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A RETROSPECTIVE VIEW ON THE TWO DECADES OF EARTHQUAKE RISK MANAGEMENT ACTIONS IN NEPAL

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Introduction and historical background

Nepal faces a multitude of natural hazards, notably floods, landslides, earthquakes, cyclonic winds, etc. The history of Nepal and Kathmandu

Valley is strewn with devastating earthquake events, at least once per century that have killed from kings to the commoners, and caused tremendous economic and political setbacks to this landlocked country. Unfortunately, the

extremely high earthquake risk is growing due to continued building up of vulnerabilities, especially due to unplanned urbanization of settlements, despite a glorious tradition of earthquake-resistant construction of monuments and



Outside of NSET

temples. Lack of systematic hazard preparedness is another reason of increasing social vulnerabilities to earthquakes.

Disaster risk management was not in active menu in modern Nepal prior to the devastating 1988 M6.6 Udaypur Earthquake and the 1993 flood in the south-central part of its territory. Both these events convinced on the need for adopting organized approaches to manage and minimize risks due to natural hazards. The international environment was also favorable: global initiatives such as the International Decade for Natural Disaster Reduction (IDNDR) of 1990-1999, and one of its reverberations, the World Seismic Safety Initiative (WSSI), contributed much towards encouraging and guiding Nepal towards awareness disaster risk management practices as one of its undertakings. The First WSSI Workshop in Bangkok in 1993 was of tremendous importance for Nepal – the meeting listened to Nepal's report on its efforts in earthquake risk management by professionals and decided to support it by holding a high level meeting (HLM) with government officials and policy makers in order to influence them towards greater support and facilitation of the ongoing national activities. The Kathmandu HLM in 1993 was instrumental in creating a supportive environment towards establishment of the National Society for Earthquake Technology-Nepal (NSET), a non-government organization that focuses on aspects of earthquake risk management by the joint efforts of professionals belonging to the fields of geology, seismology, earthquake engineering, structural

engineering, urban planner, building engineers and architects, and also economists and journalists. The HLM facilitated exposure of NSET to the activities of international community and institutions, such as International Center for Disaster-Mitigation Engineering (INCEDE) of the University of Tokyo (UTokyo), California Seismic Safety Commission, and Earthquake Engineering Research Institute (EERI). This exposure subsequently grew into networking and ultimately into partnership relationship. For example, two of NSET professionals got opportunity to study and conduct research in the civil engineering department, graduate school of UTokyo. This relationship has now become sustainable especially after signing of a MOU for collaboration between NSET and the International Center for Urban Safety Engineering (ICUS) of UTokyo. ICUS is the modern incarnation of INCEDE.

In the mean time, the government of Nepal developed the national action plan for submission to the 1994 United Nations' Yokohama World Conference on Natural Disaster Reduction, to express the country's commitments towards disaster risk reduction. NSET became deeply involved in supporting the government of Nepal in the preparation for the UN World Conference and also in participating in the conference. Further, in the 1996 World Conference on Earthquake Engineering (11WCEE), NSET joined the International Association of Earthquake Engineering (IAEE) as a bona fide member.

Such exposure as well as the national and international enabling environment together with the

national initiatives became the motivation for NSET to develop i) its vision of earthquake safety for Nepal, ii) its mission on helping people and the government in developing and implementing organized approaches for earthquake risk management, and iii) its strategic objectives of learning modern technologies globally and indigenous knowledge locally, adapting it to the present-day needs in the local context, and implementing risk reduction initiatives in partnership and collaboration.

In 1996, NSET consolidated the concept of the Kathmandu Valley Earthquake Risk Management Program (KVERMP), and started its implementation in collaboration with the Asian Disaster Preparedness Centre (ADPC) and GeoHazards International (GHI) with core funding support from the US Office of Foreign Disaster Assistance (US OFDA). This program was a milestone as it undertook several innovative and successful initiatives. Subsequent efforts in earthquake risk management in Nepal was largely influenced and guided by KVERMP, and therefore it deserves to be described in slightly more details, as given in the following sections.

