Role of Science and Technology for Building Disaster Resilience: Case Study from the National Research Institute for Earth Science and Disaster Resilience (NIED), Japan

Harnessing STI for Disaster Risk Reduction Workshop | Metro Manila, Philippines

29 February – 01 March 2024

Shohei Matsuura, PhD
Deputy Director-General, International Affairs Division, NIED
Japan is exposed to diverse range of natural hazards

Anticipated large-scale earthquakes in Japan

The Nankai Trough Earthquake

- Probability of an M8 to 9 class earthquake occurrence within 30 years: appx. 70%-80%

Trench-type earthquakes in the Vicinity of the Japan and Chishima Trench

Tokyo Inland Earthquake

- Probability of an M7 class earthquake occurrence within 30 years: appx. 70%

- M8 Class Trench-type Earthquakes

- Probability of an M8 class earthquake occurrence within 30 years: 0-6%

2023 July Kyushu flood

2023 January snowstorm

Sakurajima
Trust in STI has historically driven DRR in Japan

Takeda Shingen (1521-1573)

Normal Flow

Flooding Spills

Spills Recede

Kasumi-tei=Open levee

Flood control structures
In September 1959, more than 5,000 people were killed or went missing in a major typhoon (Ise Bay Typhoon).

In response, the government enacted the Disaster Countermeasures Basic Act (1961) to modernize disaster management in Japan. The establishment of the National Research Center for Disaster Prevention (predecessor of NIED) in 1963 and designation as one of the “Designated Public Corporations” was a significant part in promoting disaster science and technology in this process.
STI in the DRR structure in Japan

Reconstruction Agency (until 2031)

中央防災会議

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中央防災会議

内閣総理大臣

防災担当大臣と会合して全国の
防災事務を総合的に
管理し、各都府県知事と
協力して防災対策
を進めます。

専門委員会

災害対策実行会議

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★DRR academic expert group
- DRR experts
- Members of research institutes
- Medical association
- Journalist
- NGO/NPO

(Cabinet Office Japan, 2015)
# About NIED

**Name and President**

National Research Institute for Earth Science Disaster Resilience (NIED)

TAKARA Kaoru

**Employees**

324 (including 155 researchers)  *As of April 1, 2023

**Jurisdiction and Ministry of Education, Culture, Sports, Science Technology (MEXT)**

Under the values of "SCIENCE FOR RESILIENCE," NIED looks into multiple-hazards, during all phases of the disaster management cycle (response, recovery, mitigation/risk reduction, preparedness) to advance science and technology for DRR by conducting basic research and fundamental R&D with aim to protect human lives and assets from disasters for realizing a disaster resilient society.

https://www.bosai.go.jp/e
NIED HQ and Research Centers/Facilities

Snow and Ice Research Center, Cryospheric Environment Laboratory, Shinjo, Yamagata

Snow and Ice Research Center, Nagaoka, Niigata

Hyogo Earthquake Engineering Research Center, Miki, Hyogo

★Tsukuba HQ

Meteorological Observation System

Lifetime of cumulus and cumulonimbus clouds can be observed

Large-scale Rainfall Simulator

One of the world's largest facilities that realistically reproduces torrential rainfall

Three-Dimensional Full-Scale Earthquake Testing Facility

E-Defense

Check this out! 🔗

Check this out! 🔗
MOWLAS is an observation network for earthquake, tsunami, and volcano around Japan.

After the 1995 Great Hanshin-Awaji Earthquake, 2,100 seismographs were installed across the country to establish a land-based seismic observation network. When the Great East Japan Earthquake occurred in 2011, seismic and tsunami observation network (S-net) in the offshore areas of the Pacific Ocean was installed.

