

Risk-informed Governance and Innovative Technology for Disaster Risk Reduction and Resilience

– Training Syllabus –

Background

The United Nations General Assembly Resolution A/RES/69/327 emphasizes the growing need to strengthen public institutions and public services in support of sustainable development. The 2030 Agenda for Sustainable Development, adopted in 2015 by all member states, aims to achieve the 17 Sustainable Development Goals (SDGs) as a holistic and interdependent agenda of both developed and developing countries. It aspires to “leave no one behind” and to pay particular attention to countries in special situations. The Sendai Framework for Disaster Risk Reduction 2015-2030 is an integral part of the 2030 Agenda with its seven targets and indicators embedded across the SDGs. The Sendai Framework advances the achievement of eleven goals (1, 2, 3, 4, 5, 6, 9, 11, 13, 14 and 15) to ensure resilience in progress on sustainable development across all UN Member States.

Though it universally applies to all Member States, the 2030 Agenda underscores the special challenges that the most vulnerable countries, including Least Developed Countries (LDCs), Land-Locked Developing Countries (LLDCs) and Small Island Developing States (SIDS), face in realizing the SDGs.

It is well-known that disasters in vulnerable countries can rapidly setback progress towards achieving the SDGs. Given the importance to address the above challenges, the 2018 High Level Political Forum (HLPF) for Sustainable Development focused on the theme of “Transformation towards sustainable and resilient societies.” Resilience is also noted as a regional priority under the Framework for Pacific Regionalism and the 48th Pacific Islands Forum Leaders Communiqué where governments committed to ensuring a whole-of-government engagement” with regional priorities.

The UN DESA 2018 E-Government Survey on “Gearing E-Government to Support Transformation towards Sustainable and Resilient Societies” notes that digital technologies have a potential for strengthening resilience and reducing vulnerability. By leveraging innovations in technology, governments might be better equipped to effectively anticipate, prepare, and respond to risks and disasters.

Learning Outcomes

The overall learning outcome of this training toolkit is to meet the expectations and respond to the needs expressed in a series of member countries fora and consultations, based on which UN DESA/DPIDG and UNDRR developed this training curriculum and accompanying toolkit. These resources seek to build national capacities to spearhead innovations and utilize Information and Communications Technologies (ICTs) and key frontier technologies in government in order to drive DRR and resilience. Special emphasis is given to public service

innovations that serve the needs of vulnerable states, including methods for adapting and scaling them to align with developing country contexts. The materials presented and the activities that align with them explore the mechanisms for access, adoption, uptake, finance, and maintenance of emerging technology in practical formats that seek to advance public sector capacities for risk-informed policymaking and resilience.

By the end of this Training, learners will be able to:

- **Understand** the need and policy relevance of:
 1. promoting risk-informed governance and innovative technology for DRR and resilience
 2. closing technology gaps and establishing public governance frameworks for DRR and sustainable development in vulnerable states
- **Assess and analyze** the progress, status and challenges faced by member countries in:
 3. promoting the adoption of digital government solutions and pursuing public service innovation for resilience
 4. expanding the uptake of frontier technologies for DRR and resilience through self-assessment, peer-to-peer learning; knowledge-sharing, and discussions
- **Identify and apply** the various innovative approaches, strategies, and practices for:
 5. enabling the means of implementation to leverage innovations in technology through public programs and finance and technology transfer; and
 6. measuring progress on resilience for strengthened institutions through frontier technologies, particularly in:
 - the application of concepts on how to establish public governance frameworks to close technology gaps for DRR and building resilience in vulnerable states
 - being equipped with knowledge of how digital government solutions can be implemented to promote public service innovation for resilience; and
 - defining the strategies and roadmap on how to promote government innovation and expand the adoption of frontier technologies for disaster risk reduction and resilience.

Group work, practical activities, and case study scenario discussions will facilitate peer-to-peer learning and open exchange on these and related capacity development themes. Participants will have the opportunity to share and expand their knowledge and understanding of the existing and emerging technologies developed to support disaster risk reduction and resilience, and the mechanisms available to leverage them at the global, regional, national, and local levels. The training challenges participants to consider how these technologies might apply to their specific fields of responsibility and expertise, and to consider potential obstacles and risks related to their adoption.

