



Report of the **APRU-IRIDES** Multi-Hazards Program 2016 Summer School







Association of Pacific Rim Universities



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19-22 July 2016

Tohoku University

Sendai, Japan

IRIDeS, Tohoku University

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The 4th APRU Multi-Hazards Summer School was held at Tohoku University on 19-22 July 2016. It brought together nearly 50 participants including students, faculty, and lecturers from 18 universities in 11 countries to learn the lessons-learnt and experience from the 2011 Great East Japan Earthquake and Tsunami and discuss the role of different stakeholders to implement the Sendai Framework for Disaster Risk Reduction (SFDRR) adopted at the UN World Conference on Disaster Risk Reduction (UNWCDRR) held in Sendai in March 2015.

The APRU-IRIDeS Multi-Hazards (MH) Program was initiated in April 2013 by the Association of Pacific Rim Universities (APRU) and the International Research Institute of Disaster Science (IRIDeS), Tohoku University aiming at harnessing the collective capabilities of APRU universities for cutting-edge research on disaster risk reduction (DRR) as well as contributing to international policy making processes on DRR. The Summer School is one of the key activities under the MH Program.

APRU is a network of 45 premier research universities from 16 economics around the Pacific Rim. Currently, APRU members together have around two million students, 120,000 faculty members and research capabilities related to the key challenges facing the region. APRU seeks to advance the aspirations of its members and contribute to global society by: 1. Shaping Asia-Pacific Higher Education and Research; 2. Creating Asia-Pacific Global Leaders; and 3. Partnering on Solutions to Asia-Pacific Challenges.

IRIDeS in Tohoku University was established in April 2012 as a new integrated interdisciplinary research team. Together with collaborating organizations from many countries and with broad areas of specializations, IRIDeS conducts world leading research on natural disaster science and disaster mitigation leaning from and building upon past lessons in disaster management from Japan and around the world. IRIDeS also provides secretariat services as the regional program hub to the MH Program.

The key activities of the MH Program include:

- Organization of the annual summer school
- Organization of the annual APRU MH Symposium
- Foster collaboration in disaster research and information/data sharing between APRU universities
- Contribute to DRR discussions at international and regional levels and to a policy making process.

APRU and the APRU MH Program focus on strengthening the capacity of international collaborative research and influencing the policy-making process to make the best use of their strong technical expertise and knowledge of global and regional issues. The Program

Coordinator of the APRU MH Program has been a member of the UNISDR Asia Science and Technology Advisory Group (ASTAAG) since May 2015, participating in and contributing to discussions especially on the application of science and technology in the implementation of the SFDRR. For instance, the APRU MH Program has advocated the importance and need for disaster preparedness capacity on campus, and this recommendation was included in the outcome document of the 1st Asian Science and Technology Conference on Disaster Risk Reduction (ASTCDRR) as a suggestion of the Asian action by a science and technology society to implement the SFDRR.

APRU and the MH Program will continue activities that contribute to the implementation of the SFDRR and enhance the research capacity and education of disaster science in the region. In order to do that, international and regional collaboration with various stakeholders is crucial, and APRU and the MH Program seek to expand their network especially through collaboration with UNISDR and ASTAAG.

ACKNOWLEDGEMENT

IRIDeS as the main organizer of this summer school would like to extend a sincere appreciation to the participants and speakers from different sectors who shared wonderful experiences and knowledge regarding DRR issues from different perspectives. Their involvement and participation made a great contribution to the success of this event. In addition, IRIDeS received tremendous support from the APRU secretariat based in Hong Kong as well as Tohoku University. The organizer is also grateful for valuable suggestions and advices provided by the faculty members of IRIDeS on the program development and planning.

Lastly but not least, this summer school was never implemented without hard works and considerable support by the International Exchange Division of Tohoku University, the Administrative Office of IRIDeS, and the International Regional Cooperation Office of IRIDeS.

OPENING REMARKS



Prof. Susumu Satomi

President of Tohoku University

It is a great pleasure for me to welcome you to Tohoku University for "APRU-IRIDeS Multi-Hazards Summer School Program". I am pleased to meet all of you who gathered from various countries for this event.

It has been already 5 years since the Great East Japan Earthquake and Tsunami happened on March 11, 2011. Due to the warm support from all over the world, the recovery efforts have greatly progressed. Tohoku University has been also playing an important role in the recovery process. You will visit Tagajo city and Natori City on 21 July and can see their recovery efforts. I hope this summer school will give you an opportunity to consider and discuss what we can do to strengthen the disaster risk reduction capacity.

The establishment of the International Research Institute of Disaster Science (IRIDeS) under Tohoku University is one of our commitments to share our knowledge and experiences globally. IRIDeS also launched the Multi-Hazards Program together with APRU in April 2013. Since then, IRIDeS became the program hub and coordinates the program activities. This summer school is one of the major events under the Multi-Hazards Program.

In March 2015, the UN World Conference on Disaster Risk Reduction was held in Sendai. More than 10,000 (ten thousand) people participated in this event. Tohoku University made significant contributions to this Conference by participating in its preparation and organizing many events. At the end of the Conference, "the Sendai Framework for Disaster Risk Reduction" was adopted. It will be a guideline for the implementation of disaster risk reduction in the next 15 years. I expect that you will discuss universities' role and contribution in its implementation process during this Summer School.

After the World Conference, Tohoku University established the Global Center for Disaster Statistics in collaboration with the United Nations Development Program (UNDP). The objectives of the Center include: developing national systems of disaster statistics and monitoring disaster reduction targets and indicators of the Sendai Framework for Disaster Risk Reduction. Also, the World Bosai Forum will be organized in November 2017 in Sendai to share good practices and knowledge on disaster risk reduction and to discuss the implementation of the Sendai Framework for Disaster Risk Reduction with various stakeholders.

To conclude, I would like to thank the APRU secretariat for their kind support and cooperation. I wish you every success for this summer school program. Thank you.

Prof. Fumihiko Imamura

Director, Prof. of Tsunami Engineering, IRIDeS, Tohoku University

Good morning, everybody, dear participants and distinguished guests, Professor and President Satomi, and Mr. Keith Wong, the Director of the APRU International Secretariat, and dear guests. We are so happy to have the Summer School, with more than 40 participants and 10 lecturers, and many supporters, coming here to Sendai. I am Fumihiko Imamura, the Director of IRIDeS and also a Professor of Tsunami Engineering. I have been studying the technology and sciences to reduce tsunamis for more than 30 years. But as you know, in 2011, the earthquake generated a large-scale tsunami, which affected the coastal area of Japan and also other areas around the Pacific Ocean. More than 20,000 people died, mostly by the tsunami. That is why we have many issues to cope with, including the experiences and lessons learned from the 2011 earthquake and tsunami. So, we are here to start new interdisciplinary research at IRIDeS, to cover not only natural sciences but also human, social, and other sciences, including medicine, to save lives from disasters. Here you are in the new building, just two years old, with good facilities: a seismic isolation function and 72 electric power generating systems. I can say that this is safer than others places in Japan.

As President Satomi said, last year in 2015, we had a large conference to discuss how we can mitigate disasters and risks, with many participants, including the Secretary-General of the United Nations and many distinguished guests and representatives of countries; 150,000 participants were here to discuss disaster risk reduction, or DRR, and we achieved a new framework, which is the Sendai Framework for DRR. We follow this framework, and we are again working hard to mitigate disasters. That is why this time, the Summer School aims to achieve three goals. The first is to understand the mechanism of the international DRR strategy. The second is to learn from the experience and recovery process of the 2011 Tohoku Earthquake and Tsunami, through lectures and also by visiting the affected areas, Natori and Tagajo. The last goal is to discuss the role of science and technology as well as universities in the implementation of the Sendai Framework for DRR. I hope you enjoy the four days, lectures, and visits to the affected areas, as well as the discussions with other participants. I am expecting many outputs from the experiences and learning at the Summer School. Thank you very much.

Mr. Keith Chi-ho Wong

Director (International Secretariat), Association of Pacific Rim Universities (APRU)

President Susumu Satomi, Vice President Toshiya Ueki, Vice President Nobuyoshi Hara, Director Fumihiko Imamura, honourable speakers, APRU colleagues, and distinguished guests,

Good morning. On behalf of APRU Secretary General Christopher Tremewan and the APRU International Secretariat, I am most delighted to welcome our colleagues, fellow researchers and students, government officials, and industry practitioners from Japan and all parts of the Asia-Pacific region to join the 4th APRU Multi-Hazard Summer School here at Tohuku University in Sendai.

At its 4th running of the Summer School, the International Research Institute of Disaster Science (IRIDeS) have shown their strong dedication, diligence, and professionalism in sustaining international collaboration and furthering scientific research. Over the past three years, we have seen how the APRU Multi-Hazard Program advanced so much ground on knowledge creation and experience sharing with regard to disaster management, preparedness and recovery. And the Program has succeeded in bringing these findings to a much broader constituency, not just through activities such as Summer Schools, Symposia and Workshops, but also through collaborations with international organizations such as the United Nations and Asia-Pacific Economic Cooperation (APEC), and participation in many other international conferences and publications.