Data is shared in real time to the Japan Meteorological Agency (JMA) and other organizations for use in earthquake early warning and tsunami warnings.
Noto earthquake
1 January 2024
Basic Research Division
- Earthquake and Tsunami Research Division
- Volcano Disaster Resilience Research Division
- Earthquake Disaster Mitigation Research Division
- Storm, Flood and Landslide Research Division
- Multi-hazard Risk Assessment Research Division
- Snow and Ice Research Division
- Disaster Information Research Division
- Disaster Resilience Research Division

Center for Fundamental Research and Development
- Network Center for Earthquake, Tsunami and Volcano
- Center for Comprehensive Management of Disaster Information
- Center for Advanced Research Facility
- Center for Integrated Volcano Research
- Collaborative Research Center for Advanced Resilience Technology

★ Disaster Communication Operation Center set up at NIED (1 Jan)

- Monitoring and analysis of seismic activities
- Analysis by reproducing seismic motion by E-Defense and estimation of building response using numerical shake table
- Monitoring of landslide and debris flow post-EQ
- Aerial observation of disaster areas and establishing digital archive
- Analysis on distribution and characteristics of liquefaction
- Analysis of compound disaster of EQ and snowstorm
- Dispatching NIED staff to support Niigata Prefectural Government
  - Integration of information from satellite observations and multiple sensors for real-time assessment
  - Information sharing via SIP4D, bosaiXview, ISUT-SITE
  - Information sharing to first responders
- Response by local government and inter-municipality support system after the EQ
Portal of consolidated disaster-related information shared to the public:

- Road condition
- Living support points
- Activity status of NGOs, etc.
- Damage & loss assessment reports
- Communication infrastructure
- Water supply
- Satellite imagery
- Aerial photos
- Street view in affected areas
- Housing damage
- Temperature/Weather info
- Liquefaction
- Seismic intensity distribution
- Earthquake Rapid Report (J-RIDQ)
- J-SHIS Map (National Earthquake Hazard Prediction Map)
- Multi-hazard map

*bosai X view*

*The actual website is in Japanese*

https://shorturl.at/AOP37
<table>
<thead>
<tr>
<th>How we deliver STI for social implementation</th>
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<tbody>
<tr>
<td>1. Operation of observation network, advanced research facilities, information dissemination infrastructure</td>
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<tr>
<td>2. Development of information products to disseminate research outputs and application of intellectual properties</td>
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<tr>
<td>3. Promotion of co-creation by industry, government, academia and private sector</td>
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# How we deliver STI for social implementation

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<tr>
<td><strong>4.</strong> Support to disaster management operation for national and local government</td>
<td>![Image of disaster management scene]</td>
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<tr>
<td><strong>5.</strong> Capacity development through training and internship programs</td>
<td>![Image of training and internship program participants]</td>
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<tr>
<td><strong>6.</strong> International field research and collaboration</td>
<td>![Image of international collaboration]</td>
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NIED 5th Mid-term Goals (JFY 2023-2029)

NIED's Objective: Realization of Resilient Societies

R&D in various fields related to hazard and society
- Earthquake
- Volcanoes
- Rainfall
- Snowstorms
- Social

Observe and measure hazard and social data (sensing)

Integrate hazard data with social data
- Assessing hazard and risk initiatives for countermeasure and response
- Development of technology to integrate, visualize, and distribute research results
- Develop information products that support decision-making

Comprehensive R&D using digital technology

Application of R&D results to society by real world implementation

Research needs

Action Research

Society
Recommendation – TDA for DRR

Transdisciplinary Approach

Academia

Natural & Social Sciences

Humanities

Civil Society

Public sector

Private sector

Scientific Knowledge-based Decision Making

Holistic and Transformative Process of Building Resilient Society

Preparedness (Structural and non-structural)

Feedback

Mitigation Protection

Response Recovery Rehabilitation

Co-Design, Co- Produce, Co-Deliver, and Co-Implement

Source: TC21 Transdisciplinary Approach for Building Societal Resilience to Disasters, Asian Civil Engineering Coordinating Council (ACECC)
Recommendation – TDA for DRR

8-point check list

- DRR is seen as a holistic and cross-cutting issue
- Network with various stakeholders from wide range of disciplines
- Stakeholders collaborate from planning to implementation with aim to solve a common issue
- Scientific knowledge is tested and implemented in practice
- There are policies that support, encourage or requires TDA
- Budget is allocated to implement TDA
- There are capacity building programs to nurture future implementers of TDA
- Scientific knowledge is reflected in the policies

Earthquake, tsunami, volcanoes, violent winds, heavy rains, snowstorms, floods, and landslides are natural threats that will always exist. However, at NIED, we believe that disasters can be reduced. Therefore, we are constantly developing technologies and strategies to prepare for and respond to disasters. With better prediction, smarter prevention, and faster restoration, we aim to protect lives and livelihoods for a sustainable future.