Background

A national conference titled "Disaster Resilient and Sustainable Infrastructure for Better Tomorrow" was conducted by SCAEF, Nepal on December 01, 2022 at Shankar Hotel, Kathmandu. In the context of ever-increasing events of natural disasters in the local and global scale, further exacerbated by anthropogenic/non-anthropogenic climate changes, SCAEF, as the forum of the knowledge-based industry, found it very imperative to have a public discourse and dialogue on the topic with its institutional, technical and psychological ramifications. The conference consisted of eight presentations on the related topics by the prominent experts, further facilitated by a panel discussion and question and answer session.

The opening remark was delivered by Mr. Narayan Hari Rijal, Joint Secretary of SCAEF with a brief background on resilience and sustainability of structures in the context of climate change, followed by the welcome speech by Mr. Kamal Karki, GS of SCAEF. Mr. Karki elaborated a bit on the ethos of consulting industry in Nepal and the necessity to expand its wings to international arena, in the particular context of disaster, which is, needless to say, a trans-national subject nowadays.

S.N.	Title of the Presentation	Expert	Association
1	Disaster Resilience in the Verge of Disaster and Climate Change in the Nepal Himalaya	Dr. Basanta Adhikari	Tribhuvan University
2	National-scale landslide susceptibility map of Nepal in a geospatial artificial intelligence (geoAI) framework	Dr. Ananta MS Pradhan	Water Resources Research and Development Centre, MoEWRI*
3	Avenues of Innovation for Multi-hazard Resilience and Sustainability in the Sector of WASH Infrastructures in Nepal	Dr. Shankar Dhakal and Dr. Surat Bam	DWSSM* & ADB*
4	Climate Resilient Infrastructure and Adaptation	Dr. Laxman Sharma	Asian Disaster Preparedness Center
5	Moving towards resilience of the transport infrastructure	Dr. Chandra Bahadur Shrestha	ICE-UK
6	Urban Resilience and Sustainable Development	Ar. Surya Bhakta Sangache	NSET
7	Disaster Resilience in Hydropower Projects	Dr. Sanjeev Shah	Shah Consult International (P.) Ltd.
8	Minimizing Anthropogenic Negligence in Triggering Disasters using Policy Instruments	Dr. Tara Nidhi Bhattarai	Department of Geology, Tribhuvan University

*MoEWRI-Ministry of Energy, Water Resources and Irrigation, *DWSSM- Department of Water Supply & Sewerage Management, *ADB-Asian Development Bank, *ICE-UK-, NSET- National Society for Earthquake Technology

Disaster Resilience in the Verge of Disaster and Climate Change in the Nepal Himalaya

The primary theme of the presentation is how climate change is affecting the resilience of existing infrastructures in the country, further exacerbated by its non-linear coupling with other hazard such as seismicity in the case of Nepal. The presentation narrates the anecdotal evidences from the infrastructure projects in country, for instance, Melamchi Water Supply Project which provides a glaring example of how hazards of difference nature can affect the long-term resilience and sustainability of the infrastructures, thus calling for the urgency on the development of impact based multi-hazard forecast system.

The presentation was followed by an interactive question-answer session, which is summarized below:

Three Prominent Urgent Steps to be taken to address the issue	Permafrost and Sediment input in modelling Risk Assessment Research and Development
Methodology to address sedimentation issues	Collaboration between large-scale infrastructure project and Academia for research and development
Additional input required for more holistic modelling	Incorporation of cumulative cascading effect, with dure consideration to micro-climatic changes

National-scale landslide susceptibility map of Nepal in a geospatial artificial intelligence (geoAI) framework

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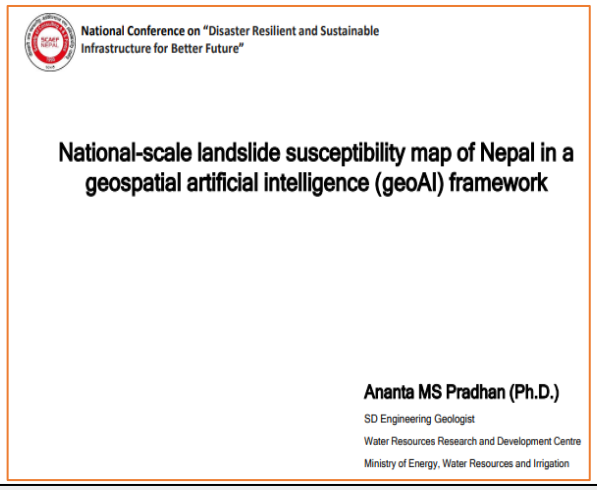

The presentation succinctly outlines how the institutional response from public entity against landslides is very poor, thus requiring a novel approaches that are required for the corresponding sensitization. While landslide mapping and zonation are the preliminary steps to achieve the objective, the author proposed application of burgeoning science of Artificial Intelligence, named as geoAI framework which could be instrumental for the quantization of landslide vulnerability. The basic tenet of geoAI framework rests on the observation that physical vulnerabilities are easier to quantify, and are therefore, more amenable to empirical verification.

