USING PROACTIVE MEANS IN REDUCING VULNERABILITY TO NATURAL DISASTERS

Y.O. Izadkhah[1] and M. Hosseini [2]

[1]*Assistant Professor, Risk Management Research Centre, International Institute of Earthquake Engineering and Seismology (IIEES), Email: izad@iiees.ac.ir*
[2]*Associate Professor in Structural Research Center, International Institute of Earthquake Engineering and Seismology (IIEES), Tehran, Iran, Email: hosseini@iiees.ac.ir*

ABSTRACT:
The number and severity of natural disasters have increased continuously over recent decades, especially in developing countries. The World Bank has estimated that 97 percent of all human deaths due to natural disasters occur in these countries. The geographical situation and people's unawareness and lack of preparedness in developing countries are among the main causes which make them suffer more severely from the effects of natural disasters. Meanwhile, the reaction and response to disasters have been more reactive than proactive in almost all disaster prone countries, particularly the underdeveloped and developing ones. There is a need therefore, to reverse the trend of increasing worldwide vulnerability, by providing "access to knowledge and technology", "increasing the public awareness", and "considering the safety measures" as the main and key factors in development. Based on the existing evidence, most of the time, these vulnerabilities are the results of the human errors rather than the nature's forces. And therefore, suggested developed and implemented proactive tools can help the vulnerable communities to protect themselves, their livelihoods and settlements from the impacts of disastrous natural hazards. This paper intends to address these proactive means, already developed and implemented in many countries, in order to show their feasibility, practicality, usefulness, along with their social and cultural outcomes. The paper particularly discusses how these factors can contribute in safety and resilience of the most vulnerable groups of the society, the children, in upcoming future natural disasters, especially in developing countries, with considering Iran as the case study.

KEYWORDS:
Disaster education, Proactive means, Natural disasters, School safety

1. INTRODUCTION

A wide range of research has been undertaken on the proactive means during the last two decades. In this regard, the International Strategy for Disaster Reduction (ISDR), United Nations Educational, Scientific and Cultural Organization (UNESCO), and their partners have launched the 2006-2007 campaign 'Disaster Risk Reduction Begins at School' (ISDR 2006), aiming to both promote the integration of disaster risk reduction into school curricula in countries vulnerable to natural hazards, as well as safe construction and retrofitting of school buildings to withstand the forces of nature.

One of the first steps in mitigating the hazardous events and reducing vulnerability is to recognize the importance of "preventive concepts" rather than "responsive strategy". In other words, addressing hazards and vulnerability "before" rather than "after" events has recently received the prior focus.

It has been argued that the vulnerability reduction concept is proactive as it can reduce the probability of loss before it becomes a real threat or tragedy, and can minimize the magnitude of damage. It is also cost-effective, since it reduces emergency, recovery, and reconstruction expenditures. Therefore, it is important to prioritize "vulnerability mitigation", and make this strategy a part of, or even central to the development process in disaster-prone as well as developing countries. There are ways for achieving this, such as appropriate policies and development plans, implementing useful and effective tools and measures, education, training and information, and stakeholder participation. These policies and measures, sustainable development, and vulnerability reduction

(disaster prevention), are all interrelated and are discussed indirectly in various sections of this paper.

2. SHIFT TO PREVENTIVE CONCEPTS

Over the last several decades, a paradigm shift has occurred in disaster management theory and practice. Until a few decades ago, disasters were viewed as one-off events and responded to by governments and relief agencies without taking into account the social and economic implications and causes of these events. Gradually this attitude has changed to an emphasis on preparedness measures, such as preparedness plans. Over the four decades from the 1960s to the 1990s, there was an exponential increase in human and material losses from disaster events, though there was no clear evidence that the frequency of extreme hazard events had increased. In recent years, a more comprehensive approach, that of disaster risk management, has emerged. This approach has three distinct but interrelated components: hazard assessment, vulnerability analysis, and enhancement of management capacity, and is more closely integrated with the ongoing development processes. Disasters are no longer viewed as extreme events created entirely by natural forces but as unresolved problems of development. It is now recognized that risks (physical, social, and economic) unmanaged (or mismanaged) for a long time lead to occurrence of disasters. This evolution of approaches from relief and response to risk management has begun to influence the way disaster management programmes are now being planned and financed. There are initiatives aimed at reducing social and economic vulnerability and investing in long-term mitigation activities. Unfortunately, 'such initiatives aimed at prevention and mitigation are few, poorly funded, and insignificant in comparison with money spent by donors and development banks on humanitarian assistance and relief, as well as on post-disaster reconstruction' (Yodmani 2001).