KVERMP: The milestone program

KVERMP was a milestone program because of its success, its innovativeness, and the national and international endorsement, acceptance and replication of its methodologies and outcomes. Some of the innovative works initiated under KVERMP by NSET included:

1. Development of earthquake

damage scenario of Kathmandu Valley using empirical methods and secondary information on earthquake hazards and past earthquake damage. The scenario served as the basis for developing an Action Plan for Earthquake Risk Management (ERM) for Kathmandu Valley. More than 50 senior government officials from various ministries contributed to the formulation of the plan. Efforts of implementing the action plan initiatives in subsequent years largely defined the efforts of ERM in Nepal.

2. Development of a methodology for assessment of the school building vulnerability leading to the development of a comprehensive School Earthquake Safety Program (SESP). The SESP included seismic retrofitting of existing weak school buildings, reconstruction of earthquake-resistant new school buildings using local materials, improvement of seismic performance of non-structural elements in school buildings, development of school earthquake preparedness plan including emergency evacuation of school children and evacuation management and earthquake drills.

In the course of implementing SESP, NSET could develop several innovative initiatives that have become very popular in Nepal and also in the region beyond the country. These are:

a. Training masons, carpenters, contractors, supervisors, engineering technicians, and building design engineers/architects on earthquake-resistant design and code-

compliance construction technology and seismic retrofitting.

- b. Earthquake awareness programs targeting teachers, students and community members.
 - c. School disaster emergency preparedness and response planning, such as safe evacuation drill, first aid, etc.
3. Establishment of the system of observing the annual earthquake safety day, in which the government, the private sector, the academia and the common people make collective pledge to reduce earthquake risk.
4. Development of a program and curriculum for mason training for earthquake resistant construction. This is necessary to address the issue of earthquake safety of building in an environment where more than 90% of the building stock is constructed at the guidance of the masons, which may not be literate enough to understand the intricacies of seismic behaviour of buildings.
5. Development of community-centred disaster risk management program.

NSET Approaches

Right from the very beginning, NSET works adopted a preference of implementation excellence over theoretical excellence, and we ensured that the technologies that were easily adopted by the local masons far outweighed in preference in comparison to the technologies that required heavy heterografting. This efforts on localization of ERM methodologies resulted in gradual increasing of involvement of a variety of stakeholders, and a series of successful operational approaches

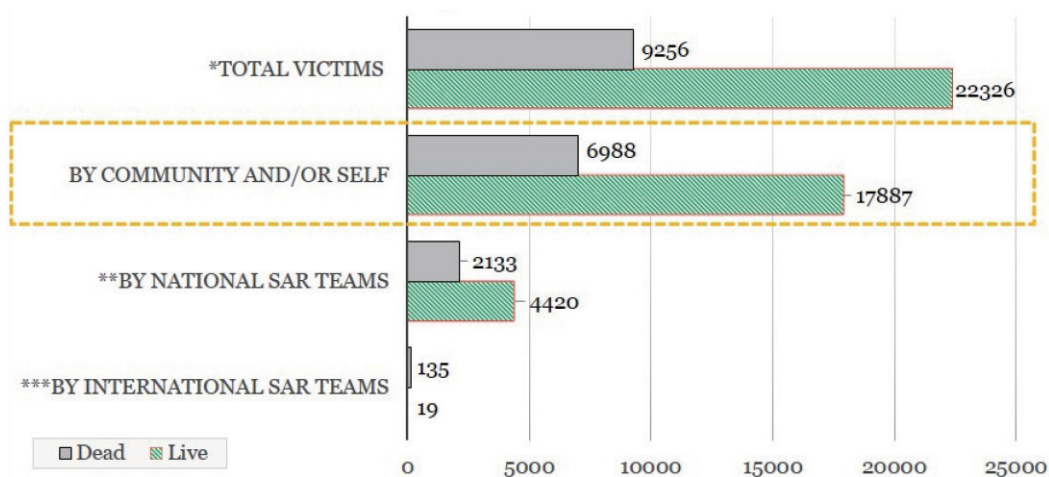
as follows:

- a. Preferential use of local resources, local masons, local contractors, local construction materials and local building typologies.
- b. Foster collaboration and partnership among governmental agencies, NGOs, CBOs and business community by involving them in the decision making at all stages.
- c. Follow strict technical and financial transparency: be always ready to answer the following questions –what is being done, how and who is doing this, why it is being done, what time, technology and resources are required and how much resources on what aspect are used.