The presentation was followed by an interactive question-answer session, which is summarized below:

Possibility of using satellite imageries to study local geology and formation below the surface	Satellite imageries cannot give information on the sub-surface geology
Possibility of procuring maps using the geoAI framework from the public entities	Maps will be uploaded in the website of WRRDC and can be obtained for free

Avenues of Innovation for Multi-hazard Resilience and Sustainability in the Sector of WASH Infrastructures in Nepal

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The presentation very vividly calls for the development of infrastructures which planning and design is governed by more integrated, holistic and futuristic approach. In the present context, it is very worthwhile to realize that the civil infrastructures can no longer be regarded as isolated developments, and must be viewed in the broader context consisting of overlapping layers of socio-economy, environment, geology, seismology etc of the region, thus calling for following approaches:

Holism: One of the tenets of system-thinking which is synonymous with holistic approach is the appreciation of the fact that "A whole is more than the sum of its parts". Civil infrastructures are no longer the isolated events and they have to be viewed to have multiple and unforeseeable impact on the different layers of the community.

Integration: For the development of resilient infrastructures, it is pivotal that they are liable to serve a broader spectrum of applicability. This will assist in ensuring that the developed infrastructures can operate in different spatial and temporal scales, thus ensuring their resilience and sustainability.

Futurism: This call for the incorporation of ever-evolving design philosophies, state-of-the-art research and state-of-the-art technology during optimization, planning and design phases such that the proposed infrastructures can be remodeled and contextualized with time.

The presentation was followed by an interactive question-answer session, which is summarized below:

Requirement of public entities to be more proactive in terms of innovation and dissemination of information

The organizational structure of the public entities is more sectoral, thus vertical; thus despite being in support of innovation, there is an unavoidable silo-effect.

Climate Resilient Infrastructure and Adaptation

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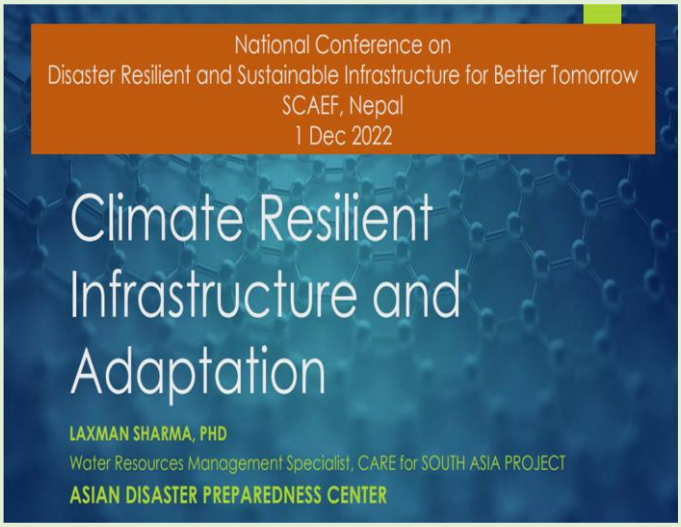
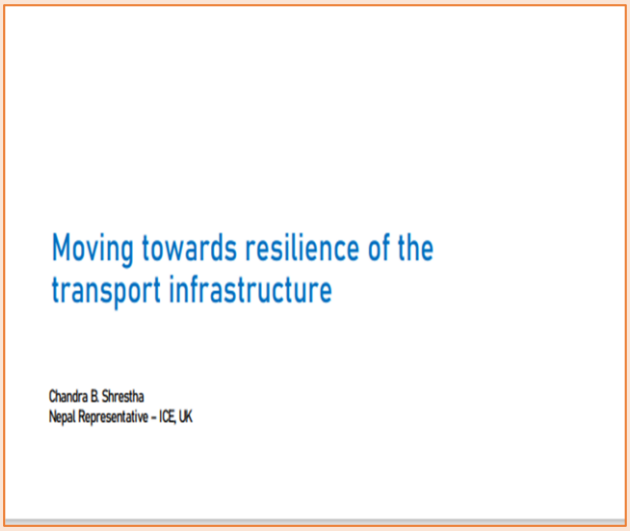


The presentation outlines how the Global Climate Models (GCM) provides broader framework for the assessment of more representative design parameters for the design of infrastructures, the models can be biased nonetheless based on the assumptions of the modelers, which can be sometimes intrinsically subjective. The author also focused on how risk, vulnerability, adaptation and resilience of the infrastructures are deeply correlated with the incorporation of robustness, redundancy, resourcefulness, adaptability and responsiveness in their design philosophy. The presentation also stresses on the fact that how the traditional design are based on the on probability distributions that hang on mean values, and therefore, are not suitable to predict the extreme event which are rapidly becoming commonplace. To reduce the subjectivity during the design phase, the presentation also stressed on the immediate need for the development of generic maps and standardized tables.