As the new Director of the APRU International Secretariat, I am pleased to announced that the International Secretariat has completed its relocation from Singapore to Hong Kong with a new team of staff, and we are now ready to step up our efforts to advance APRU's collective efforts. And as APRU and Tohuku University take on a new 3-year partnership, we are working very hard to explore all different angles and opportunities where we can bring more resources from various partners, and to broaden our collective impact through different channels and means.

Again, may I express my most sincere gratitude to Tohuku University and the IRIDeS for putting in so much efforts to keep the Multi-Hazard Program running and making more farreaching impacts. In particular, I would to thank Prof. Imamura, Prof. Takako Izumi, and all the colleagues at Tohuku University and IRIDeS for their keen and continuous support to APRU's joint efforts.

May I convey my best wishes for a productive and successful meeting. Thank you.

PRESENTATIONS









Why does IRIDeS take a multidisciplinary approach to large scale disasters?

Makoto Okumura

Deputy Director / Professor, IRIDeS, Tohoku University



The IRIDes was established in 2012, one year after the Great East Japan Earthquake and Tsunami (GEJET) in order to share our experience and lessons learned from the disaster. In Japan, there are three disaster institutes under major universities, namely the Earthquake Research Institute under the University of Tokyo, the Disaster Prevention Research Institute under Kyoto University, and the International Research Institute for Disaster Science (IRIDeS) under Tohoku University. Such institutes are normally established after a large disaster. One of the focuses of the IRIDeS is to prepare for disasters of low frequency and high consequences (LFHCD).

IRIDeS aims to conduct interdisciplinary research. As one of the methodologies, IRIDeS actively focuses on expanding the time scope of research to examine LFHCD drawing on different areas of research such as history (historical documents), geology (tsunami sediments), seismology, and tsunami engineering in collaboration with various universities, institutions, and organizations all over the world.

In order to manage risks for LFHCD, it is important to understand the mechanism of Hazard, Exposure, Vulnerability, and Resilience. To reduce vulnerability, it is crucial to build facilities that are physically strong, i.e., with anti-seismic structure. The second strategy is to decrease exposure by using land-use control. Thirdly, by increasing good preparedness capacity among communities, such as effective response and disaster insurance, it is possible to increase community resilience for recovery as quickly as possible. A combination of these strategies is required to reduce disaster risks.

For the above actions, three strategies are necessary: prevention (reducing vulnerability through natural science and engineering), aversion (decreasing exposure through social science, behavior science, and urban planning), and mitigation (increasing resilience through social science, economics, and medical science). In order to implement interdisciplinary approaches and research, IRIDeS includes 7 divisions and 37 research areas that cover broad areas of disaster science including Hazards and risk evaluation, Disaster information management and public collaboration, Disaster medical science, Disaster science, an Endowed research division, Regional and urban reconstruction, and Human and social response.

The projects and research that IRIDeS has been conducting include The Michinoku Shinrokuden, a collaborative archive project made up of 120 organizations from industry, government, academia, and the private sector. Its purpose is to document images of GEJET as it happened. Also included is The Kakeagare Japan, which aims to habitualize evacuation behavior in preparation for a tsunami while tackling regional problems based on the lessons learned from GEJET. Tsunami evacuation drill programs are being planned and implemented in collaboration with various stakeholders.

IRIDeS made a great contribution to the United Nations World Conference on Disaster Risk Reduction (UNWCDRR) and the preparatory process in the Sendai Framework for Disaster Risk Reduction (SFDRR) in the last three years following its establishment. The second phase of the Institute began in April 2016, and IRIDeS identified the importance of "a needs-oriented approach" and taking a pro-active action. For that purpose, it established six areas (5 fundamental research areas: Medical science and system for multi-hazard disasters, Resilience engineering, Support and response technologies, Disaster archive

and education, and Mechanism of large earthquakes and tsunamis; and 1 applicative research area: Comprehensive disaster mitigation system implementation).

IRIDeS has been also contributing to higher education of disaster management. Tohoku University established the Inter-graduate School Doctoral Degree Program on the Science of Global Safety with the support of the Ministry of Education, Culture, Sports, Science and Technology (MEXT). The Program collaborates with different graduate schools such as Science, Engineering, and Arts as well as IRIDeS. It aims to train internationally prominent researchers in the field of disaster management.



Enhancing community-based DRR and role of schools based on lessons learnt from the 3.11 disaster

Aiko Sakurai

Associate Professor, IRIDeS, Tohoku University



In Japan community disaster management organizations (CDMOs) are legally designated for community disaster preparedness in the 1995 revised Disaster Countermeasures Basic Act. Though the government has promoted increasing organization ratio of CDMOs, these CDMOs have not recently much been active due to declining population and aging society, and they are volunteer-based. One of lessons learnt from the 2011 disaster showed that member of the community are primary responsible for the community's DRR efforts, and that school-community collaboration should be reinforced for effective community-based disaster response.

In the 2013 revision of the Disaster Countermeasures Basic Act added new clauses on introducing a system of Community Disaster Management Plan in line with the national, provincial and municipal disaster risk management plans. One of the most important idea of the Community Disaster Management Plan is to encourage community residents to identify issues and concerns in their own community related to DRR according to the area's local context, and to develop their disaster risk management plan as possible solutions.

In that context, school has a potential to raise children as an active community member on DRR in the future. "Reconstruction and Disaster Prevention Mapping Program", which is composed of townwatching and map making and have been implemented in Ishinomaki City, Miyagi Prefecture since 2012, is one of approaches for the school children to understand their community's damage by and recovery from the 2011 disaster, and to raise their awareness toward the community's reconstruction and disaster preparedness. The program has a potential for school children to link damages by the disaster to geographical features as well as history of community development including land-use if the learning contents could be customized at each school's local context Teachers are generally not from the local community and are transferred to another school regularly. For developing a resilient community with capacities to cope with and recover from disasters, it is necessary to improve community disaster preparedness through disaster education with the cooperation of the whole community including children, parents, teachers, and the community disaster management organizations.







Geological and historical evidence of paleotsunami

Kazuhisa Goto

Associate Professor, IRIDeS, Tohoku University



The 2011 Tohoku earthquake (Mw=9.0) was extremely large and the consequent tsunami reached approx. 40 m in height along the coast. The earthquake and tsunami were indeed large but, before this event, geological and historical researches had revealed possible occurrence of large events in the past along the Pacific coast of Tohoku. In fact, it had been well known that AD869 Jogan earthquake and tsunami was outstandingly large. Similar size of earthquake and tsunami might have been occurred few hundred to thousand years' interval according to the previous works.

In order to prepare for low-frequency but large events, it is very important to recognize earthquake and tsunami histories in the past. Memories and measurement records can be useful to know the events that were occurred last \sim 100 years while information from history, archeology, geology, and geomorphology is important to recognize low-frequency but large events over \sim 1,000 to 10,000 years or more.

After the 2011 event, policy for the tsunami risk assessment in Japan was changed: the national government issued new guideline for tsunami disaster prevention plans and they recommended to prepare for the "maximum possible earthquakes and tsunamis". However, how to assume "maximum possible earthquakes and tsunamis" is problematic because sizes of past events may not necessarily be the maximum in the future. Quick consideration of maximum possible earthquakes and tsunamis may indeed require at high-risk areas but appropriate assumption with science basis is important.

The issues that arise after the 2011 event in Japan are probably not only the case in Japan but also the case to the other countries along the subduction zones. In fact, tsunami recurrence has been investigated along the high-risk areas (e.g. Pacific coast of North America and Chile, and Indian Ocean countries). It is also important to recognize that tsunami can be generated by non-seismic triggers such as submarine landslide, volcanic eruption, and asteroid impact.

In summary, large tsunamis were occurred very low frequency with few hundred to thousand years' interval. However, once such event occur, severe damage will be generated. Geological and historical researches may not be practical for countermeasures against large tsunami, but knowing the past events from these researches is the basis for future preparation. The 2011 event was not an unexpected hazard among geologists and many other regions in the world are "at-risk" in the geological sense. There are many areas where paleotsunami history has not been studied well so that studying in such area will be very important to further reduce the tsunami risk in the world.





Kheo Lek, Theilend



Follow up work on the Sendai Framework for Disaster Risk Reduction

Yuichi Ono

Professor, IRIDeS, Tohoku University



Japan hosted the Third UN World Conference on Disaster Risk Reduction in 2015 in Sendai. The outcome, the Sendai Framework for Disaster Risk Reduction (SFDRR) was adopted by 187 countries, and will be effective for the next 15 years.

The SFDRR set forth seven global targets.

(a) Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared to 2005-2015.

(b) Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared to 2005-2015.

(c) Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030.(d) Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030.(e) Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020.

(f) Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this framework by 2030.

(g) Substantially increase the availability of and access to **multi-hazard early warning systems** and disaster risk information and assessments to the people by 2030.

