the above factors into consideration, the following six communities (panchayat [3]) were selected.

- Valadia Bitta (East) in Anjar Taluka, Kutch district, Gujarat
- Manginapudi in Machlipatnam Mandal, Krishna district, Andhra Pradesh
- Mundpadar in Bangomunda block, Bolangir district, Orissa
- Gupti in Rajnagar block, Jagatsinghpur district, Orissa
- Rampar in Anjar Taluka, Kutch district, Gujarat
- Kallana in Rasulpur block, Jajpur district, Orissa

Hazard assessment

To assess community preparedness for multi-hazards requires addressing the complicated issue of hazard assessment. There are two major problems faced here i.e. a) giving weightage to probable hazards e.g. how to differentiate between a dominant recurring hazard and a hazard which is infrequent but with reasonable probability of occurrence and b) how to select hazards for preparedness-assessment given that there may exist difference between scientific assessment and the community assessment of hazards and the necessity to include them. The approach in this work to resolve the above problems has been a) to give equal weights to all hazards on the basis that all probable hazards need to be adequately prepared for and should not be discriminated on the basis of their frequency of occurrence and b) hazard selection for a community should be based both on the scientific assessment as well as that of the communities. Thus hazards selected (i.e. out of the six hazards which are under consideration) for each community in this study is based on taking both views i.e. opinion of concerned scientific agencies and that of community members.

Data collection

Data required for using the instrument were collected from different sources and through different techniques such as survey, interviews and focused group discussions. Two kinds of questionnaire surveys were conducted in each of the six communities i.e. a) among head of households and b) among general population. The second survey was necessitated for data relating to hazard awareness which required equal representation of women and children in the sample. Data were also collected from key informants such as senior citizens; opinion makers etc. and from secondary source such as census hand books, government reports, local newspapers etc. Data after being collected were put into the designed instrument and indexed and results obtained for the six communities are given here in brief.

Case-I: Valadia Bitta (East), Gujarat

Hazards considered for the community: Earthquake, drought, cyclone, epidemics and fire

The community is one village with a total population of 779 i.e. 169 households. Literacy level is around 25% and agriculture is the major occupation. The overall preparedness of the community as assessed through the instrument is 33% and the scores for individual parameters are as follows. Physical safety: 42%, hazard awareness: 23%, organizational preparedness: 39%, infrastructures and services: 47%, recovery ability: 23%, social capital: 56%, physical environment: 23%, psychological preparedness: 50%, cultural capital: 16% and household preparedness: 8%.

Case-II: Manginapudi, Andhra Pradesh

Hazards considered for the community: Cyclone, drought, fire and epidemics

The community is one village located near the popular tourist destination Manginapudi beach with a total population of 1940 i.e. 473 occupied households. The community suffered heavy losses during earlier cyclones of 1971 and 2003. Drought is also a recurring hazard here due to the ingress of saline water. The overall preparedness for the community is measured to be 37% and the scores for individual parameters are as follows; physical safety: 45%, hazard awareness: 27%, organizational preparedness: 34%, infrastructures and services: 60%, recovery ability: 45%, social capital: 56%, physical environment: 23%, psychological preparedness: 34%, cultural capital: 18%, household preparedness: 28%.

Case-III: Mundpadar, Orissa

Hazards considered for the community: Drought, fire and epidemics

The community consists of eleven villages with a total population of 4838 i.e. 1046 households. It is located in economically poor region of KBK (i.e. Kalahandi-Bolangir- Koraput districts of Orissa) from where several cases of starvation deaths have been reported earlier. Literacy level in the community is 25%. Agriculture (i.e. mostly rain-fed, 7% of the total agricultural land is irrigated) is the major occupation for community members. Drought is thus a recurring hazard here in addition to fire and cases of epidemics. The overall preparedness assessed for the community is 31% and the individual parameter scores are as follows; physical safety: 50%, hazard awareness: 34%, organizational preparedness: 17%, infrastructures and services: 27%, recovery ability: 34%, social capital: 45%, physical environment: 34%, psychological preparedness: 34%, cultural capital: 12% and household preparedness: 22%.

Case-IV: Gupti, Orissa

Hazard considered for the community: Cyclone, fire and epidemics

The community is spread over twelve villages with a total population of 8266 i.e. 1266 households. It is located close to the Bhitarakanika National Park and agriculture is the major occupation for the community members. The general infrastructural condition such as road, communication, health care etc. is very poor. The community had suffered heavy losses during the 1971 cyclone which caused more than 10,000 human deaths and since then an embankment (popularly known as saline embankment) has been constructed around the area as a measure of protection against sea water surge. The overall preparedness for the community is assessed to be 29%. The individual scores for the parameters are as follows; physical safety: 34%, hazard awareness: 42%, organizational preparedness: 34%, infrastructures and services: 27%, recovery ability: 12%, social capital: 45%, physical environment: 34%, psychological preparedness: 17%, cultural capital: 28%, household preparedness: 9%.

Case-V: Rampar, Gujarat

Hazard considered for the community: Earthquake, cyclone, drought and epidemics

The community is one village with a total population of 627 i.e. 124 households. Literacy level in the community is 35% and agriculture and fishing are the major occupations. The overall community preparedness is measured to be 36% and the individual parameter scores are as follows; physical safety: 34%, hazard awareness: 56%, infrastructures and services: 54%, organizational preparedness: 39%, recovery ability: 23%, social capital: 45%, physical environment: 23%, psychological preparedness: 50%, cultural capital: 16%, household preparedness: 12%.