Other Programs of NSET

KVERMP subsequently encouraged and provided NSET with motivation for the design and implementation of several other innovative programs, that NSET has been successfully implementing them over the years in Nepal and the South Asian Region. The main of them include:

1. Municipality earthquake safety program that gradually metamorphosed into the Building Code Implementation Program (BCIPN) being successfully implemented in over 30 municipalities in Nepal.
2. Program for public private partnership for earthquake risk management, by which the private sector businesses are made aware on the need to progress onto business continuity planning progressing from the current considerations of disaster charity and corporate social responsibility.



Source: *Nepal Police, 2 July 2015, **Reports by Nepalese Army, Nepal Police and Armed Police Force June 2015 *** report by Nepalese Army, June 16, 2015

Rescued Victims and Discovered Dead Bodies by Different Search and Rescue (SAR) Teams

- Community-based disaster preparedness and capacity enhancement.
- Building up capacity of national disaster response agencies in medical first response and collapsed structure search and rescue (SAR) – the Program for Enhancement for Emergency Response (PEER), etc.

The Gorkha Earthquake of April 2015 tested NSET efforts

The Mw 7.8 Gorkha Earthquake and its four major aftershocks resulted in 9,256 human death, 22,326 injury, and inflicted damage to the extent of reconstruction of about 850,000 houses, and loss of assets over several billion US dollars (MoHA-GoN, 2015). The earthquake has also inflicted social, economical and psychological stressors to the people and government of Nepal.

In this condition of immense shock, we are proud at the positive impact of the earthquake risk management efforts implemented by NSET and the efficacy of

the approaches, philosophy and methodologies adopted in Nepal in the past 22 years.

The followings provide a few of the success cases.

Retrofitted buildings performed excellent: All the 290 schools that were retrofitted and seismically reconstructed performed very well during 25 April earthquake and a series of aftershocks: no death or injury reported, no serious damage, and no collapse of any of such retrofitted school buildings, including those located in epicenter areas. Almost all of the retrofitted school buildings were used during the earthquake response as emergency shelter, warehouse, health posts, or as safe offices. This contrasted sharply with poor performance of the “un-retrofitted” school buildings, including those located nearby the retrofitted ones, during the Gorkha earthquake: about 80% of the “un-retrofitted” were damaged beyond repair.

Investment in PEER and Community Level Emergency Response Capacity Enhancement Paid Off: The 15-year old PEER investment justified the investment -

the national capacity developed and the national discourse of emergency preparedness were very handy, albeit “not enough,” for responding the situation.

The performance of the national responder, notwithstanding the problems of logistics, was superb. The figure above shows the efficiency of the national responders. Had the same level of earthquake happened a decade earlier, the performance of SAR could have been much less effective.

The Gorkha Earthquake once again revealed the importance and usefulness of community SAR volunteer responders. It was clear that community volunteers are in fact the first responders, and that they need to be trained in the training programs listed above together with the training of First Aid. Additionally, the earthquake also revealed the need to train security forces from the private sectors including those from tourism and travel business, industry, hotels, river rafting etc. – a learning that NSET has been propagating since two decades.

By Dr. Ramesh Guragain, NSET, Nepal

The 14th International Symposium on New Technologies for Urban Safety of Mega Cities in Asia (USMCA 2015) was commenced on 29-31 October 2015 in Kathmandu, Nepal. Honorable Minister Mr. Som Prasad Pandey, Ministry of Industry, Nepal Government inaugurated together with inaugural remarks.

The overall objective of the symposium is to share experiences on urban safety and environmental management across the countries in the world and to organize interaction

of scientists, researchers, academics and decision makers from different countries.

Total of seven keynote presentations and 80 papers on various areas and themes were presented in three plenary and eight parallel sessions. Around 100 international participants and more than a hundred Nepali participants actively engaged in this scientific discourse. Further, different professional organizations and businesses demonstrated their work and products through 12 different

booths. Young researchers with excellent presentation were awarded with Excellent Young Researcher Award.

The symposium was jointly organized by National Society for Earthquake Technology-Nepal (NSET) and International Center for Urban Safety Engineering (ICUS), Institute of Industrial Science (IIS), the University of Tokyo (UTokyo), Japan in association with number of other partner organizations.