Structure

The training course consists mainly of 3 Modules subdivided into 12 sub-modules. The course is designed to cover a five-day training period. The materials and activities presented explores mechanisms for access, adoption, uptake, finance, and maintenance of emerging technology and seeks to advance public sector capacities for risk-informed policymaking and governance.

The training program addresses the key issues of government innovation for DRR and resilience along three main dimensions/themes:

- 1) Module 1 covers Science, Technology, and Innovation in Public Governance for DRR and Resilience for Risk-informed Governance. This Module is composed of four sub-modules and preceded by an introductory presentation for the first training day.
- 2) Module 2 on Practical and Planned Application of Emerging Technology and Innovation for DRR and Resilience is composed of five sub-modules covering the second day, all through the third day till the afternoon of the fourth day. This Module as well has a Site visit on the second day and Big Data Analysis Training on the fourth day.
- 3) Module 3 on Implementation of Emerging Technologies and Innovation for DRR and Resilience is composed of three sub-modules for the fifth day of the training program. The training program ends on the fifth day with a wrap-up session composed of an action plan preparation session and program evaluation.

Syllabus

The toolkit is comprised of the following 3 main Modules and 12 sub-modules that can be used to conduct a regional or national level training:

Module 1: Science, Technology, and Innovation in Public Governance for DRR and Resilience for Risk-Informed Governance

- Module 1.1: Risk-Informed Governance for DRR and Resilience
- Module 1.2: Science, Technology, and Innovation for Risk-informed Governance
- Module 1.3: Global, Regional, and National Efforts to Advance Innovative Technologies Use in DRR and Resilience
- Module 1.4: Risk-informed Governance and Innovative Technology for Public Health Emergencies

Module 2: Practical and Planned Application of Emerging Technology and Innovation for DRR and Resilience

- Module 2.1: Extending Our Reach and Expanding Our Capabilities
- Module 2.2: Changing How We Make and Acquire Things
- Module 2.3: Connecting People, Things, and Technology
- Module 2.4: Improving Data Analysis and the Presentation of Information
- Module 2.5: Humans as a Resource
- Site Visit: Innovative Technologies for DRR and Resilience in Practice
- Training: Big Data Analysis

Module 3: Implementation of Emerging Technologies and Innovation for DRR and Resilience

- Module 3.1: Implementing and Financing Technology Solutions
- Module 3.2: Technology Gaps and Challenges to Implementation of Innovative Technologies for DRR and Resilience
- Module 3.3: Measuring Progress: Monitoring and Evaluation of Implementation Efforts

Course Wrap-Up

- Course materials review
- Action plan preparation
- Evaluations

Target Audience

Through their engagement in this program, participants will have the opportunity to examine a variety of innovative technologies currently being applied by, for, the Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction targets. The Sendai Framework's targets are part of SDG targets under goals 1, 11 and 13.1. Target audiences for this training include public institutions leading the implementation of the Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction, and schools of public administration and other educational institutions which can scale up and replicate the use of these training materials. Using a cascade training methodology, the training may target schools of public administration and similar training institutions, which can contextualize the training for national use.

Risk-informed Governance and Innovative Technology for Disaster Risk Reduction and Resilience”

