

**6th sem. Hons., CC-14,
Study material prepared by SurajitLet**

RISK ASSESSMENT AND EARTHQUAKE HAZARD MANAGEMENT

Natural hazard may be considered uncontrollable forces of nature but the unanticipated and unnecessary losses of life, property, economy and other social disruption are often the result of inadequate proper policies and planning and their implementation in advance, before a disaster occurs. As the community continues to concentrate development activities in earthquake prone areas without adequate protective cover. This leads to disastrous effect upon a community, when a disaster occurs and community for grown beyond limits. Therefore understanding the nature of earthquake risks and consequences demand special protective alteration. There are many tools and techniques available in this respect. Importantly Risk Assessment approach is paramount, of all other activities, because risk assessment is the only mechanism which provides base for all type of earthquake hazard management activities, such as suggesting alternative policies and various mitigation measures. The present chapter tries to bring out a conceptual analysis of risk assessment and management aspects, with special emphasis given to earthquake hazard policy, planning and management aspects rather than purely technical or economic methods.

BACKGROUND

Scholars and researchers have divided the hazard consequences into two broad categories i.e. high-probability | Low-consequences events and low-probability | high consequences events. Even within this categorization there is possible to differentiate disaster agents that produce sudden onset events (eg. earthquakes, tornado, explosion and toxic release) and those that are slow onset (eg. drought, epidemics, famine). It is sudden onset low-probability/high consequence category (such as earthquakes) that is of primary concern in this chapter.

Since ambiguity persists over the very meaning of hazard and risk, it is first necessary to distinguish between the term risk and hazard. Risk is some time taken as synonymous with hazard but risk has the additional implication of the chance of a particular hazard actually occurring. Thus defining risk we can say as "the probability of hazard occurrence" and hazard as " a potential threat to humans and their welfare" (Keith Smith, 1992).

In welfare economics, risk viewed as a social cost and acceptability depends upon a significant degree on the costs of avoiding risk or as a matter of costs and benefits, or as a matter of right and responsibilities. Where as Hays (1995) stress risk is a statement of the economic losses, deaths and injuries, and loss of function expected when a specific physical effect (for example, found shaking triggered by a natural hazard) strike in a given region, local jurisdiction site(s) or structure. The above mentioned definition are much related with the present study. However, a simple distinction between hazard and risk is used here by, W.H. Petak (1993) that hazard is defined simply a source of harm. Risk is the likelihood of hazardous developing into an actual event with adverse societal consequences.

RISK ANALYSIS

Generally, the risk assessments or risk analysis, typically is defined as including three related operational elements; such as risk identification, risk estimation and risk evaluation. Whereas UNESCO,

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environment and development brief (1993) pointed out risk assessment has three steps as hazard identification, vulnerability analysis and risk evaluation.

Purpose And Usefulness

Risk Assessment is useful in estimates likely losses from natural hazard in a community over the time. Once the losses are identified, then it would be better for a community to evaluate the benefits of various measures to reduce losses (such as , preparedness and emergency responses) . Risk assessment is a form of applied policy analysis and not necessarily pure scientific studies and its purpose is to provide a system in which specific risks may be weighed, thus giving a basis for a open policy making process. Therefore , policy makers should view this process as an opportunity to develop and refine policy that can be used directly upon the problem. 8 It can also provide information in a context that are useful in weighing alternatives and analyzing trade -offs between various policy options.

In fact, risk assessment provides a critical basis for planning long term prevention activities that would reduce communities vulnerability on a more permanent basis.9 Further this analysis would provide priorities for hazard management and to develop alternative management strategies to mitigate them . Moreover, risk assessment methods are used in both Public and Private Sector Decision making process. It is increasingly routine for use in assessing the cost or different types of land use insurance , chemical Industries and Electric utility in Public Sectors.

In fact risk analysis is bringing together researcher from wide range of academic disciplines so as to focus the expertise on consensus on considerable significance, in natural hazard areas.

It is also used to identify especially hazardous geographic areas, groups of buildings, or lifelines to aid in the development of emergency response plans, to formulate general strategies for earthquake reduction, such as land use plans or building codes to educate overall economic impact on the nation.

Risk Assessment Methods

According to Kates and Kasperson (1983) 13 risk assessment comprises of three distinct steps:

- An identification of hazards likely to result m disasters, 1.e. what hazardous events may occur ?
- An estimation of the risk of such event , i.e what is the probability of each event?
- An evaluation of social consequences of the desired risk i.e what is the loss created by each hazard ?