USMCA2015 Participants



Left: Honorable Minister of Industry, the Government of Nepal Inaugurating the Symposium by Lightening the Traditional Lamp
Right: Prof. Kimiro Meguro Co-convenor of the symposium with Honorable Minister of Industry, The Government of Nepal Mr. Som Prasads Pandey and His Excellency the Japanese Ambassador to Nepal, Mr. Masashi, Ogawa



Left: High-level Dignitaries during Opening Ceremony
Right: Dr. Amod Mani Dixit, Co-Convener of the Symposium Presenting Excellent Young Researcher Award to Mr. K. Yamamoto, PhD Candidate, UTokyo



YTU delegates visit Tokyo for the first Myanmar-Japan Joint Meeting

Prof. Khin Than Yu, YTU, Myamu

We visited Tokyo from 9 - 15 November 2015 for the first Myanmar-Japan Joint Meeting (MJJM) of the SATREPS project. Delegates from Myanmar were Prof. Nyi Hla Nge, a chairman of a steering committee for Yangon Technological University

(YTU) and Mandalay Technological University (MTU), Prof. Aye Myint, Rector of YTU, Dr. Win Win Zin, Associate Professor from the Department of Civil Engineering, YTU and myself Prof. Khin Than Yu, Pro-Rector of YTU.

The main purpose of the visit was to meet and discuss face to face together with the project leaders from both Myanmar and Japan. All leaders from the Japanese SATREPS project groups as well as officers from JST and JICA, our sponsors, participated in

the two-day meeting and it was a good opportunity after eight months since the start of the project to confirm the project progress, discuss managerial issues, make adjustment as necessary and finally to build consensus and agree on Action Plan which was drafted at the end of the meeting.

At IIS, we visited their research and experimental facilities such as Intelligent Transport System (ITS) Center, Earthquake Resistant Structure (ERS) facility, Kuwano



visit to Meguro Lab. at IIS

Laboratory and Nagai Laboratory. Also we took the day trip to Tsukuba to visit National Research Institute for Earth Science and Disaster Prevention, Public Works Research



meeting among members

Institute/ICHARM and Nippon Kohei Research and Development Center for observing their laboratory facilities. We also made a half-day visit to Metropolitan Expressway Company Ltd.

This trip made us realize how important disaster reduction preparation is to become a disaster resilient society and how wide and intense its spectrum is. There may be some unavoidable difficulties on the way to disaster resilient society. Experience during this trip encouraged us to run into those difficulties on our way.



Members of SATREPS-Myanmar

The 6th ICSE 2015 in Yangon

By T. Matsushita

The 6th International Conference on Science and Engineering (ICSE) was held on 12–13 December 2015 at Yangon Technological University (YTU) in Yangon, Myanmar. The two-day conference was organized by YTU, sponsored by JICA and covered six categories of studies that were carried out in seven parallel sessions, with 183 participants. There were 165 presentations including many from YTU, Mandalay Technological University (MTU), other Myanmar universities and Japanese universities. Majority of the entries were from the field of Electrical and Electronics (48) and Energy, Environment and

Natural Sciences (45), substantial number of entries were from ICT (25) and Manufacturing and Automation (24) and some from Natural Disaster Management (11) and Infrastructure (12). Sixteen researchers and members from SATREPS project team have participated in the conference and five of them gave presentations. Dr. Wataru Takeuchi was invited to give a keynote speech and presented his progress in SATREPS project in the field of GIS/RS, titled “Estimation of Land Use Change and Building Heights from 1966 to 2013 in Yangon by Corona, Landsat and Geospatial Images.” Prof. Takehiko Kitamori, a former vice-President of the University of Tokyo also gave a lecture about international collaboration in the academia titled “International Cooperation in University Education in the Era of Knowledge Based Economy.” SATREPS project leader, Prof. Kimiro Meguro has introduced about the



exhibition booth

SATREPS project and Prof. Osamu Murao and Dr. Akiyuki Kawasaki presented about the research progress of their project groups, respectively. The ground floor exhibition area was filled with many booths from various industries and it was lively with TV camera crews interviewing the participants. The conference was filled with researchers from universities across Myanmar and was successful in providing a great opportunity for researchers to present their works as well as learn from others and exchange information among the participants.