Discussions on the indicators of the targets are still ongoing. The final confirmation is scheduled to be announced later this year.

Tohoku University commits to the SFDRR through the Global Centre for Disaster Statistics, established with UNDP in April last year. The role of this organization is to collect and analyze data, and to provide feedback to governments. There is no such mechanism yet in the world, so we are committed to assisting the SFDRR in this way. Further, Tohoku University also plan to organize the "World Bosai Forum"/IDRC 2017 in Sendai" on November 25-27, 2017. The objectives of the Forum include: promoting the implementation of the SFDRR, exploring Japanese experiences on DRR and observing the recovery process of the Tohoku Region, and exploring and developing business opportunities in DRR. The Forum will be a venue to spin knowledge from disasters and weave wisdom of DRR into society.

Sendai Framework for Disaster Risk Reduction 2015-2030

Adopted by 187 countries at the World Conference on Disaster Risk Reduction, 18 March 2015

I. Preamble

II. Expected outcome and goal

Seven targets

III. Guiding principles

IV. Priorities for action

Priority 1: Understanding disaster risk Priority 2: Strengthening disaster risk provenance to manage disaster risk Priority 3: Investing In disaster risk reduction for resilience Priority 4: Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction

V. Role of stakeholders

VI. International cooperation and global partnership

Targets

17. To attain the expected outcome, the following goal must be pursued:

Prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience.

The pursuance of this goal requires the enhancement of the implementation capacity and capability of developing countries, in particular the least developed countries, small island developing States, landlocked developing countries and African countries, as well as middle-income countries facing specific challenges, including the mobilization of support through international cooperation for the provision of means of implementation in accordance with their national priorities.

1. Global Centre for Disaster Statistics

Launch of the Global Centre for Disaster Statistics during the WCDRR in Sendai (15 March 2015)







How to make a healthy resilient community

Shinichi Egawa Professor, IRIDeS, Tohoku University



Disaster and Disease have many common features. Disaster is defined as an emergency in which the humanitarian needs are beyond local capacity to meet those needs i.e. the response and recovery operation must be managed at the national and/or international level. Disaster risk is calculated by the following equation: Risk = Hazard x Vulnerability / Capacity. Similar approach to decrease the disease risk can be applied to disaster risk reduction. International commitment for disaster risk reduction (DRR) was crystalized into the Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR) in the World Conference for DRR in Sendai March 2015, in which "health" was greatly incorporated.

On Mar. 11, 2011, Great East Japan Earthquake (GEJE, M9.0) and Tsunami attacked the Tohoku Area, North-east part of Japan and killed more than 18,000 people. Japanese health professionals established the disaster medicine and public health response system that includes Disaster Base Hospitals (DBH), Disaster Medical Assistant Teams (DMAT), Staging Care Unit (SCU) and Wide Area Transportation System, Emergency Medical Information System (EMIS) and Disaster Medical and Public Health Coordinator. These system is managed by the Ministry of Health, Labour and Welfare after experiencing the number of crush syndromes and preventable deaths at Hanshin-Awaji Great Earthquake in 1995. The medical needs of the affected people in 2011, however, was very different from that in 1995 as a result of DRR due to Tsunami and NPP accident. The needs for non-trauma, non-communicable disease and mental health overwhelmed. The vulnerability of the hospitals in the affected area revealed that every hospital and health professional should be prepared for disaster to receive support and provide the local health care in disaster. Thus, after GEJE, the disaster medical coordinator was rapidly assigned in prefectures with nation-wide establishment of Disaster Psychiatric Assistance Team (DPAT), Disaster Rehabilitation Assistance Team (DRAT), Disaster Health Emergency Assistance Team (DHEAT) and oral health care support.

Disaster always exceeds the expectations, but the pre-disaster assessment and improvement of resilience of the health-care system can save the life and the quality of life of people both mentally and physically.

In order to promote the health aspect of Sendai Framework, Bangkok Principles were agreed in March 2016, to enhance the following seven items:

- 1. Health to DRR, DRR to health.
- 2. Cooperation between health and other stakeholders for DRR
- 3. Stimulate people-centered investment in DRR including health
- 4. Integrate DRR into health education and training, health into DRR.
- 5. Disaster data and health data into risk assessment.
- 6. Advocacy and support by science, information and technology
- 7. National policies and strategies for DRR and health

The scientific analysis of the relationship of health factors and disaster risk needs further advancement. The life expectancy at birth by World Health Organization (WHO), for example, correlates well with the disaster risk by Index for Risk Management (INFORM) as shown in the Fig. 1 and most reflects the coping capacity as shown in Fig. 2.



Fig. 1: WHO life expectancy and INFORM disaster risk of 182 UN member states

INFORM disaster risk (data source: INDEX FOR RISK MANAGEMENT RESULTS 2016, http://www.bestliferates.org/blog/life-expectancy/) WHO life expectancy at birth (data source: WHO Global Health Observatory 2016, http://apps.who.int/ gho/data/node.main.688?lang=en)



Fig. 2 Life expectancy and the factors of disaster risk

INFORM disaster risk (data source: INDEX FOR RISK MANAGEMENT RESULTS 2016, http://www.bestliferates.org/blog/life-expectancy/) WHO life expectancy at birth (data source: WHO Global Health Observatory 2016, http://apps.who.int/ gho/data/node.main.688?lang=en)

It is important to understand the notion of SFDRR and implement it. But, at the same time, we also have to think about what the life is and how we can manage our community to have a better, healthier life. Collaboration, coordination and transdisciplinary approach is a key to promote mutual understanding of countries, clusters and each individual.

Repeated failure of humanitarian logistics for recent disasters in Japan

Makoto Okumura

Deputy Director / Professor, IRIDeS, Tohoku University



1. Kumamoto Earthquake and essential supplies for refugee

Two large earthquakes hit Kumamoto area on 14th and 16th April 2016 with interval of 28 hours and people in Kumamoto city and vicinities faced to difficulties for life. Full, half and partly damaged residential buildings were 8,184, 29,447 and 137,111, respectively. 311 public buildings including the municipality headquarters of Uto, Yatsushiro, Mashiki, Ozu were damaged to be unusable. Total refugee in Kumamoto Prefecture reached up to 184 thousand on 17th, at 859 designated shelters. That number is 22 percent of total inhabitants (847 thousand) of 9 severely affected municipalities (Mashiki, Nishihara, Minami-aso, Aso, Kumamoto, Mifune, Kashima).

Besides the refugee in the designated shelters, many people afraid to stay in their affected house aftershocks and chose to sleep in car instead. Those car refuge was not included in the number above. **Figure 1** gives two examples of message from the refugee in unregistered shelter, appealing emergent delivery of food, drinking water. Similar shortage occurred for car refuge, and such situations were reported swiftly and widely through social network service (SNS) such as Facebook, LINE, and so on.

Responding to those messages, some of them were from famous TV talents, many people in other area personally tried to send food, water and other goods for life in small lot size. Because of home delivery services to Kumamoto Prefecture area by Yamato, Nittsu, Japan Post, and so on had suspended for weeks, senders rent truck or wagon personally and drive to Kumamoto. As a result, those individual traffic consumed the limited highway capacity to the affected area.

Though food or other goods were not arrived to each people in the affected area, shortage did not occur in Kumamoto Area in wider point of view. **Figure 2** shows plenty of arrived goods in front of Kumamoto Prefecture Office Building on April 19th. The real problem was not shortage of goods, but abundance of goods exceeding the local capacity of sorting for delivery.

Figure 1. Message from refugee of Kumamoto Earthquake (April, 2016)



Characters made by chairs on the playground April 17. "SOSI Paper, Bread, Water needed" Kokufu High School in Downtown Kumamoto City (Kyodo.NP)

Characters written on parking of a elderly care facility in Mifune Kumamoto. April 17. "Rice, Water, Preserve food, HELP" (Kyodo.NP)

Figure 2 Plenty of goods in Kumamoto (April 19)



Plenty of goods arrived in front of Kumamoto Prefecture Office (April 19)

2

2. Repeated Failure of Humanitarian Logistics in Recent Disasters

If we review the recent large natural disasters in Japan after 1995, abundance of relief goods problem and overlook of the relief for affected people at house or un-designated shelters were repeated again and again. Only one exception was the first several weeks after the Great East Japan Earthquake and Tsunami, where both interregional and local logistics systems faced to difficulties such as, fuel shortage, stoppage of telecommunication and shortage of goods were observed. In more recent disasters , such as Hiroshima earth slides (2014), Kinugawa River flood (2015), and Kumamoto Earthquake (2016), relief goods were abundant in distribution center inside the affected area. **Figure 3** shows an example of Hiroshima case (2014).