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Time	Day 1	Day 2	Day 3	Day 4	Day 5
Modules	Science, Technology, and Government Innovation in Public Governance for DRR and Resilience	Practical and Planned Application of Emerging Technology and Government Innovation for DRR and Resilience	Practical and Planned Application of Emerging Technology and Innovation for DRR and Resilience	Practical and Planned Application of Emerging Technology and Innovation for DRR and Resilience	Implementation of Emerging Technologies and Government Innovation for DRR and Resilience
Morning Session	Welcome & Course Introduction <i>Introduction of Speakers and Participants; Programme Overview; Icebreaker Activity</i> (9:00-10:00)	Module 1.4: Risk-informed Governance and Innovative Technology for Public Health Emergencies <i>Presentation (9:00-9:45)</i> <i>Group Work (9:45-10:00)</i>	Module 2.2: Changing How We Make and Acquire Things <i>Presentation (9:00-10:00)</i> <i>Group Work (10:00-11:00)</i>	Module 2.4 (Continued) <i>Presentation (9:00-9:30)</i> <i>Group Work (9:30-10:00)</i>	Module 3.1: Implementing and Financing Technology Solutions <i>Presentation (9:00-11:00)</i> <i>Group Work (11:00-12:00)</i>
	Module 1.1: Risk-Informed Governance for DRR and Resilience <i>Presentation (10:00-11:00)</i> <i>Group Work (11:00-12:00)</i>	Module 2.1: Extending Our Reach and Expanding Our Capabilities <i>Presentation (10:00-11:00)</i> <i>Group Work (11:00-12:00)</i>	Module 2.3: Connecting People, Things, and Technology <i>Presentation (11:00-11:30)</i> <i>Group Work (11:30-12:00)</i>	Module 2.5: Humans as a Resource <i>Presentation (10:00-11:00)</i> <i>Group Work (11:00-12:00)</i>	
Lunch Break					
Afternoon Session	Module 1.2: Science, Technology, and Government Innovation for Risk-Informed Governance <i>Presentation (13:00-14:30)</i> <i>Group Work (14:30-15:30)</i>	Site Visit Innovative Technologies for DRR and Resilience in Practice (13:00-17:00)	Module 2.3 (Continued) <i>Presentation (13:00-14:00)</i> <i>Group Work (14:00-15:00)</i>	Big Data Analysis Training (13:00-17:00)	Module 3.2: Technology Gaps and Challenges to Implementation of Government Innovation for DRR and Resilience <i>Presentation (13:00-14:00)</i> <i>Group Work (14:00-15:00)</i>
	Module 1.3: Global, Regional, and National Efforts to Advance Innovative Technologies Use in DRR and Resilience <i>Presentation (15:30-16:30)</i> <i>Group Work (16:30-17:00)</i>		Module 2.4: Improving Data Analysis and the Presentation of Information <i>Presentation (15:00-16:00)</i> <i>Group Work (16:00-17:00)</i>		Module 3.3: Measuring Progress: Monitoring and Evaluation of Implementation Efforts (15:00-16:00)
	Wrap-up & Reflection (17:00-17:15)	Wrap-up & Reflection (17:00-17:15)	Wrap-up & Reflection (17:00-17:15)	Wrap-up & Reflection (17:00-17:15)	Course Evaluation by Participants & Closing Session (16:00 -17:00)

Risk-informed Governance and Innovative Technology for Disaster Risk Reduction and Resilience	
Day 1: Science, Technology, and Government Innovation in Public Governance for DRR and Resilience	
9:00-10:00	<p style="text-align: center;">Welcome and Course Introduction</p> <p>In this opening session, participants and facilitating team introductions are undertaken. The facilitating team explains to participants how the course will be administered, which includes an overview of program policies and facility emergency procedures. The facilitator will also explain the course structure, format, and evaluation methods, and provide a summary of the topics and activities that will be included in the five days of facilitation that follow.</p> <ul style="list-style-type: none"> ● Introduction of Speakers and Participants; Programme Overview; Icebreaker Activity
10:00-12:00	Module 1.1: Risk-Informed Governance for DRR and Resilience
Content	<p>Session 1 introduces, defines, and explains at both the theoretical and technical levels emergency and disaster risk management and resilience building efforts. Participants are to reflect on what and where data informs risk planning and how risks are integrated into current planning and decision-making. Participants also reflect on the entities in government that are informed about resilience and risk, and how these government entities coordinate with central planning and decision-making, as well as SDGs institutional coordination for resilience. Participants consider how public sector entities identify hazards, assess, and manage risk, and respond to and recover from disasters. Public alert and warning are also covered in recognition of the significant contributions to these functions that have emerged on account of new technologies and innovations. The lessons contained in this session serve to establish a baseline understanding of the various foci of technology and innovation applications, whether that be identification and monitoring of risk, detection, notification, and assessment of emergency and disaster situations, and response and recovery support during and in the aftermath of actualized events. In this session, participants are also to share and learn about their specific country risk profiles according to PreventionWeb country data. Risk-informed governance and decision-making are addressed.</p> <p>Discussion Topics:</p> <ul style="list-style-type: none"> ● Natural, Technological, and Intentional Hazards ● Measuring and Mapping Exposure ● Event Scale and Size ● Economic Vulnerability ● Sources of Data