Looking at the "present time" in any place (a country or a part of a country) as a period of time between the two disastrous events, and keeping in mind the preventive measures, it can be said that three acts should be taken in parallel to change the next disastrous event to a controlled and non-disastrous one. These three parallel acts are:

1) Performing all development acts considering the avoidance of disasters
2) Reducing the vulnerability of existing buildings and facilities
3) Acquiring and maintaining the preparedness.

It is obvious that if the principles of the resistant design (for earthquake or other extreme natural phenomena) are not followed in design of building and facilities, their behavior will not be reliable. Also if the location of buildings and facilities, particularly the critical ones, are not selected based on hazard microzonation maps, they will have to withstand higher loads, and this will make them more costly and still unreliable. Therefore, performing development acts while avoiding disasters is a key issue for the safety of the community in future. Reducing vulnerability of existing buildings and facilities is also a very important act. There are other several issues in this regard of which the key ones are discussed in the next section of this paper.

The third important act is to be prepared for the future hazardous and extreme events by all means ranging from education and training at all levels of community up to preparing various disaster scenarios for managing the emergency situations which can be created by future events. It is very important that the gained preparedness to be maintained in all levels of community by various means including national or local drills. Maintaining preparedness is particularly important in the case of earthquake disaster which usually happens in relatively long time distances.

3. KEY ISSUES IN VULNERABILITY REDUCTION

General policy guidelines and key issues for implementing vulnerability reduction are proposed for consideration by each country. There are many relevant policies and issues, seven critical issues are highlighted below (Uribe et al 1999):

1) 'Political commitment with vision of long-term sustainable development: A vision and scope of a broader, long-term, concept of development including social and environmental vulnerability reduction is one of

the key elements of all sustainable actions. Political commitment to reduce a country's vulnerability by means of development actions, legislation, allocation of financial and human resources, political decisions and actions is essential.

2) Disaster management and social development: This should be an important part of the development plans.
3) Integrated regional approach to vulnerability mitigation: There is an important regional dimension to environmental management to reduce vulnerability to natural hazards.
4) Institutional capacity building: The public sector and concerned stakeholders should be institutionally organized, adequately staffed and trained, in order to reduce vulnerability to hazards.
5) Structural safety: This is highly important especially in case of critical facility buildings such as hospitals and schools.
6) Community participation: Adaptation of a participatory development approach is essential, since it is almost impossible to accomplish a nation's vulnerability reduction plan with only the public sector's "top-down" efforts. Basic to the participatory approach is for "people to become agents of their own development" (DAC 1993), and to promote involvement and active participation of the general public and other stakeholders in a country's development.
7) Utilization of tools and measures: Appropriate tools and measures – including state-of-the-art technology – are available and should be applied judiciously to implement vulnerability reduction and long-term development'.

4. DEVELOPMENT OF PROACTIVE MEANS IN IRAN

The trend of increasing worldwide vulnerability to natural hazards can be reversed by providing access to knowledge and technology, increasing the public awareness, and considering the safety measures as the main and key factors. In the next sections, these are discussed with regard to Iran as the case study.

Iran is located in high seismic hazard regions of the world, and frequently experiences the occurrence of devastating earthquakes. Experience of the loss of more than 33,000 people in Bam earthquake of 26 December 2003 in Iran, as the most recent destructive one in the last 10 years, had shown that people are always vulnerable to disasters. Therefore, there is a need to establish a culture of safety among various groups of the society. Safety culture can be achieved through the long-term process of education for raising the public awareness, to create sensitiveness and belief on the "fact of earthquakes" in order to take an effective action. Also structural safety is another important factor that needs special consideration.

In Iran, many initiatives have been developed in regard to these two top mentioned proactive means. As an example, the International Institute of Earthquake Engineering and Seismology (IIEES) has developed a comprehensive public education programme called "Increasing public awareness and promoting a collective prevention and safety culture" as a component of the "Iran's Strategy of Risk Reduction". Creating earthquake safety culture among the youth in Iran with more than 25% of population under 18 years old and more than 14 million students, can act as a key factor in earthquake risk activities. Adding the 655,690 teachers and more than 1 million schools staff to the number of students, will become more than one third of Iran's 65 million population (Ghafory-Ashtiany and Parsizadeh 2005).

In the next three sections, some proactive means are discussed in detail.