Figure 4 summarizes relief logistics flows in Japan. Until GEJE,2011, Japanese Act of Disaster Management, consider that relief goods supply work be under the responsibility of municipality government (black arrows in Figure 4). Prefectural government takes role instead only when municipal government is severely affected and lost the management ability (orange arrows in Figure 4); freight transportation is still delivered in type of cargo to the Municipal Depots, where sorting work should be done in order to match them to local needs. However, in many disasters before 2011, function of municipal depot could not sustained and cargos inflated fast there. In GEJE, 2011, Prefectural government decided to place Prefectural Depots for sorting work (orange dashed arrows in Figure 4). However sooner, the National government found that affected prefecture government cannot sustain their role to control the orders, then part of the Cabinet Office settled a special team for logistics and conduct the ordering work instead the prefectures (red arrows in Figure 4). The nationally ordered goods transportation was also headed to Prefectural Depots, but most of them were filled up by the arrived cargo, in weeks.

In the reviews of the National government after GEJE, they understand the limit of sorting capacity of both municipal and prefectural depots in the affected area. As a preparation for the possible large earthquake in Tokyo, the Cabinet Office began to investigate a push logistic system, where arranging facility will be placed outside the affected area, and the sorted goods will be directly transported to the refugee camps, shelters and hospitals in the affected area. That new system (double lines arrow in Figure 4) was introduced firstly after the Kumamoto earthquake (2016), using logistics centers of Nittsu in Tosu city, Saga prefecture, and of Yamato in Hisayama town near Fukuoka Highway interchange in Fukuoka prefecture as the sorting facility outside. The Cabinet office disclosed a short report of the system in Kumamoto in July, and evaluate the trial as successful one.



 Xthine Ketter (Kither Fill)
 避難場所には、大量の物資が・・・。

 Really needed:
 Report by a School Principal in Hiroshima

 High Pressure Cleaner, Sand bag kit
 3



3. Discussion

Many people including specialists indicated the difficulties in local transportation using "The last mile problem." It is true the last mile needs much of transportation resource such as trucks, vans, drivers, fuel, and so on. But even there were sufficient transportation resources, the last mile problem could not be solved, because the essential difficulty is lack of information. We cannot easily get information for the needs of individuals, even in ordinal situation. Then we rely on the individual choice at stores and the last mile transportation is usually done by individual customers. Considering this, we must be modest to rely the relief logistics system, and permit qualitative mismatches to the people's needs. We should give priority on speed, not on equality. We can make piles of undelivered goods in several locations and permit the taking outs freely; it means we rely the personal transportation for the last mile transportation part.

Secondly, many people also highly evaluate the performance of professional logistics specialists in management of sorting facilities and depots. They can use special machines such as forklift, and arrange the place efficiently (as shown in Figure 5). However, their good performance is based on prior information especially from upstream actors, concerning on what, how much and when the cargos arrives next, and when that cargo will go out from the facility. based on those information, they can make a location plan (**Figure 6**). Not only the information from downstream, that is information of local needs, but also the information from senders should be collected. Good-will sending good and voluntary donations usually lacks the "upstream information", then may increase the confusion of the local depots.

At last, continuation of ordinal commercial logistics is much more important than relief logistics. In Kumamoto case, the evacuated people are only 20% of the residents in the affected area. It means, 80% of the residents relied on the ordinal commercial service. Basically speaking, commercial business can more efficiently correspond to the diversified and sophisticated needs of people. It is important to facilitate a return to the commercial based supply, from the distribution of relief supplies. Swift recovery of commercial logistics is the first priority.

Figure 5. Professional depot management

[Depot in disaster area] (★ineffective Handling)

- Handling by non-professional
 No carrying instruments
 No space for transport
 Naïve Place allocations
 Unclear signage





- Signs and plates



(By Prof. Kuwahara, Tohoku University)

5

Figure 6. Information from upstream

- For a smooth operation of distribution depots, it is necessary to get information about in what timing, what goods and how much being brought in, in advance.
- In the normal time logistics, the administrator obtain such information from information systems such as POS systems, and arrange personnel and space necessary on the basis of them.



Restoration and Challenge of Sendai Towards a Disaster-Resilient and Environmentally-Friendly City

Akira Takahashi

Director, Disaster-Resilient and Environmentally-Friendly City Promotion Office, City Planning Policy Bureau, City of Sendai

Overview of Damage from The Great East Japan Earthquake

On March11, 2011, Sendai City was struck by a tremendous earthquake with a magnitude 9.0, which is the largest earthquake in Japan's recorded history and the 4th largest earthquake in the world since 1900. A huge tsunami followed, for the first time in 400 years in this area.

Sendai City incurred the following damage.

- Around 900 people lost their lives in the earthquake and tsunami
- Around 30,000 buildings in the city completely collapsed
- Cost of damage is approximately 1.3829 trillion yen (\$12.6 billion \$1=\110)
- 1.37 million tons of debris from the earthquake and 1.35 million tons of debris deposited by the tsunami. (The disposal of debris was completed in December 2013)

Overview of Restoration

Sendai created a minimum five-year restoration plan for its disaster-affected areas. Our main mission is to rebuild housing for those who lost their homes during the earthquake and to develop a safe urban infrastructure that will stand-up to another tsunami.

- Collective relocation for those people who had their homes damaged by the tsunami
- Restoration of inland areas damaged by landslides
- Cleaning debris, desalinization and reclamation of the land for the restoration of agriculture



Strengthening Disaster Prevention Measures

Sendai combined the following three measures to create a plan to prepare in case another tsunami was to hit.

- (1)Multiple defenses (2) Evacuation to save lives (3) Relocation

In addition, based on the lessons learned from the earthquake, we have implemented several disaster

prevention measures.

- Volunteer disaster prevention organization at community level
- Introduction of solar power generators and storage batteries in evacuation centers
- Strengthening our infrastructure
- More practical drills and disaster prevention education

Passing on Experiences and Lessons of the Disaster

Along with the initiatives carried out during this period, Sendai aims to thoroughly convey the experiences and lessons learned from the disaster to people in Japan and abroad, and to contribute to the prevention and reduction of disasters globally as the city that produced the Sendai Framework for Disaster Risk Reduction 2015-2030.

- Developing memorial facilities
- Sending out the civic cooperation initiatives for disaster prevention
 (e.g. holding "Sendai Symposium for Disaster Risk Reduction and the Future)

Aiming to Make Sendai a Disaster-Resilient and Environmentally-Friendly City

Based on the three pillars of our concept, Sendai aims to build a disaster-resilient city, bracing for threats such as natural disasters and climate change.

- Urban development
- Human capacity building
- Contributing to world's disaster prevention culture and establishing a city brand





Towards disaster risk reduction city: A disasterresilient Tagajo City

Takumi Fujimura

Bureau of Reconstruction Promotion, Office of Mayor, Tagajo City



Tagajo City is located in the eastern region of Miyagi Prefecture near Sendai City, about 12 kilometers away from central Sendai, with a population of 62,000. Tagajo City was greatly damaged by the Great East Japan Earthquake and Tsunami in 2011. The tsunami hit the city approximately one hour after the earthquake. The highest wave reached 4.6 meters. One-third (662 ha) of the city was inundated by water, and about 12,000 people fled to evacuation sites such as schools.

A severe and inconvenient evacuation life started. As a result of the tsunami, a total of 188 precious lives were lost, and over 11,000 houses were destroyed in the city. Factories and offices in the industrial area were almost totally destroyed. Before the Great East Japan Earthquake and Tsunami, it was estimated that there was a 99% probability of an earthquake within 30 years off the coast of Miyagi Prefecture. Therefore, citizens were relatively prepared for earthquakes, and most were aware of how terrifying tsunamis were. At the same time, however, most people knew that Tagajo City was never affected by tsunamis in the past, and thus adopted the mentality that Tagajo would be unaffected even after the large-scale tsunami warning was issued. As a result, some people did not evacuate quickly, and others who evacuated by cars were caught in traffic jams, causing many injuries and loss of lives.

There are four major points in the DRR city strategy.

- 1. "Developing a disaster-resilient city." Four strategies have been drawn up, centering on the construction of infrastructure.
- 2. "Increasing DRR capability based on self-help and mutual help." Two strategies have been implemented so that citizens and local communities can cope with disasters by themselves, rather than depending fully on local administrations.
- 3. "Sharing disaster experience." The aim of this strategy is to pass on the experience of disasters accurately to future generations so that they are not forgotten.
- 4. "DRR technology." This is a strategy that enables companies to maximize their strength and be involved in projects that only regions damaged by the disaster can engage in, enabling these areas to turn the disaster experience into something productive and positive.

Under the four goals, eight implementation strategies were established.

Strategy 1: "Building multiple barriers for tsunami."

Although sea walls will be constructed along the coast as a result of the damages seen in the 2011 disaster, these are only sufficient to cope with tsunamis that will strike once in 100 years. Therefore, when a huge tsunami that occurs once in 1,000 years strikes, overflow and flooding will result. This strategy aims to overcome this situation by considering evacuation as the basic policy, even though multiple barriers will be built. Specifically, main projects include the development of evacuation announcement facilities to send information accurately and swiftly, the construction of evacuation roads, the designation of temporary

escape buildings to rescue people who are unable to evacuate, and the building of barriers to reduce the force and speed of tsunamis.