The present study about risk assessment is conceptualised in four

steps:- I. Hazard Identification and Vulnerability Analysis

II. Risk Estimation

III. Risk Evaluation

IV. Feedback or Post Audit Analysis.

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Identification:

Identification, means recognising that a hazard exists and define its characteristics , it can be measured for some time before the adverse consequences happen. It involves the examination of the natural source and effects that give rise to risk (eg. such potential natural hazard sources as earthquakes). Including their characteristic distribution , intensity qualities and historical records to review the frequency and probability occurrence. Further provide a chance to map the hazard zones according to the frequency, location, intensity, and probability of future hazardous events, in a community.

However, hazard identifications frequently can be carried out on the basis of existing various reports. In fact, hazard identification needs to be an ongoing process. Any new information about the frequency and probability of natural events can be incorporated to redefine and update hazard maps.

Vulnerability Analysis:

Vulnerability analysis estimates the degree of loss or damage that would result from the occurrence of a natural phenomena of a given events. Vulnerability analysis considers the popularization, structures at risk in hazard prone areas and resources (i.e. as earthquakes) and include the elements such as: settlements, lifelines, production facilities, cultural patrimony, economic activities, vital economic facilities, evacuation routes, energy and transport.

In fact, community's vulnerability changes continuously with population fluctuations and the construction of new houses, roads, industrial facilities and other infrastructure. In case of, information obtained after natural disasters, they should be used to update vulnerability analysis and for strengthening buildings, modifying forest or agricultural management projects, ensuring low intensity use of high hazard areas, modifying transportation and energy distribution system, constructing protective work in highly developed areas, enforcing regulations and immediate economic benefits, for instance, hazard resistant design, construction and retrofitting and so on.

Risk Estimation:

Risk estimation is aimed at identifying:

- Probability with particular events of specified intensities will occur and overcome in indicated time frame.
- The area and/or population that will be exposed to the events (ie., population at risk;)
- The vulnerability of the area or exposed population to effects associated with the events; and
- The consequences to the population at risk of exposure to the expected series and intensities of the events over some specified time frame.

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Risk estimation requires performance of hazard analysis, vulnerability analysis and exposure analysis. When both analysis are integrated to a given hazard they will provide an estimation of the expected loss occurring from the event.

Risk estimation is generally, considered to be based on facts, although the analysis requires the application of technical and scientific expert judgment in applying probabilistic methods which utilized technical, scientific, or engineering data.

Risk Evaluation:

The third operational element or component in risk assessment is risk evaluation. This stage is central to policy determination. The risk evaluation are intended to provide basis for answering the central question of policies regarding risk mitigation measures and providing considerable openness to the aspects of policy making. As observed by Fischhoff and others (1986), the evaluation component attempts to determine which hazard, in what form, society should tolerate, or put it other wise as; how safe is safe enough.

After taking together of hazard identification and vulnerability information, the risk evaluation analysis sets a foundation for the decision makers to decide at what level of resources can be allocated to prevention, preparedness and emergency response measures against a natural hazard.

Feed Back:

Finally and ideally, there should be a fourth step in risk assessment process. Many scholars, Whilte (1988), Parker and Hardner (1922) and Smith (1993) emphasise the need for the fourth step in risk assessment and management process, such as 'Feed back' or 'Post-Audit' stage.

In practice only few studies have followed risk assessment through enquiry i.e. what were the impact or effects of any mitigation or protection measures if implemented. In otherwords, one of the main or serious deficiencies of risk assessment and management studies is the lack of 'Feedback' research.

Problem Identified

There are many problems identified in Risk Assessment approach. Risk assessment information is simply too technical to understood by layman. It frequently functions as a more acrane expert process, linked with technical term such as probability, which have little or no meaning to most layman. 28 Indeed, it has been proved that layman do perceive risks differently from 'experts', overestimating some and under estimating others (See Fischhoff et. al. 1981) 29. It was suggested that since risk assessment techniques are too technical it is better to leave them to experts. However, 'experts' also are prone to certain type of misjudgement.

Lawrance (1976) believes that scientific components of analysing risk is appropriately left to the professionally trained in such field as Physics, Chemistry and Engineering. A fundamental argument for opening the process and the consideration that such decisions are not merely technical choices, but matter of public governance. Even many others felt that, judgements about the consequences or

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acceptability of risk is (i.e. degree of safety) a matter of public values and is best left to the political process. 31 As O'Riordan (1979) puts: that in many risk assessments scientific rationality is to be noted.

Even though the concept of expected value is neither widely accepted by the general public nor legitimately approved as the basis for decision making. Further, Lave (1987) cautions that risk analysts should not attempt to understate or overstate threats, but rather give an accurate estimate and the range of uncertainty. However, the risk assessment approach is utmost important in natural disaster management activities. Because risk assessment always play a pivotal role in initiating an effective policy and planning measures against natural disasters.