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学位論文要旨
Dissertation Summary

氏名 (Name) Amod Mani Dixit

論文名: An Evaluation of Earthquake Risk Management Initiatives in Nepal
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Earthquakes are one of the most significant natural hazards in Nepal. There is a long history of destructive earthquakes in the Himalayan region. Many studies have been carried out in the past to evaluate the earthquake hazard, and in later times, the risk in Nepal. Few initiatives have also been started towards reducing earthquake risk in rural and urban settlements with phenomenal success. At the same time, the seismic risk, unfortunately, continues growing unabated, which fact is proven by unacceptably high casualty due to even medium-sized earthquakes in the region in recent years. Confrontation with such controversy of simultaneous success and failure compels one to explore deeply into the root causes and influencing factors for successes and also of the wants. In fact, evaluation of the earthquake risk management initiatives, especially in developing countries like Nepal, has become urgency for enhancing effectiveness of the initiatives to reduce and manage earthquake risk in urban, sub-urban and village communities of Nepal in a resource-constrained environment. This doctoral research aims to contribute to this need – it aims to understand and evaluate some of initiatives taken for earthquake risk management in Nepal in the past two decades. The main drive here is to critically evaluate the entire process of earthquake risk management initiative, from the understanding of the earthquake occurrence and associated geological processes, formulation of the objectives and approaches taken, the role and contribution of the stakeholders involved and their inter-relationships, the measures and levels of success and main causative factors, the gaps and challenges, needs for improvements and corrections, and the replicable potentials. For this, I have

selected major three initiatives, namely, Kathmandu valley earthquake risk management, public school earthquake safety and non-structural earthquake vulnerability assessment in major hospital of Nepal as major research spheres to evaluate the initiatives taken for earthquake risk management in Nepal.

The Kathmandu valley, which used to be a lake in geological past, has a long history of destructive earthquakes. In recent years, the earthquake risk of the valley has significantly increased due mainly to uncontrolled development, poor construction practices with no earthquake safety consideration, and lack of awareness among the general public and government authorities. Implementation of land use plans and building codes, strengthening of design and construction regulations, relocation of communities in risky areas, and conduction of public awareness programs are the suitable means for managing the earthquake disaster risk. Several of these, and some other initiatives of far reaching consequences, implemented by both governmental and non-governmental organizations of Nepal have been analyzed comprehensively, the outcomes and challenges evaluated, and the gaps as well as possible steps to address the shortcomings have been forwarded.

This research concludes that the strength and richness of the urban earthquake risk management programs such as the Kathmandu Valley Earthquake Risk Management Program, lies in the fact that it includes a variety of interrelated logical steps – starting from hazard and risk assessment to risk communication, capacity development, implementation of vulnerability reduction as pilot activity. In the mean time, there is a huge opportunity of participation by the stakeholders including the members of the community at risk. The program is impactful, has introduced changes in risk perception, and has influenced the policy and decision makers to institutionalize the program elements. The program has made an impact even outside the borders of Nepal providing an evidence of the tremendous replication potential.

Public and private schools in developing countries present special challenge in terms of earthquake risk and great opportunity for reducing it. Most school buildings are weak with poor seismic performance, nonetheless, their structural safety continue to be ignored and even new structures are being constructed without consideration of the seismic hazards faced. At the same time, programs for enhancing seismic performance of not only the school building but of the entire system are being implemented successfully. This research evaluates some of the public school earthquake safety programs that cover more than 1000 public schools from six districts of Nepal. The schools were evaluated for earthquake safety of the building structure and other non-structural aspects such as the various awareness raising and preparedness programs. This research describes the program features, extent of community participation, retrofitting processes, and lessons learned while implementing the earthquake safety program. It also demonstrates how school earthquake safety program ultimately increases the seismic safety of the entire community in the Himalayan regions.

This research points out on the far-reaching impact of the public school earthquake safety works. It recognizes that the program works as a strong vehicle to communicate and encourage earthquake safety of the community via the school, the teachers and students to the parents and household members and from there to the entire community. Capacity building element of the program is recognized as a strong benefit – together with making the school building safe, the school system has been made safer, and masons have been trained in aspects of earthquake-resistant construction and a great deal of earthquake awareness as been generated in the community. Emphasis on the use of locally available materials and the involvement of the local government as well as the local private sector businesses is given much value to the program and made it successful and all acceptable. No wonder that the school program has received widest possible replication in Asia.

The third area researched in this analytical exploration is the effort towards improving seismic performance of hospital systems. Hospital systems are rather complex, their services are more important than their infrastructure. At the same time, vulnerability reduction in hospital system is much more complicated and, most importantly, costly, than in residential homes, schools or in offices. Therefore, naturally, the earthquake risk management works in the health systems have pertained so far largely to implementation of non-structural vulnerability reduction. This is the main target of the research in the third part of this dissertation. Naturally, is the seismic performance of even the non-structural elements good assessment of all structural elements, non-structural elements and also the functional elements. In Nepal, the fact that a devastating earthquake is inevitable in the long term and likely in the near future is known to all, including the managers of the hospital systems. Nonetheless, the results of seismic vulnerability assessment of the major hospital systems show an alarming situation, and demand immediate actions in most of the hospitals. The works carried out so far in Nepal suggest that Nepal should adopt a policy of gradual improvement of seismic performance starting with the retrofitting of non-structural services and systems in conditions of resource constraint for structural intervention. Furthermore, it is pointed out that in a hospital, the non-structural elements could be vulnerable even to a medium or small-scale earthquake shaking disrupting the services. Therefore, the logical recommendation to adopt a gradual step-by-step approach and fix the non-structural elements such as the water supply, electricity and other ancillary services securing their seismic performance during earthquakes. This approach, with a detailed assessment of the non-structural components in several hospitals has largely helped to convince the government officials and hospitals authorities on the affordability and possibility of constructing earthquake-resistant non-structural components in the hospitals of developing countries like Nepal, employing a slight improvement in the already employed methods of construction.

The conclusion of the research is that the health sector institutions need to be

assessed in terms of structural, non-structural and functional vulnerability with respect to earthquakes, and that corrective measures should be taken to ensure continued functionality of the system. While structural retrofitting of hospitals is an endeavor that demands huge resources, improvement of seismic performance of health institutions can be started on an incremental basis by addressing the non-structural and functional vulnerability first. The methodology has been developed and successfully implemented.

The overall conclusion of the research is that Nepal has done a great stride in learning the modern methods of earthquake risk management from international practices, has adapted the methodologies to local context, piloted the methodologies successfully with further refinement of the methodologies towards cost reduction, and has demonstrated the success of capacity development programs generating a community of practitioners. The greatest challenge is to scale up the success and institutionalize the methods and successes in the existing government, public and private institutions and incorporation of the rich experiences in the academic curricula and programs for sustained knowledge management.