Building disaster resilience through quantified assessment of social and institutional vulnerability: Lessons from India

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Resilience can only be built when vulnerabilities are identified and methodically assessed. Literatures illustrate that vulnerability has three dimensions; physical, social and institutional. While much of work has been on the first dimension, the later two dimensions witness almost non-existential research. The vulnerability profiles found in the disaster management plans in different states of India are flawed as they are inadequate in the following ways; macroscopic approach towards vulnerability assessment when it is instinctive that vulnerability is hazard specific and region dependent, qualitative assessment techniques, has a tendency to present vulnerability as exposure or recurrence, does not pin-point the factors which adds to vulnerability, does not exploit the potential of diversity in all forms evident in India and lacks the incorporation of vernacular knowledge, experience and awareness. Building on these gaps of the contemporary practice, this research proposes a model to quantitatively assess social and institutional vulnerability using fuzzy logic based multi-criteria decision making.

The proposed model encapsulates a pathway which begins with the identification of the area and the hazard. Through content analysis of disaster management plans, reports and KAP studies, points of failure are identified from social and institutional perspective. These points are referred to as factors. These factors are then turned into two sets of questionnaire. The first set is taken to a panel of experts consisting of disaster management authority personnel, line department personnel, academicians, researchers to elicit opinion on how much do they think the identified factors contribute to building resilience. Their responses are collected in terms of linguistic variables mapped to fuzzy numbers. The second questionnaire is taken to the general population of the area and they are asked about the level of awareness and knowledge they have about the identified factors. Their responses are also collected in terms of linguistic variables.

The opinions collected in the two surveys are laid down into two matrix. These two matrices are put through an array of operation to finally evaluate the total vulnerability of the community, socially and institutionally.

The study plugs all the loopholes that are evident in the current methods and since social and institutional vulnerability involves and includes social elements like individuals and groups, fuzzy logic is used to capture the subjectivity and ambiguity of human response. The resultant matrix shows factors which contribute to vulnerability and hence requires special attention. These factors can become avenues in which training programs can be carried out in order to build the capacity of the targeted area. The outcome is illustrated in forms of sun-burst diagrams for lucid and easy interpretation. The use of this model would usher in an area of methodical and quantitative assessment of the so-called intangible dimensions of vulnerability.

The proposed model can be used to develop resilient ecosystem for the 2020 Olympics as well. All the

steps of the pathway remains the same and instead of targeting the general population, in this case, the foreign visitors needs to be targeted to understand the generic awareness of the groups of people that visit Japan. Once the general mentality is captured and understood through fuzzy methods, the learnings can be used to take proper steps of educating visitors on factors (for which the level of awareness and knowledge was found to be low through surveys) through different media. The pathway can be repeated every 6 months to gauge the improvement over each cycle and no doubt, by 2020, the city would be much more resilient than it is today.

Keywords: Dimensions of vulnerability, Quantitative assessment of vulnerability, Fuzzy logic based evaluation of vulnerability, Representation of vulnerability using modified sunburst diagram