4.1. Structural Safety

As mentioned earlier, structural safety is also a very important element in prevention. Structural safety, itself, has two aspects:

1) Design and construction of future buildings and facilities based on specific standards to prevent them from disastrous damages (this aspect is in fact related to "disaster-avoiding development"), and
2) Increasing the seismic safety of existing weak buildings and facilities by decreasing their structural vulnerability through seismic retrofit.

The Standard Code No. 2800 for "Seismic Design of Building Systems" has been enforced since 1988 in Iran, however it was not followed seriously in many parts of the country, particularly in places far from the Capital, because of the lack of proper supervision. However, after the destructive Manjil-Roudbar earthquake of June 1990, people became more sensitive to the seismic rules, and the quality of construction improved to some extent, but again after a few years people lost their sensitivity and other priorities start dominating their previous concerns.

With regard to the seismic retrofit of existing buildings and facilities, a national act has been started since 2002 for governmental buildings and facilities by assigning a specific budget to this task especially for strengthening the critical facilities such as schools and hospitals. The International Institute of Earthquake Engineering and Seismology (IIEES) launched a campaign for the safety of school buildings almost 15 years ago. Since mid 1990, the School Construction and Development Organisation of the Ministry of Education considered the safety of schools in its priorities. The organization is also responsible for strengthening of existing vulnerable school buildings. This has been more priotorised after the destructive earthquake of Bam in which the total 0f 131 schools collapsed. In general, the attention is paid to both new and existing schools. First a high priority is given to build the new schools safe as well as to identify the vulnerability of existing schools along with establishing a safety guideline for retrofitting schools (Parsizadeh et al 2007).

In Iran, around 131,935 classrooms need to be reconstructed and 126,010 classrooms need to be strengthened, that is 39 percent of the schools need to become safe. The allocation of USD4 billion for strengthening and retrofitting vulnerable schools has been approved and passed by the Iran's parliament in April 2006. Therefore the school safety act intends to consider the following:

- High priority and attention has been given to making sure that new schools are built safe.
- Establish specials standards and guideline for "Safe Schools".
- Identify vulnerability of existing schools (Qualitative Assessment).
- Prioritise the vulnerable schools with social, economic, strategic and structural issues.
- Establish special guideline for retrofitting of schools (COGSS 2006).

Finally it should be mentioned that before the Bam earthquake, technical faults were considered as just error. That is the engineers would not have encountered penalties for their direct or indirect technical faults. However, after the occurrence of the Bam earthquake, these faults are treated as felony by law (Ghafory-Ashtiany and Hosseini 2006).

4.2. Earthquake Education and Training

Education is one of the best media for making a community prepared for disasters. This can be started from educating the young children on disasters. Various aspects and materials on health, safety and hazards have been incorporated to a greater or lesser extent into the formal school curriculum. The aim of all these initiatives is to increase the knowledge and understanding of children about risk to teach preparedness and also how to react in times of disasters (Twigg 2003). Children are believed to be more receptive to new ideas than adults. Consequently, many existing disaster mitigation and preparedness programmes have tried to introduce disaster related topics into the school curriculum. Also kindergarten children can also learn about disasters. Preschoolers can then move to higher education with a basic background knowledge about disasters and their consequences. In the next level, primary and secondary schools can play a major role in the development of good citizens (Lidstone 1999).

During the IDNDR, the strategy of supporting school disaster education was developed. The aim was to provide children with guidelines for disaster preparedness and mitigation. The strategy also aimed to raise the public's awareness and knowledge of disasters and risk reduction. The challenge was to shift to a culture of mitigation through the school system. Accordingly, many developing countries, such as Iran, Nepal, Viet Nam, and others, developed strategies which support disaster education in schools (Izadkhah and Hosseini 2005). The purpose was to include the information that may be used by children as the next generation in order to equip them as future leaders in raising community awareness. This would indirectly contribute to making the communities more resilient against imminent disasters. As mentioned earlier, Iran has been selected for the case study as a

developing country.

IIEES "Public Education Department" has provided a website for children in English, including earthquake preparedness (http://www.iiees.ac.ir/edu.kids). Methods of education in various school levels in Iran are:

1) Preschool level through posters/songs/role-plays/drills/games;
2) Elementary level through textbooks/games/posters/drills/brochures/audio-visual tapes;
3) Secondary level through textbooks/games/posters/drills/brochures/audio-visual tapes;
4) High school level through textbooks/posters/drills/ brochures/ audio-visual tapes.