Group photo of ICSE keypersons

Tsinghua Univ. delegates visit ICUS

Prof. Hong Huang, Tsinghua University, China

Based on the international investigation requirement of the project on the Development Strategy of National Public Safety Science and Technology supported by Chinese Academy of Engineering, the project members visited Japan for investigation led by the project leader, Prof. Weicheng Fan (Director of Institute of Public Safety Research, Tsinghua University) from October 12 to 16, 2015. The visit was kindly cooperated by Prof. Kimiro Meguro, Director of ICUS and other ICUS members. During this trip, the

members visited Kanto Regional Development Bureau of Japan, Fire and Disaster Management Agency of Japan; National Research Institute for Earth and Science and Disaster Prevention and ICUS. The members also attended RISON (the Security & Safety Trade Expo 2015). The members discussed recent progress on the studies on urban and public safety with many researchers. It is shown that the science and technology are paid great attention for disaster prevention and reduction in Japan. For example, large scale experiment

and simulation facilities are well established and used, the emergency management industry are well developed, the education of national personnel in disaster prevention and reduction is widely conducted. The visit provided an excellent opportunity to further enhance our mutual understanding and to set the foundation for future collaboration and partnership on public safety and emergency management between China and Japan.

Chiba Experiment Station Open House

Dr. H. Gokon

The Annual Open Campus was held in Chiba Experiment Station of IIS on November 13th, 2015. Totally,



special lectures at seminar room



The primary school students visit the experiment station

21 topics were exhibited in the Annual Open Campus, which were related to architecture, transportation,

civil engineering, information and communications and so on. In the afternoon, Special lectures were given by Professor Subhansu Roy, the head of Center for Railway Research of the Indian Institute of Technology Kharagpur, India and Dr. Yutaka Takahashi, Professor Emeritus of the Who was the 2015 Japan Prize. The Open House was successfully finished.

CODE2015

Dr. H. Gokon

The 3rd International Conference on Computational Design in Engineering (CODE2015) was held from December 14th to 15th, 2015, at the Institute of Industrial Science, The University of Tokyo, Japan, hosted by the International Center for Urban Safety Engineering (ICUS) and organized by the Local Organizing Committee of CODE 2015. Totally, 6 keynote speeches and 75 presentations were given by the participants. A lot of valuable



CODE 2015 Participants

research results were presented in the session, and the participants

communicated with each other in the active discussion.

Editor's note...

It is almost six years since I have become a member of ICUS. During this time, I have been given the opportunities to carry out research activities and collaborations in close connection with many different countries in Asia.

My regular research activities were concerned more with national issues than international, and concentrate on realizing applicable solutions for these issues. However, through the international experiences provided by ICUS, my abilities to sharply assess the problems and consider them through multiple perspectives

have been fostered.

At the same time, these experiences have also led me to re-consider the 'advancement' of Japan. The commonly understood fact that Japan is always ahead of rest of Asia is no longer true. In terms of the will to carry forward an innovation; the ability to think outside the box; engaging in cross-sectoral collaborations; and investing in various funds and grants, I even feel that Japan is lagging behind. Japan is good at presenting an excellent vision; however, realization of the vision includes various societal obstacles which are difficult to

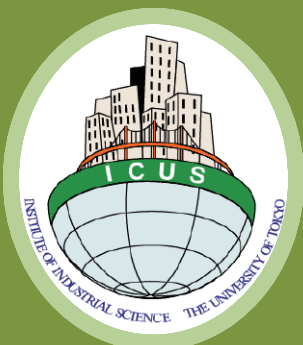
overcome. These obstacles are not due to technical problems but rather because of societal problems including policies and systematic issues. Therefore, we also need to consider the possibilities of realizing the solutions in some Asian country first, through collaboration research, and then importing it back to Japan as a new model.

Through the international collaborative work at ICUS, I hope to continue to build a model which allows for progress through the mutual stimulation and growth of all parties involved.

by T. Kato

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The International Center for Urban Safety Engineering (ICUS) is a research center located at the Institute of Industrial Science, The University of Tokyo.

The purpose of ICUS is to identify, investigate, and resolve issues towards the realization of sustainable urban systems for the prosperity and safety of society considering challenging socio-economic problems.