	<ul style="list-style-type: none"> ● Hazard Monitoring Methods ● Motivation for Adopting New Technologies
Learning Outcomes	<ul style="list-style-type: none"> ● Ability to explain how an adverse event progresses from emergency to catastrophe. ● Ability to list and define the major components of comprehensive disaster management ● Understanding of the range and diversity of functions of government that support disaster risk management and how technologies can streamline risk information across government. ● Ability to explain how innovative technologies improve the disaster management planning process, and how official and citizen disaster preparedness efforts might be improved as a result of new technology applications.
Key Readings	<ul style="list-style-type: none"> ● Izumi, T., Shaw, R., Ishiwatari, M., Djalante, R., Komino, T. 2019. 30 Innovations for Disaster Risk Reduction. IRIDeS, Keio University, the University of Tokyo, UNU-IAS, and CWS Japan, Japan, http://bit.ly/2OkCMWg. ● Center for Sustainable Community Design. n/d. Types of Mitigation Actions. Beyond the Basics. http://bit.ly/2H7LGSn. ● International Telecommunications Union (ITU). 2019. Disruptive Technologies and Their Use in Disaster Risk Reduction and Management. ITUGET 2019 Background Document. http://bit.ly/2Lu3j2G ● Inform. 2019. Inform Global Risk Index: Results 2019. http://bit.ly/38lztQn. ● Eastern Kentucky University. n/d. When Disaster Strikes: Technology's Role in Disaster Aid Relief. Blog. http://bit.ly/2OSoGgy. Offline Document: http://bit.ly/32ACmjb
Schedule	10:00-11:00: Presentation 11:00-12:00: Work Group
12:00-13:00	Lunch Break
13:00-15:30	Module 1.2: Science, Technology, and Government Innovation for Risk-informed Governance

<p style="text-align: center;">Content</p>	<p>This session provides a foundational context for the application of technology in emergency and disaster management, and for the enhancement of resilience. Instructional materials allow participants to better conceptualize the purpose and nature of technological innovation as it applies in a theoretical sense and as it supports the achievement of societal and public sector goals including sustainable development. A conceptual basis of data and information, both of which play important roles in the furtherance of science and the adoption of new technologies and innovations, is provided. The importance of new technologies in collecting data and informing decision-making in public governance and planning in disaster prevention phases and risk mitigation is discussed. Participants are given a first look at the limitations of technology use and technological innovation, the challenges encountered, and risks faced or created.</p> <p>Discussion Topics:</p> <ul style="list-style-type: none"> ● The availability and application of technologies used in participants’ own work, and how this has changed over their career. ● The benefits that participants have gained and the costs that have been incurred as technologies are introduced and adopted in their professions. ● Information and Communications Technologies (ICTs). ● Links between e-Government, Smart Cities, and emerging technologies adoption. ● e-Government implementation considerations. ● The impact of new technologies, and the readiness of governments to implement them. ● Macro-level changes that are occurring in the disaster risk management field as a result of technological innovation. ● Different types of knowledge. ● Different types of data and information used in participants’ work. ● The limitations, challenges, and risks that are key to understanding and planning for new and emerging technologies. ● Differences in access to technology. ● Technology and innovation risks.
<p style="text-align: center;">Learning Outcomes</p>	<ul style="list-style-type: none"> ● Ability to define science and technology, and innovation, and to understand what qualifies a system or solution as being “emerging” or “disruptive”. ● Ability to explain what resilience is, and how it applies to individuals, communities, organizations, and societies. ● Increased understanding of the ways science and technology may be used to support society and governance, including the pursuit of sustainable development goals. ● Knowledge of the technological solutions available to support digital government and public service innovation for DRR ● Ability to explain what resilience is, and how it applies to individuals, communities, organizations, and societies.
<p style="text-align: center;">Key Readings</p>	<ul style="list-style-type: none"> ● United Nations. 2019. The Role of Science, Technology, and Innovation in Building Resilient communities, Including Through the