Strategy 2: "Developing earthquake-resilient city."

This strategy aims to increase earthquake-resistant roads and bridges, and to promote the retrofit of wooden buildings to make them earthquake-resistant.

Strategy 3: "Minimizing flood damage."

There is a higher risk of flooding due to the fact that the ground has sunk after the Great East Japan Earthquake and Tsunami, and due to a recent trend of heavy rain in a short period of time. To overcome this problem, projects such as the development of a rainwater draining system and the construction of new rainwater drain pumps have been planned.

Strategy 4: "Developing a disaster response system."

During the Great East Japan Earthquake and Tsunami, the number of people who evacuated was far greater than previously estimated. Thus, evacuation support was insufficient. By reflecting on that experience, we have reviewed our disaster response system.

Strategy 5: "Enhancing self-help ability."

The aim of this strategy is to enable citizens themselves to prepare for disasters. Paired with Tohoku University's International Research Institute of Disaster Science, we have developed the DRR handbook that outlines measures on how to cope with and prepare for disasters. We have been holding classes for citizens making use of this handbook.

Strategy 6: "Strengthening community DRR capacity."

This strategy aims for the improvement of DRR capacity, as well as mitigation of local communities by such tactics as voluntary emergency drills.

Strategy 7: "Sharing disaster experience."

Many pictures of the 2011 disaster were taken, and it is crucial to preserve and compile those records carefully, and to share it with future generations.

Strategy 8: "DRR Research Park Program."

This strategy seeks to promote DRR technology development as well as the accumulation and creation of industries using DRR technology by utilizing space created from factories damaged by the earthquake.

As well as to promote the DRR city strategy, the city felt the need to enhance urban development to accomplish recovery and reconstruction. For this reason, the Tagajo City Library was built, combining restaurants, a book store, childcare center and a parents' support center. The aim is to create the best cultural hub in the Tohoku region.

Tagajo City experienced tremendous loss due to the tsunami. To change the way of thinking from negative to positive to promote urban development, the city will go on with strong determination to carry out DRR measures and reconstruction.





Roles of different stakeholders in Disaster Risk Reduction

Takako Izumi

Associate Professor, IRIDeS, Tohoku University



Stakeholders in disaster risk reduction (DRR) include UN agencies, NGOs, regional organizations, donor agencies, governments, communities, academia, media, and the private sector. Each stakeholder has a different role in each disaster management phase: response, recovery, mitigation, and preparedness.

Specifically, what are the expected roles and actions of academia and universities in DRR? The Sendai Framework for Disaster Risk Reduction (SFDRR) adopted at the UN World Conference on Disaster Risk Reduction (UNWCDRR) in March 2015 calls for *"Academia, science and research entities and networks to: focus on the disaster risk factors and scenarios; increase research for regional, national and local application; support action by local communities and authorities; and support the interface between policy and science for decision-making."* Two important events for the APRU Multi-Hazards Program generated recommendations for academia and universities to take actions to strengthen their involvement in DRR:

Recommendations from the UNWCDRR Public Forum session by APRU

- 1. Collaboration, especially between the private sector and academia, should be enhanced;
- 2. Multi-stakeholder collaboration, including with local schools and communities, is necessary for making data and technology useful, usable, and accessible;
- 3. Social science elements as such as psychology, cultural studies, communications, ethics, and history must be incorporated because most problems are currently considered to involve social rather than engineering aspects.

Recommendations from the APRU Multi-Hazards Symposium as the Kyoto Declaration:

- 1. Strengthen the capacities of the scientific community by fostering young researchers and encouraging multi-disciplinary/trans-disciplinary implementation research;
- Continue our support for science and technology (S&T) innovations to be included in national policy/ decision-making on DRR;
- 3. Foster greater collaboration with local institutions and local governments for S&T-based decisionmaking;
- 4. Learn from the experiences of good practices in the region and foster further collaboration with various stakeholders;
- 5. Contribute to organizing/supporting periodic S&T conferences/events on DRR at national/regional levels.

The APRU Multi-Hazards Program that organized the above two events has two major objectives: 1) Contribute to international and regional discussions and DRR-related policy making; and 2) Strengthen DRR research and education in collaboration with APRU member universities. The Program supports the above recommendations and works to implement these actions among academic society through various activities.





The Power of Partnership

Takeshi Komino

General Secretary, Church World Service (CWS) Japan



The presentation highlighted the necessity of maximizing the potential of partnership with various stakeholders in disaster risk reduction. The world is facing the worst humanitarian crisis since the World War II, and this is also due to increasing disasters due to climate change impacts. At the 3rd World Conference on Disaster Risk Reduction (WCDRR), the world acknowledged over 1.5 billion people being affected by disasters each year, and the necessity to proactively capture and understand existing and emerging risks, and to invest in mitigating impacts from such risks. Our economy globally is suffering USD 300 billion from disasters each year, and this poses a good rationale for private sector to engage more proactively in disaster risk reduction.

Among many stakeholders in disaster management field, the strengths of local civil society was highlighted with examples such as Road to Sendai Campaign that mobilized 7 million people from 55 countries, the World Humanitarian Summit (WHS) consultations that mobilized more than 20,000 stakeholders (many come from civil society), and bottom up strategy creation process from Afghanistan that led to creation of national DRR platform as well as Strategic National Action Plan (SNAP) on DRR and Climate Change Adaptation.

However, just like any other stakeholders, there are weakness within civil society such as linkages with regional/global system, capacity to handle monetary resources, and creating multi-stakeholder alliance for innovative solutions.

Understanding both strengths and weakness of stakeholders is a key for next generation leaders. These leaders should be able to 'maximize the strengths', and to 'minimize/compliment the weakness', which lead to creation of strong partnership that can deliver optimal results. Innovation starts from accurate assessment of social issues (the root causes) and partnership that can overcome such problems. This is not where companies are the strongest. Such value creation through partnership is definitely a core skill required from next generation leadership.





Nearly 70 million people, half of them children, have been forced from their homes due to conflict and violence.

- In the last two decades, <u>218 million people</u> each year were affected by disasters; at an annual cost to the global economy that now exceeds <u>\$300 billion</u>.
 Build hope and splutions by investing in preparefunctions, <u>managing and mitigating risk</u>, reducing vulnerability, finding durable solutions for protracted displacement, and <u>adapting</u> to new threats.
- Business as usual is not going to address humanitarian needs.
- Increase in disasters →More risks to industrial sites.

It's Time to Re-examine Partnership

Why…?

- We'll need to do more with less
- We'll need to solve the unsolved
- We'll need to make solutions constant and sustainable

1+1=3



Bridging policy and practice - strengths demonstrated in DRR

- Road to Sendai campaign
- World Humanitarian
 Summit consultations
- Strategic National Action Plan (SNAP) for DRR in Afghanistan

Always think about operationalizing when creating policies!



Challenges for Local Organizations



- Knowledge the 'system'
 Resources –monetary resources and administrative capacity of large grants
- Capacity and innovation not much incentives for changing

Create Enabling Environment

- Knowledge A platform that…
 - One can feel at home for meaningful participation
 Can learn from each other
 Think about and act on collaboration
- Initia about and act billaboration
 Resources Support mechanism that…
 Allows more programmatic funding towards local organizations
 Integrate capacity support for those elements that are not strong
 Intentionally involve from preparedness stage
- Intentionally involve from preparedness stage
 Innovation facilitation that...
 Conversion from the state of th
 - Captures innovative elements
 Amplify best practices to regional/global learning
 Fosters cross/mutual learning for enhancing capacity

As local as possible, as international as necessary…. Agenda for Humanity – SG Report

Key Lessons from HIF Japan 2016



Private sector engagement towards disaster resilient societies

Yoshiko Abe

Sustainability Strategist, Kokusai Kogyo Co., Ltd.



The Sendai Framework stresses the importance of engaging the private sector in disaster risk reduction, with private sector mentions found throughout the document. Private sector engagement is presented as a necessary element toward its implementation. The presentation discussed why the private sector has been recognized as a key actor; the role of UNISDR and Global Assessment Reports in building and disseminating this understanding; and examples of what the private sector can do. Businesses are community-embedded resources, providers of innovative products and services, partners to governments, and both victims and sometimes cause of disaster economic loss. Mainstreaming DRR into the business community and a business's central strategy is thus a key focus of the Sendai Framework that aims to mainstream DRR as a fundamental, expected, and desired element of our society to build community resilience through an all-ofsociety approach.