The presentation was followed by an interactive question-answer session, which is summarized below:

Indeterminacy of hydraulic variables due to extreme events	Need to follow the local trends and considering local situation as the datum
Increase in cost of infrastructure project with consideration to extreme events	Exploration of nature-based solutions to economize the increased cost

Moving towards Resilience of the Transport Infrastructure



The presentation outlines how the resilience of transport infrastructure such as rural road networks can be ensured with the incorporation of more robustness in their planning, layout and design. The incorporation of robustness is not only associated with proper hydrological, geological, seismicity etc studies, and also with the socio-politics and institutional arrangement of the area proper. For instance, development of unengineered roads, uncontrolled minings in the vicinity, larger and ad-hoc maintenance cycle are also equally culpable factors. According to the author, we can also learn from the fact that major bridges were not much affected during the major earthquake event of 2015. The methodology employed during the investigation, planning and design of those bridges can be a learning lesson for us for the development of more resilient transport infrastructures in future. However, according to the author, the most urgent need at the moment is to convert the science to implementable codes and engineering to avoid noise during the planning, layout and design stages, thus ensuring the development of more resilient infrastructure.

The presentation was followed by an interactive question-answer session, which is summarized below:

Assurance of voluntary resettlement → Provision of attractive packages, such as employment opportunities

Increase in cost of infrastructure project with consideration to extreme events → Exploration of nature-based solutions to economize the increased cost

Public entities need to address the reverse effects such as increase in flooding and landslides due to the construction of infrastructures.

Urban Resilience and Sustainable Development

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National Conference on Disaster Resilient and Sustainable Infrastructure for Better Future".

Presentation on

Urban Resilience and Sustainable Development

November 24, 2022

Surya Bhakta Sangachhe, Senior Urban Planner

Surya Narayan Shrestha, ED / Disaster Risk Management Expert NSET

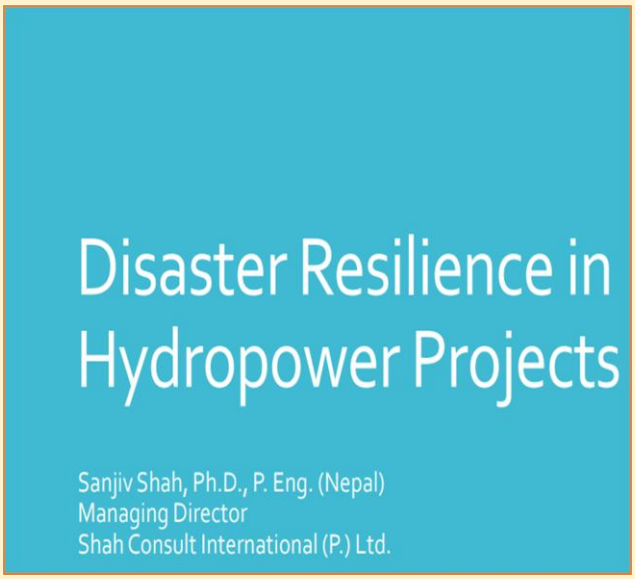
Suman Pradhan, Director, NSET

The presentation succinctly presents the very important fact that how the planning of infrastructures in urban setting are lagging sharply behind the rapid population growth of the city, thus affecting the resilience of the infrastructures in the long run. As per the author, the urban resilience can only be realized through proper decisions pertaining to investment, which is further backed by right kind of policy documents in place; for instance, Emergency Preparedness Plan, leadership and strategy, empowered stakeholders and by bringing in more focus on integrated development planning.