Since 1991, a six-page chapter titled "*Safety against Earthquakes*" explaining the seismic hazards and safety measures has been inserted in the Geography textbook for Iranian students of 8th and 12th grades. Also IIEES has designed and published a special textbook titled "*Earthquake Preparedness*" which is added to the 8th, 9th and 10th grades curricula. A lesson entitled "*Mysteries of Earth*" has been included in the Literature textbook of the 8th grade. Additionally, a chapter has been inserted in the Science textbook for the 4th grade called "Earthquake" about what to do in an earthquake and a chapter called "*Calmless Earth*" has been inserted in the 5th grade Science book. This nationwide programme is being implemented with the cooperation of the Ministry of Education and many related organisations.

In some initiatives, children are taught to be physically and psychologically prepared for a disaster by the use of specially designed teaching tools, including the use of a mobile teaching facility, a trailer, which is used in the elementary schools. One of the advantages of this tool is the active participation of the children in activities such as experiencing a simulated earthquake impact. This activity enhances their sense of responsibility to gain knowledge and share their experience with their friends and within families (Colie 1998). Also in Iran, the "*Shaking House*" is used as a tool for children in order to give them some understanding and experience of the expected experience of what should be expected during an earthquake (IIEES Website 2008).

With the cooperation of the Ministry of Education, a pictorial brochure titled "*Earthquake Hazard Reduction at Educational Institutions*" has been produced and widely distributed among Iranian school children. Moreover, educational-aids such as painting books, comic strips, story books, crossword puzzles and games are being developed for an even wider spectrum of the Iranian children. A bilingual pictorial booklet entitled "*Earthquake Preparedness*" is available with the proper procedures and steps that one should take at home or at work before, during and after an earthquake. Another booklet prepared with the cooperation of UNDP entitled "*E for Earthquake*" written in both English and Persian helps the children to learn the individual precautions to protect themselves at the time of earthquakes. The scientific concepts of earthquakes and safety measures for reducing their damage have been presented in this workbook in the form of puzzles, illustrations and easy-to-read explanations for children of seven to eleven years of age.

Audio and visual tapes can be beneficially used in preschool and school levels, in addition to which children can benefit from the messages conveyed by music, songs and films. In Iran, audio-tapes are used to disseminate safety messages to families including recommended preparatory measures such as sheltering during earthquakes, and recovery activities after an earthquake. The audio-tape is also useful in dissemination to illiterate people. An audio-tape is produced by IIEES and is in use in Iran in nursery schools and schools. The tape, presents safety recommendations to be applied during an earthquake in the form of a song, "*Earthquake and safety*", accompanied by a lively music. Children are very receptive to the song which is simple and easily understood. The tape also incorporates a simply worded conversational explanation of some scientific principles relating to earthquakes and appropriate safety measures to be taken in a manner which is appealing to children and welcoming to the parents (Izadkhah 2004, Izadkhah and Hosseini 2005).

Additionally, a simulated or an unreal earthquake can be conducted for children to evaluate their reactions in a real situation. This method has been piloted before and has had shown a great impact on children's learning. This can be done with advanced permission from the parents (Izadkhah and Hosseini, 2003 and 2006, and Izadkhah and Heshmati 2007).

Also, disaster training for all members of a society should also become a continuous process devising short-term and long-term low-profile campaigns through general training in order to expand the earthquake preparedness strategy. The overall aim is to classify various target categories and groups in the society and to identify the potential for educating and training each group for disasters, so as to help in training and educating more and more groups in the society, and reaching to a desirable level of disaster training for all in the community. It is tried to link all these groups together as a network for exchanging information and experience. Training programmes for each of the categories could be described in more detail, which has been discussed briefly in studies such as (Izadkhah & Hosseini 2002, Hosseini & Izadkhah 2006a, Hosseini & Izadkhah 2007, Izadkhah & Hosseini 2007, Hosseini & Izadkhah 2008). More in-depth studies can be undertaken by interested researchers in elaborating on training programmes for each separate group of the society.