3rd UN World Conference on DRR, Sendai, Japan



Adoption of Sendai Framework for Disaster Risk Reduction 2015-2030 UNISDR private sector groups re-organized towards implementation







Today's topics

- How did Kokusai Kogyo get involved in the UNISDR private sector group, and what has the UNISDR private sector group been doing?
- Why is DRR by the private sector so important?
- ARISE (UNISDR Private Sector Alliance for Disaster Resilient Societies)and private sector engagement



Natural Disasters: Forecasting and Nowcasting

John B. Rundle

Distinguished Professor and Senior Advisor to APRU MH Program, Departments of Physics and Geology, University of California Davis



Given a seismically active local region, a problem of interest is to determine how much stress and strain has accumulated since the last major earthquake. In other words, we would like to determine the level of progress of the region through the "earthquake cycle". This earthquake cycle problem is complicated because the absolute stress and strain since the last major earthquake cannot be determined from direct observations at locations of interest. However, we propose that a new method, "nowcasting", is available that may provide an answer to this problem.

Nowcasting is a term originating from economics and finance. It refers to the process of determining the uncertain state of the economy or markets at the current time by indirect means. We apply this idea to seismically active regions, where the goal is to determine the current state of the fault system, and its current level of progress through the earthquake cycle. In our implementation of this idea, we use the global catalog of earthquakes, using "small" earthquakes to determine the level of hazard from "large" earthquakes in the region. Our method does not involve any model other than the idea of an earthquake cycle.

Rather, we define a specific region and a specific large earthquake magnitude of interest, ensuring that we have enough data to span at least ~ 20 or more large earthquake cycles in the region. We then compute the current level of hazard, and assign a number between 0% and 100% to every region so defined, thus providing a unique measure. Physically, the current hazard computed in this way corresponds to an estimate of the level of progress through the earthquake cycle in the defined region at the current time.

We use the accumulation of small earthquakes since the last large earthquake in a defined region to estimate the current hazard level in the region. Event counts that are used as a measure of "time", rather than the clock time, are known as "natural" time. Natural time has at least two advantages when applied to seismicity:

- It is not necessary to decluster the aftershocks. The natural time count is uniformly valid when aftershocks dominate, when background seismicity dominates, and when both contribute.
- Natural time statistics are independent of the level of the seismicity as long as the b-value is approximately constant. In computing nowcasts, the concept of natural time, counts of small earthquakes, is used as a measure of the accumulation of stress and strain between large earthquakes in a defined geographic region.

Note that nowcasting, which describes the present state of a system, is distinct from the idea of forecasting, which looks forward in time. Forecasting is the calculation of probabilities for the future. Nowcasting is the calculation of the current state of the system. Nowcasting can be used as a basis for forecasting if a method is used to project the current state into future states. In fact, nowcasting should be a prerequisite to forecasting, the estimation of the future state of the system. The current state must be known, at least approximately, before the future state can be accurately estimated.

Global earthquake forecasts can be obtained from the web site http://www.openhazards.com/viewer.

An example of several Nowcasts are shown in the table below for several global megacities as of April, 2016. Data we used correspond to cycles of earthquakes having magnitude larger than 6.0, within 100 km of the designated city. The term "EPS" corresponds to the "Earthquake Potential Score", on a scale of 0% to 100%. The table shows that Santiago, Chile was at that time the city that had progressed the most through the earthquake cycle, being 86.3% towards the occurrence of the next M6 event.

City	Region	Population (Millions)	Number of Regional Earthquake Cycles	EPS (Highest=100)	
Santiago, Chile	57°S to 18°S	5	313	86.3	
33.45°5, 70.00°E	83° W 10 56° W				
Manila, Philippines	5°N to 20°N	16	196	74.0	
14.60°N,120.98°E	116ºE to 129ºE	1.0	170		
Tokyo, Japan 25°N to 50°N		20	(50	(0.7	
35.69°N,139.68°E	125°E to 155°E	39	059	08.7	
Taipei, Taiwan 19°N to 27°N		2.6	05	17.1	
25.º3ºN,121.63ºE	117ºE to 124ºE	2.6	95	47.4	
Jakarta, Indonesia 6.17°S,106.82°E	12.25°S to 6.25°N 90°E to 115°E	32	235	38.3	

Table 1: EPS values for 5 global megacities

A Textual Analysis of the SFDRR 2015-2030 in terms of Disaster Risk Factor Management B. M. Pacheco

Professor, University of the Philippines Dilman



The Sendai Framework for Disaster Risk Reduction 2015-2030 is a landmark document which, while crucial to implement, is equally crucial to analyze further. Having emerged as a consensus document it is now imbued with a multitude of meanings to all the stakeholders who contributed, coming as they were from a multitude of cultures worldwide.

A textual analysis is really about making sense of the world, aside from making sense of the words. As for the SFDRR, while it is 25-page long in words it banners the singular goal to "[p]revent new and reduce existing disaster risk through the implementation of ... measures that prevent and reduce hazard exposure and vulnerability to disaster..." I prefer to refer to HAZARD, EXPOSURE and VULNERABILITY as the generic underlying disaster risk factors. I suggest to operationalize disaster risk management as disaster risk factor management.

To illustrate the overlap of disaster risk factors to create a disaster risk product, I frequently use a Boulder and Monkey Parable in a general education course for undergraduates in my university. First, each disaster risk factor may or may not be possible to reduce. For example, if the hazard (boulder) and exposed element (monkey approaching a banana tree) have to be there, a structure (shed) may protect the exposed element (monkey) and thus reduce the latter's vulnerability. Second, usually a disaster risk factor may only be reduced, not eliminated. For example, the vulnerability-reducing structure (shed) itself is vulnerable to damage, and the original exposed element (monkey) is partly and not totally protected from the hazard (boulder). There may even be created, unwittingly, a new hazard (such as the shed falling on the monkey). Evolving through time like the plot of a story unfolding, such is the reality of disaster risk.

Reducing disaster risk, as the SFDRR declares, is a shared responsibility between governments and relevant stakeholders. Just as there are multiple hazards, and in fact multiple disaster risk factors, we involve multiple stakeholders – public and private – including civil society, academia, business, and media. What could be the specific role or responsibility of the academia?

The SFDRR exhorts "academia, scientific and research entities and networks to focus on the DISASTER RISK FACTORS and scenarios, including emerging disaster risks, in the medium and long term; increase research for regional, national and local application; support action by local communities and authorities; and support the interface between policy and science for decision-making." I have added the emphasis.

While the SDFRR mentions "risk factors" four times without enumerating, it happens that the National DRRM Framework of the Philippines of 2011 recognizes the underlying disaster risk factors are hazards, exposures, vulnerabilities and capacities. I regard capacities as the inverse of social vulnerabilities.

Believing that risk is better understood and better reduced through the underlying risk factors, I advocate implementing the SFDRR through hazard reduction and management, exposure management, vulnerability management and capacity management.







Whereas we affirm* the Sendai Framework 2015-2030 recognition of stakeholder roles that:

"[W]hile States have the overall responsibility for reducing disaster risk, it is a shared responsibility between Governments and relevant stakeholders. ...

Academia, scientific and research entities and networks [are to be encouraged by the States] to:

focus on the disaster risk factors and scenarios, including emerging disaster risks, in the medium and long term; increase research for regional, national and local application; support action by local communities and authorities; and support the interface between policy and science for decision-making..."

*Based on "Sendai Framework for Disaster Risk Reduction 2015-2030" (2015 March 18)

GROUP WORK DISCUSSIONS









Group work 1: Role of various stakeholders in disaster management

Stakeholders in disaster risk reduction (DRR) include UN agencies, NGOs, regional organizations, donor agencies, governments, communities, academia, media, and the private sector. Each stakeholder has a different role in each disaster management phase: response, recovery, mitigation, and preparedness.

Specifically, what are the expected roles and actions of academia and universities in DRR? The Sendai Framework for Disaster Risk Reduction (SFDRR) adopted at the UN World Conference on Disaster Risk Reduction (UNWCDRR) in March 2015 calls for *"Academia, science and research entities and networks to: focus on the disaster risk factors and scenarios; increase research for regional, national and local application; support action by local communities and authorities; and support the interface between policy and science for decision-making."* Two important events for the APRU Multi-Hazards Program generated recommendations for academia and universities to take actions to strengthen their involvement in DRR:

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GROUP A

LOCAL GOVERNMENT





GROUP B

GROUP C

ACADEMIA

Resources	What we can do	Others		
S Finances -can receive funds from diff sector - Intellectual resources W	-freedom to do research in any field/interest -serve as an information hub -bridge/influence policy making -freedom to work with e stakeholders/sector s in society -generate innovation, make contribution to society	→ enjoys the trust of all/most sectors of society, especially of local people in best position to influence societal changes → keep the trust → improve on the delivery of societal services		
-dependent on → demand for govt gov't suppo -not enough → diversity man power(HR), sources knowledge -takes long time → leveling off while society expectation needs are urgent Change the	-high/mismatch → leveling of expectation for help of expectation of	 mismatched expectations ivory tower complex come down to "earth" translate ideas to useful forms 		

GROUP D



GROUP E

MEDIA

Accessibility & Visibility Un-filter, Dependent on services

Influence – misinformation, trust

Awareness, Teaching, Information

Early warning & well being Trust, guidelines for media

Database Authenticity, Contradiction

Sense of community

Print media –Newspaper, Magazines

Electronic media – TV, Radio

Social media \rightarrow FB, Twitter, etc

^{Phone,} Apps, emails



Group work 2: How we can pass on lessons learned to the next generation

The five groups discussed the following topics:

- Share proverbs and saying on disasters in your culture
- List any actions already taken in your country
- Address new ideas on passing on the lessons learned to the next generation

Different countries have their own provers on disasters to draw attention to the need for evacuation, etc., and their own activities such as building museums and monuments, conducting evacuation drills, and setting up disaster risk reduction days. In addition, ideas such as using SNS and internet for awareness raising and information sharing and organizing educational events on DRR were also proposed.