The presentation was followed by an interactive question-answer session, which is summarized below:

- Urban monoculture tends to make the economy less resilient
- Significance of vulnerability assessment for the urban resilience

Disaster Resilience in Hydropower Projects



The paper succinctly presents how hydropower projects are subject to various kinds of disasters, thus affecting their long-term resilience. The presentation delineate various hydropower projects as the relevant case studies for the same; for instance, river damming by debris flow in Chamelia HEP, devastation caused by debris flood in Upper Doedi "A" HEP resulting in lot of erosion, exposure of foundation, devastation by debris fllod in Melamchi WS Project (GLOF Event) etc. The paper aptly demostrated that how the resilience of hydro-power projects which form the major chunk of Nepal's infrastrucrues are getting severly compromised due to their elevate susceptibility to hydrological, geoloigcal and seismic events, thus calling for the practice of Design and Operation Approach. Similarly, the author suggested the application of Probable Maximum Outburst Flood (PMOF) instead of Probable Maximum Flood (PMF) for the hydraulic design of the associated structures.

The presentation was followed by an interactive question-answer session, which is summarized below:

Since there are not any proper tools/methodology available yet for the quantification of debris flow, a judicious assessment must be made based on the lessons learnt form the past.

Minimizing Anthropogenic Negligence in Triggering Disasters using Policy Instruments

The paper discusses case studies in a broad spectrum of disasters, which are generally initiated by human-induced activities thus resulting in loss of property and life. While it is presumed that the disasters are intrinsically natural, the paper was very vocal to raise the very important fact that even anthropogenic activities are equally liable to create, or to create the necessary condition that promote the disaster-related events. The following case studies were significant:

-Nagpuje, Barhabise where 26 houses were destroyed and 31 people died caused by the flooding resulting from improper drainage on the road upstream of the village

-Panchpokhari Thangal Municipality, Tipnee Villege where a disastrous landslide was caused due to disturbance to the stable slope during cutting

-Debris flow inside the Tunnel of Upper Modikhola HEP, Kaski

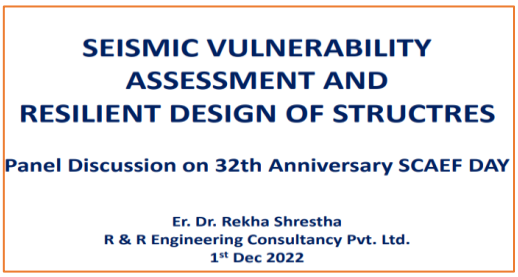
-Kalanga HP Project, Bhajang; people died due to lack of oxygen inside the tunnel

-Uttargaya HP, Rasuwa; water seeping from the canal caused landslides resulting in road damaged

Panel Discussion Session

With the successful presentation of the papers, the event was succeeded by a comprehensive panel discussion chaired by Dr. Amod Dixit, alongwith Ms. Rekha Shrestha, Mr. Chnadra Bahadur Gurung and Dr. Hari Krishna Shrestha. Dr. Chandra Bahadur Gurung discussed how the resilience of infrastructures amidst disasters can be addressed or not addressed within the Sendai Framework, and the necessity of National Reconstruction Authority to align their policies with the due regard to resilience. Dr. Gurung also stressed on the necessity of National Building Code revision to align the design and planning philosophy of the urban infrastructure to properly address the issue of resilience, with concurrent appreciation of the fact that land-use may play a significant role on that part.

This was followed by the presentation from Dr. Rekha Shrestha on significance of seismic vulnerability Assessment based on the assumptions and methodology of; 15988: 20B.



Dr. Hari Krishna Shrestha brought it to the attention of the participants that most of the disasters/hazards are intrinsically natural, but are created by anthropogenic activities and a proper care should be attributed to that part. He also stressed on the significance of academic research, and the necessity of proper bridge between the designers and the intended users of the planned infrastructures to ensure resilience. He also advised the public entities to include the proper collection and documentation of data as the integral part of Terms of Reference, and the necessity of modality to promote the project which simultaneously highlights conservation during their planning.

Panel Discussion Session

Requirement of policy to ensure that the constructed infrastructures are not in conflict with heritage

Serious concern on the Infrastructures being constructed on the same spot where the failure had occurred during the Earthquake

Need to bring in more focus on robustness of infrastructures to ensure resilience

Necessity of NBC 2020 revision to align the design methodology along the philosophy of resilience

Unsustainability of combined sewer system in urban setting

Need of due consideration to land-subsidence of Kathmandu valley

Evidence-based study of retention ponds in urban setting

Policy-level intervention to promote young graduates to increase their expertise

The panel discussion session was closed by Dr. Dixit with the following points articulated:

-Per unit cost of physical resilience must be proportionately reduced to ensure its long-term financial resilience
-Increased focus on urban drainage and land-use planning for better resilience
-Promotion to internship and corresponding changes in academic curriculum to properly sensitizer the young engineers on the topic of resilience
-Necessity of righteous advocacy for aligning the donor funding with the local needs
-Necessity of development of a rigorous methodology for heritage conservation