4.3. Improving the Level of Preparedness and its Maintenance

The "Earthquake and Safety Drill" programme has been officially integrated into the school curriculum of school children by the Iranian Ministry of Education. The First National Safety Drill was held successfully on Nov. 29, 1999 in 15499 high schools in Iran. The Second National Drill with the subject of "Earthquake and Safety" was held on November 28, 2000 in all Iran's secondary and high schools. The aim of this drill was to prepare students for appropriate and timely responses in the event of an earthquake. The educational guidelines were sent to all high schools by IIEES and were broadcast two weeks before the drill through almost all the radio channels. On that day, the "Safety Bell" was heard concurrently in all secondary and high schools in Iran between 8:30 to 10:30 a.m. for about 30 seconds from the National radio. The students were to take appropriate shelters upon hearing the bell and in accordance with the guidelines already provided to them. Additionally all Iranian radio channels broadcast the educational guidelines and programmes related to the drill concurrently. This drill simultaneously involved about eleven million students at a time in around 48000 secondary and high schools. The "Safety Drill" programme has been developed by IIEES (Ministry of Science, Research and Technology) with the cooperation of Ministry of Education, the National Committee for Natural Disaster Reduction, the Iranian Red Crescent Society, and Iran National Television and Radio. The purpose of these drills is to prepare students for the appropriate and timely responses during earthquake (Izadkhah and Hosseini 2005). The last drill in November 2007 covered all levels of school children throughout the country. The earthquake drills have also been organised for preschool children since 2000 and are underway approximately once every year. The recent preschool drill was performed in May 2008.

In addition, information and Communication Technology (ICT) is being used increasingly for disaster mitigation as means of disseminating information. It has been identified as an integral part of disaster prevention and management. Communication technologies, skills and media are important tools in linking the scientists, disaster management authorities, and the public. They can also be useful in educating people on disaster preparedness, getting information about upcoming hazards and providing the officials with necessary information. There are different tools that can inform people about hazards, help in assessing the damage, collecting information, coordinate the activities and to motivate people, etc. (Hosseini and Izadkhah 2006). At the same time, the development of the information management systems continues to increase. The impact is still yet to be observed. Communication with mobile instruments continues to improve with many tools. It can be argued that one of the most popular ICT tools is the internet as the main tool (Izadkhah and Hosseini 2004), however still can not be used in remote areas.

Another preventive act after the Bam Earthquake is the Round clock monitoring of the National Seismic Network for "quick locating and announcement" of earthquakes in order not to lose the golden hours for response. (Ghafory-Ashtiany and Hosseini 2007).

Also, initiating safety councils in schools is of great importance. There is need for expanding a system that each group of the society and the organisations can rely on their own sources and ingenuity for a while before a gradual return to normality. This requires an efficient organisation of resources, staff and priorisations of actions with time and an understanding of the possible consequences of the disaster (Coburn and Spence, 2002). A disaster management action plan is needed in schools with various operational teams. These teams should be assigned to work in coordination with each other in different phases of before, during and after a disaster with

assigned roles and responsibilities. Some teams can be more functional before the earthquake happens, whereas some of them should be coordinating in all three phases (Hosseini and Izadkhah 2006b).

It is worth emphasizing that in designing any disaster awareness programme, many factors such as age and sex of the target groups need to be considered (Davis et al 2003 and Izadkhah et al 2006). However, the current emphasis of most of these initiatives is only on the safety procedures of what to do before, during, and after a natural hazard.

5. CONCLUSIONS

Experience has demonstrated that lack of preparedness may result in significant losses both on the onset of the disaster, and subsequently. Therefore, the goal is to shift from existing “reactive” approaches of "disaster recovery", to “proactive” approaches of "disaster mitigation”. These "proactive" mitigation measures focus more on two aspects of 1) structural safety and 2) education and training, as well as maintaining people’s preparedness with the aim of making communities resilient to natural disasters.

Several attempts have been made by specialists as well as NGOs and some authorities for increasing the safety level of the communities against disasters. However, the lack of efficient and on-time communication between experts and the people has nullified many of these efforts. Therefore there is a need to develop a common language between experts and the community in order to facilitate the procedures in regard to consideration of proactive means such as structural safety along with education and public awareness issues. Therefore, the strategies for earthquake risk reduction which needs enforcement include: 1) a change in general policy, 2) improving the structural quality, 3) using the advanced technology, 4) enforcing the guidelines, and 5) increasing the public awareness and preparedness.

In conclusion, many factors are also needed in order to implement these proactive means, among which are: 1) the commitment and joint coordination of various groups of the stakeholders in a society such as children, parents, teachers, policy-makers and disaster experts, 2) the need for the partnership of different national and international organisations involved in disaster reduction combined with placing “good governance” at the heart of “disaster management”, 3) making the “Earthquake Safety Initiative” a nation-wide programme, 4) increasing education, training and public awareness as well as promoting a collective prevention and safety culture and finally, 5) implementing the law and will to achieve the structural safety using the existing knowledge, experience and available resources along with good planning and efficient management.

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