GROUP A





GROUP B



• Set a national holiday for disaster education/remembrance

Proverbs/Sayings

USA

- A stitch , in time, saves nine.
- You reap what you sow.

Malaysia

- Sediakan payung sebelum nujan Prepare an umbrella before it rains
- Malang tidak berbau Trouble can't be smelled
- Bersusah-susah dahulu, bersenangsenang kemudian
 - Hardship now, Pleasure later

Taiwan

China: 未雨綢謬

一方有难 八方支援
 ⇒ one gets into trouble, all other help
 蚂蚁搬家蛇过道 明日必有大雨到
 ⇒ If ants move home and snakes come across the road, tomorrow will rain heavily
 大难不死、必有后福

⇒If you survive from a disaster, you will get fortune

Group work discussions

GROUP C

Indonesia

Jangan biarkan bencana terjadi berulang-ulang The same tragedy must never be repeated



China ①生于忧患,死于安乐

beware the thief every night

日日防火、 夜夜防盗

Prevent the fire everyday

Hardships died of happiness ②多难兴邦

Much distress regenerates a nation ③祸福相依

Fortune and misfortune are two buckets in a well

Japan

天災は忘れたころにやってくる

Disasters come back when you forget them

Philippines

Walang mahirap na gawa "pag dinaan sa tiyaga" "Nothing's hard to do if you pursue it through perseverance"

Taiwan

Community program for elderly & kids

Hawaii (Waikiki)

★ Education
 -Adults'
 -K-12
 ☆ Inundation Map

China

☆Monument (memory)/Wenchuan ☆Drills (fire/campus)

Indonesia

- -Assessing the hazard areas -Building a local culture of
- disaster awareness
- * Gathering a local wisdom and motivation from past disaster
- * Doing contingencies plan/act

Philippines

- * National Disaster Risk Reduction and Management Plan (NDRRMP)
 →Local
- * Fire and earthquake drill
- Disaster readiness & risk reduction
 - → core subject for senior highs in the K-12 basic education curriculum
- Institutional mechanisms for disaster response operations

Taiwan

Better idea





Upper part :

Lower part :

Wooden

Cement

Hawaii (Waikiki)

☆Education ①Public ②Private sector ③Academia

Collaboration, - Expertise, Leadership

China

- ① School education
- ② Bridging the gap between regions
- ③ More academic research
- (a. humanities b. social science)

Indonesia

- * Case : Mentawai Island (earthquake prone areas)
 - Have only one floor building
 ↓
 The community has informal
- commitment * Case: Aceh & Jogjakarta Build a museum to remember and learn from the previous disaster

Philippines

- * Development & establishment of several early warning systems
- * Development of tools on risk assessment
- * Conduct multi-stakeholders dialogues
- * Conduct more DRR/DRM researches
- * Regular review of contingency plans
- * Development of information and database generation
- Mainstreaming of DRR in social, economic
 & human settlements development plans

GROUP D



JAPAN:天災は忘れた頃にやってくる
Disaster comes when you've forgotten it
禍福はあざなえる縄の如し
Tomorrow is another day
CHINA: 防患于未然 居安恩危
Be prepared against want Be prepared for danger in the time of peace
INDIA : जगह के अनुसार रहना चाहिय Live according to the surroundings
Keen vourself safe hv own
पर्यावरण बचायें, जीवन बचायें
Save the environment, save the life
SHINGAPORE : 人算不如天算
Human proposes, nature disposes
PHILIPPINES : Pagkatapos ng bagyo, may liwanag
After a storm, there is sunshine
SPAIN : Lluvia de levante no deja nada delante
Rain from the east doesn't leave anything standing
En abril aguas mil
In April thousand rains



GROUP E

PROVERB/SAYING	ACTION TAKEN	BETTER IDEAS!!
INDIA: 1+1=11	Documentation of indigenous knowledge!!—	① Bring DRR into religious context for wider acceptance
PHILLIPPINE: Those who don't look back to their PAST won't get to their FUTURE!!	 Mainstreaming DRR into education!! Popular media: documentaries about the disasters 	 2 Study religious text in context of DRR best practices 3 Ecosystem-based DRR approach
 CHINA: • Time is an arrow Pigs are running; cocks are shouting; birds are flying everywhere, an earthquake is coming 	Museum Memorial monument	 Build on traditional knowledge for early warnings/DRR practices Start them younger
MYANMAR: When huge amount of ants are found at the house, flood is coming!!	Memorial monument of Cyclone Nargis!!	6 Use academia & social media
PAKISTAN: Wishing won't keep you safe, but safety will!!	→ Up to community!!	
National initiatives?	ocal actions?	

National initiatives? Laws LawsProjectsEducation

Academia Industries
Civic groups
Cultural









FIELD TRIP



Field trip to Natori City and Tagajo City on 21 July 2016

The participants joined the field trip to the areas affected by the Great East Japan Earthquake and Tsunami. The places include Hiyoriyama Mountain, memorial monument, sea wall at Kitagama beach, disaster public housing and Tagajo High School.

Dr. Yiqun Chen

Research Fellow, The University of Melbourne

This program had been professionally organized by IRIDeS, Tohoku University. It contained 3 days seminars and 1 day field trip. Invited speakers came from both local governments and international disaster research institutes, covering broad topics such as disaster risk reduction, humanitarian logistics, community resilience, roles of NGO, disaster forecasting and so on. The summer school provided an excellent platform to share practical experiences and leading research activities in disaster related field and offered a great opportunity to meet people and build connections. We had very good discussions with the teams from Sichuan University, Osaka University and Kyoto University, etc. and will definitely continue our collaborations in future.

Besides all the excellent academic and cultural experiences provided by the organisers, the one day field trip impressed me the most. It was my first time to step into a disaster destroyed area and was absolutely shocked by the mighty of nature as well as the durability of Japanese people. The trip started from a Shinto Shrine in Yuriage, Natori city. A memorial has been erected on the hill for the remembrance of the 3.11 Great East Japan Earthquakes, which triggered huge tsunami that swept the entire area. A local city council staff accompanied us throughout the trip, who extensively explained how this area was destroyed and how it now is being reconstructed and answered all sorts of questions. Then we moved to new tsunami prevention dike, a giant construction which utilises local tsunami debris as major filling materials. The dike was designed and built based on the research findings of IRIDeS and it demonstrates a great example of how disaster science and research can be directly applied to save lives in the real world. We also visit the resettlement areas and have a real good face-to-face discussion with tsunami victims and survivors. Lives had been totally disrupted after that calamity and many of them lost families and homes for ever, but they were so attached to their land and still stayed optimistic for their future. To them, "build-back-better" is more than just a slogan, it is a belief and they take it into actions. The afternoon trip to Tagajo city was also full of discoveries. In particular, we visited the Tagajo Senior High School. Students presented their recent work and activities for dealing with disasters and it is amazing that how well they are prepared. The round table discussion with them was also loads of fun and we really liked the brilliant idea of printing safety instructions on a handkerchief.

APRU summer school literally offers everything that required by researchers or students who work in disaster management field, it includes such as leading disaster science and research trends, real world catastrophe best practices, visiting disaster relic sites, face-to-face communicating with victims, building international connections and even cultural experience. It absolutely expanded my knowledge and understanding about disasters and how people should cope with nature. I highly recommend this program.



New sea wall in Natori

Noor Diyana Fazan Ahmad

PhD Student, Universiti Putra Malaysia

First and foremost I would like to thank the organizers of the APRU-IRIDeS Multi-Hazards Program 2016 for the opportunity for me to attend this program. It is a good programme for anyone who is interested in the field of disaster management to be exposed to all the areas of study related to disaster preparedness, management and mitigation.

The summer school is a good platform to enhance networking between different fields of research which provide an exchange of ideas as well as the sharing of experience. All the topics during the seminar was very fascinating and expanded the view of research in disaster.

During the field trip, the visit to all the areas affected by the tsunami in 2011 gave me a whole new experience to see the devastating effects of the tsunami. However, the most valuable experience was learning the community's resiliency towards a disaster during the visit to Sakuragi Public Housing. This is very important as they saw the importance of moving forward after a disaster no matter how devastating the effects were. Additionally, the recovery efforts done by the local council such as the the recovery of the industries prior to the housing quarters to ensure that the community had income before acquiring a permanent home is a different approach to recovery which is not common after a disaster.