Case-VI: Kallana, Orissa (Control Group)

Hazard considered for the community: Flood, earthquake, fire and epidemics

The community was taken as the control group i.e. considered for being relatively better prepared. It consists of six villages with a total population of 5782 i.e. 902 households. Business and agriculture are the major occupation for the community members and available infrastructures are reasonably good. The community is located on the bank of the river (Brahmani) and an embankment runs through it. The embankment had breached on an earlier occasion causing substantial losses to the community. An interesting feature is that approximately 350 households (i.e. 40% of total) are located in between the river and the embankment i.e. in the flood plain itself and it provides an opportunity to study how people here live with the risk of annual flooding. The overall preparedness for the community is 44%. The individual parameter scores are as

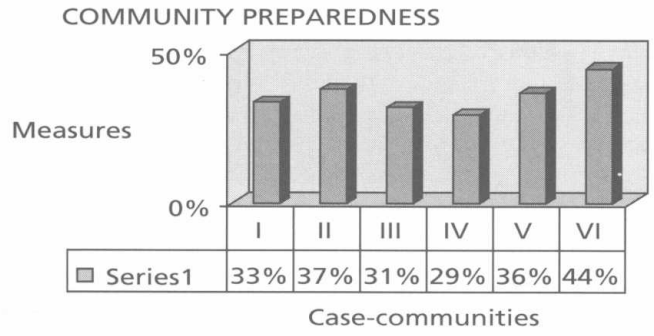

Figure 2. Graph showing overall preparedness of the six communities.

follows; physical safety: 45%, hazard awareness: 20%, organizational preparedness: 23%, infrastructures and services: 54%, recovery ability: 56%, social capital: 34%, physical environment: 78%, psychological preparedness: 50%, cultural capital: 47%, household preparedness: 27%.

Analysis of findings

The overall preparedness (as assessed using the instrument) of the six communities when compared shows that it varies between 29 to

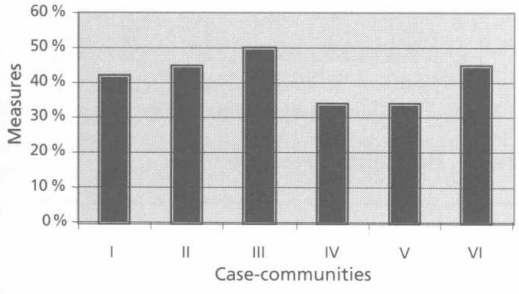

Figure 3. Physical Safety

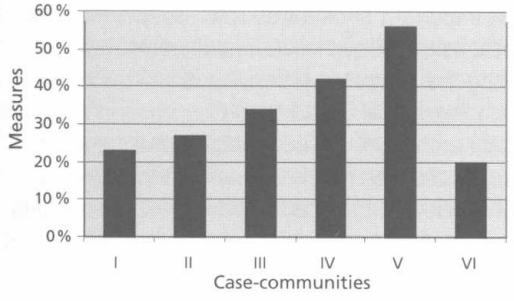

Figure 4. Hazard Awareness

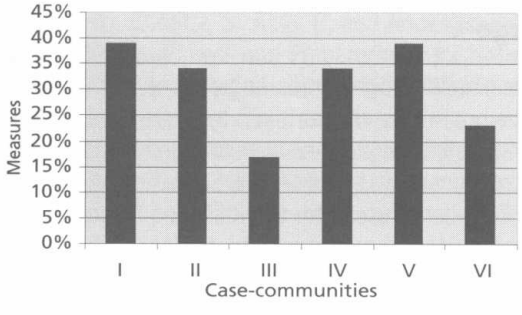

Figure 5. Organizational Preparedness

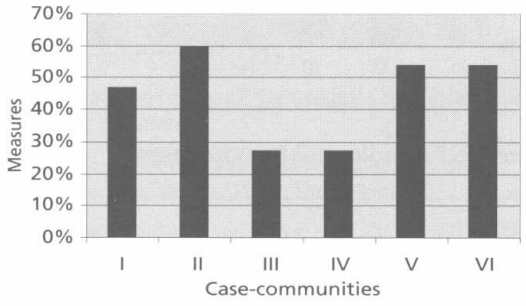

Figure 6. Infrastructures and Services

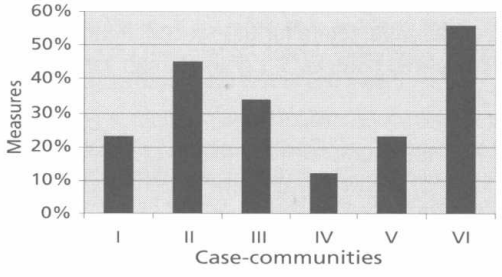

Figure 7. Recovery Ability

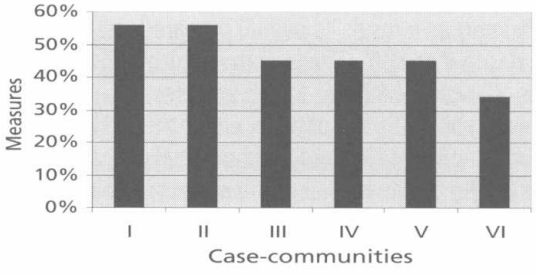

Figure 8. Social Capital