Apart from that, I was amazed to learn Japanese culture of recording history and persevering it by keeping the remains of the only house to survive the impact of the tsunami and similarly in the town of Yuriage by placing a monument which is as high as the tsunami wave that hit the city, to ensure that the future generation can learn from the past. The visit to the Tagajo Senior High School was also very beneficial as we got to enjoy the students' presentation and discuss with the students by sharing our experiences as well as learning about other countries' disaster. I was very impressed with the work the students have been involved in preparing for the next disaster by meeting with the local council to place the tsunami signage in the area. It was inspirational to see that the students also contributed to the preparedness efforts by actively participating in the process and that they also have a course on disaster management in their school.

As a whole the important value that was emphasized during the duration of the program was to never forget about the past and to learn from it. It was a good experience for me personally as it was my first time in Japan and it was a good first experience which I can never forget. All the participants learnt something new and was able to share their experiences based on their country as well as make new friends from all over the world. I highly recommend this program to anyone interested in the field of disaster management and researchers in the field of disaster risk reduction.



A house damaged by tsunami



Disaster public housing in Tagajo



Tagajo High School



ANNEX I : APRU-IRIDeS Summer School Program

19-20 and 22 July: Seminar at the IRIDeS building on the Aobayama New Campus, Tohoku University

21 July: Field trip to Natori City and Tagajo City

July 19

09	:	00	_	09	:	20	Opening
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Opening remarks by President Susumu Satomi (Tohoku University) Welcoming address by Prof. Fumihiko Imamura (Director, IRIDeS) Opening remarks by Mr. Keith Wong (Director, APRU Secretariat)

- 09:20-09:30 Group photo
- 09:30 10:00 *"Why does IRIDeS take a multidisciplinary approach to large scale disasters?"* Prof. Makoto Okumura (Deputy Director, IRIDeS)
- 10:00-10:40 Movie [Great Tsunami]
- 10:40-11:00 Coffee break / moving to the Seminar room
- 11:00 12:00 *"Enhancing community-based DRR and role of schools based on lessons learnt from the 3.11 disaster"* Assoc. Prof. Aiko Sakurai (IRIDeS)
- 12:00-13:00 Lunch / self-introduction
- 13:00 14:00 "Geological and historical evidence of paleotsunami" Assoc. Prof. Kazuhisa Goto (IRIDeS)
- 14:00 15:00 *"Follow up work on the Sendai Framework for Disaster Risk Reduction"* Prof. Yuichi Ono (IRIDeS)
- 15:00-15:15 Coffee break
- 15:15 16:15 *"How to make a healthy resilient community"* Prof. Shinichi Egawa (IRIDeS)
- 16:15 17:15 "Repeated failure of humanitarian logistics for recent disasters in Japan" Prof. Makoto
 Okumura (Deputy Director, IRIDeS)

July 20

Experience sharing by different stakeholders: towards implementation of the Sendai Framework for Disaster Risk Reduction

- 09:00 10:00 "Restoration and Challenge of Sendai Towards a Disaster-Resilient and Environmentally-Friendly City" Mr. Akira Takahashi (Sendai City)
- 10:00 11:00 *"Towards disaster risk reduction city: A disaster-resilient Tagajo City"* Mr. Takumi Fujimura

(Tagajo City)

- 11:15 12:15 *"Roles of different stakeholders in Disaster Risk Reduction"* Assoc. Prof. Takako Izumi (IRIDeS)
- 12:15-13:15 Lunch
- 13: 15 14: 15 *"The Power of Partnership"* Mr. Takeshi Komino (Church World Service (CWS) Japan)
- 14:15 15:15 *"Private sector engagement towards disaster resilient societies"* Dr. Yoshiko Abe (Kokusai Kogyo Co., Ltd.)
- 15:15-15:30 Coffee break
- 15:30-16:30 Group work: Roles of various stakeholders in disaster management
- 16:30-17:15 Group presentation/discussion

July 21: Field trip

Natori City and Tagajo City

July 22

09:00-10:00 "Natural Disasters: Forecasting and Nowcasting" Prof. John Rundle (University of California Davis)

10:00 – 11:00 "A textual analysis of the SFDRR 2015-2030 in terms of disaster risk factor management" Prof. Benito M. Pacheco (University of Philippines)

11:00-11:15 Coffee break

11: 15 - 12: 15 *"Disaster Resilience: From Science to Action"* Prof. Denise Konan (University of Hawaii Manoa)

12:15-13:15 Lunch

13:15-14:45 Group work: How we can pass on lessons learned to the next generation

14:45-15:00 Coffee break

15:00 - 16:00 Group presentation/discussion

16:00 - 16:15 Closing

ANNEX II : List of Participants

	Name	Status	Country	University
1	Yiqun Chen	Research Fellow	Australia	The University of Melbourne
2	Arash Kaviani Arani	Ph.D. Student	Australia	The University of Melbourne
3	He Peng	Under Graduate	China	Beijing institute of technology
4	Shiyan Li	M.A. Student	China	Fudan University
5	Bingwei Tian	Lecturer	China	Sichuan University
6	Ruoyu Luo	M.A. Student	China	Sichuan University
7	Tingxi Liu	Ph.D. Student	China	Sichuan University
8	Kaiqi Lin	Ph.D. Student	China	Tsinghua University
9	Priyanka Tyagi	Ph.D. Student	India	Kumaun University
10	Rahmat Aris Pratomo	Lecturer	Indonesia	Tadulako University
11	Chatterjee Ranit	Ph.D. Student	Japan	Kyoto University
12	Kaiwei Zhang	M.A. Student	Japan	Kyoto University
13	Nadia Binti Kamaruddin	Ph.D. Student	Japan	Kyoto University
14	Rohaya Abdul Malek	Ph.D. Student	Japan	Kyoto University
15	Souphaysone Manodharm	M.A. Student	Japan	Kyoto University
16	Thinn Hlaing Oo	M.A. Student	Japan	Kyoto University
17	Machi Ashina	Under Graduate	Japan	Miyagigakuin Women's University
18	Jing Li	M.A. Student	Japan	Osaka University
19	Xin Gao	Ph.D. Student	Japan	Osaka University
20	Yasuaki Wadasaki	M.A. Student	Japan	Osaka University
21	Yixuan Chen	M.A. Student	Japan	Osaka University
22	Ben Epstein	Special Research Student	Japan	Tohoku University
23	Alessandro Massazza	Under Graduate	Japan	Tohoku University
24	Noor Diyana Fazan Ahmad	Ph.D. Student	Malaysia	Universiti Putra Malaysia
25	Alma Rossana Aldea Gutierrez	Ph.D. Student	Philippines	Philippine School of Business Administration
26	Tariq Alam Siddiqui	Ph.D. Student	Philippines	Philippine School of Business Administration
27	Decibel Faustino Eslava	Associate Professor	Philippines	University of the Philippines Los Banos
28	Maria Victoria Ortega Espaldon	Professor	Philippines	University of the Philippines Los Banos
29	Bi Jurong	M.A. Student	Singapore	National University of Singapore
30	Ignacio Barranco Granged	Ph.D. Student	Singapore	National University of Singapore
31	Quek Ser Tong	Professor and Acting Head	Singapore	National University of Singapore
32	Chiung-wen Hsu	Professor	Taiwan	National Cheng Chi University

	Name	Status	Country	University
33	John Wilson	Ph.D. Student	USA	University of California Davis
34	Molly Luginbuhl	Ph.D. Student	USA	University of California Davis
35	Ivy Yeung	Director of International Cooperation	USA	University of Hawaii
36	Nori Tarui	Associate Professor	USA	University of Hawaii
37	Shintaro Taniguchi	Ph.D. Student	USA	University of Hawaii
38	Keith Chi-ho Wong	Director	Hong Kong	APRU Secretariat
39	Christina Schonleber		Hong Kong	APRU Secretariat
40	Akira Takahashi		Japan	Sendai City
41	Takumi Fujimura		Japan	Tagajo City
42	Takeshi Komino	General Secretary	Japan	Chureh World Service (CWS) Japan
43	Yoshiko Abe	Sustainability Strategist	Japan	Kokusai Kogyo Co., Ltd.
44	Fumihiko Imamura	Professor	Japan	Tohoku University (IRIDeS)
45	Makoto Okumura	Professor	Japan	Tohoku University (IRIDeS)
46	Aiko Sakurai	Associate Professor	Japan	Tohoku University (IRIDeS)
47	Kazuhisa Goto	Associate Professor	Japan	Tohoku University (IRIDeS)
48	Shinichi Egawa	Professor	Japan	Tohoku University (IRIDeS)
49	Yuichi Ono	Professor	Japan	Tohoku University (IRIDeS)
50	Takako Izumi	Associate Professor	Japan	Tohoku University (IRIDeS)
51	Takuya Ito	Co-Researcher	Japan	Tohoku University (IRIDeS)
52	Benito M. Pacheco	Professor	Philippines	University of Philippines
53	John Rundle	Professor	USA	University of California Davis
54	Denise Konan	Professor	USA	University of Hawaii



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