	<p>Contribution of Citizen Science. Economic and Social Commission. Commission on Science and Technology for Development. May 13-17. Geneva. http://bit.ly/2MIB46z</p> <ul style="list-style-type: none"> • United Nations. 2018. E-Government Survey 2018: Gearing E-Government to Support Transformation Towards Sustainable and Resilient Societies. Department of Economic and Social Affairs. New York. http://bit.ly/2SsKvl4 [Chapter 1]
Schedule	<p>13:00-14:30: Presentation 14:30-15:30: Work Group</p>
15:30-17:00	Module 1.3: Global, Regional, and National Efforts to Advance Innovative Technologies Use in DRR and Resilience
Content	<p>Improving technological innovation in support of disaster risk reduction and sustainable development, and expanding access to the products of innovation, are complementary efforts that play a central role in the Sendai Framework and the 2030 Agenda for Sustainable Development. In this session, participants learn how these and other efforts support the expanded use of technology in support of evidence-based policy making and risk-informed governance for resilience. Some of the leading challenges that exist (notably with regards to the Small Island Developing States (SIDS), the Landlocked Developing Countries (LLDCs), and the Least Developed Countries (LDCs)) are introduced. The practice of developing science and technology national strategies and how these are integrated into national development strategies is included.</p> <p>Discussion Topics:</p> <ul style="list-style-type: none"> • Scientific and Technical Advisory Group (STAG) Report Recommendations • Focus of S&T in the Sendai Framework • Linking Development and Disaster Resilience • Information Sharing Experience • Recommendations of the UN Commission on Science and Technology for Development (CSTD) • Universality of the Strategy for STI in Africa (STISA-2024) Pillars • Good Practices for Advancing STI National and Local Strategies
Learning Outcomes	<ul style="list-style-type: none"> • Ability to describe how the 2030 Agenda for Sustainable Development and the Sendai Framework address the need for scientific and technological innovation. • Enhanced capacity to promote or support creation and/or advancement of national science and technology strategies.
Key Readings	<ul style="list-style-type: none"> • UNDRR. 2019. The Science and Technology Roadmap to Support Implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030. http://bit.ly/2mkomcW. • Shaw, R., L. Lu and F. Lian. 2017. Science Technology Plan for Disaster Risk Reduction: Asian and Pacific Perspectives. ICSU and IRDR. Beijing, China. http://bit.ly/2YLqhlL • Asian Science and Technology Conference for DRR. 2018. Science-Policy Dialogue for Implementation of the Sendai Framework. UNISDR. April. http://bit.ly/2Zzp98f.

	<ul style="list-style-type: none"> United Nations. 2015. Strengthening the Role of Science and Technology for Disaster Risk Reduction in the Arab Region. United Nations Office for Disaster Risk Reduction. Geneva. http://bit.ly/2YjFBNj
Schedule	15:30-16:30: Presentation 16:30-17:00: Work Group
17:00-17:15	Day 1 Wrap-up and Reflection
Day 2: Practical and Planned Application of Emerging Technology and Government Innovation for DRR and Resilience	
9:00-10:00	Module 1.4: Risk-informed Governance and Innovative Technology for Public Health Emergencies
Content	<p>Public health is constantly threatened by a wide range of hazards and disasters. Despite measures to prevent them, emergencies of varying types, scales and consequences still occur. Emergency preparedness is a continuous process in which action, funding, partnerships, and political commitment at all levels must be sustained. The overall responsibility for safeguarding, maintaining, and restoring the health and wellbeing of communities lies with national governments. Strengthening governance capacities and leveraging innovative technologies is critical for public health emergencies. This session presentation and discussions will focus on the role of risk-informed governance and innovative technology for public health emergencies including COVID-19 pandemic.</p> <p>Discussion Topics:</p> <ul style="list-style-type: none"> Public Governance Innovation for Public Health Emergencies Principles for Public Health Emergency Preparedness Strengthening Governance Capacity for Public Health Emergencies Data-driven Decision Making for Public Health Emergencies Digital Government for Public Health Emergencies Innovative Practices in Governance Innovation for COVID-19 Response Managing Public Health Emergencies
Learning Outcomes	<ul style="list-style-type: none"> Increased understanding on the role of Risk-Informed Governance and Innovative Technologies for Public Health Emergencies. Understand the contribution of Science, Technology and Innovation to DRR in the context of COVID-19. Strengthened capacity on the entire process of preparedness, prevention, response and post-recovery to respond to public health emergencies including COVID-19 pandemic
Key Readings	<ul style="list-style-type: none"> Albris, K., Lauta, K. C., & Raju, E. (2020). Strengthening governance for disaster prevention: the enhancing risk management capabilities guidelines. International journal of disaster risk reduction, 101647. https://www.sciencedirect.com/science/article/abs/pii/S221242091930771X

- Tomorrow, A. H. OECD Reviews of Public Health: Korea. https://www.oecd-ilibrary.org/social-issues-migration-health/oecd-reviews-of-public-health-korea_be2b7063-en
- The Report of the High-Level Panel of Eminent Persons on the Post-2015 Development Agenda (<https://www.post2020hlp.org/wp-content/uploads/docs/UN-Report.pdf>)
- United Nations. 2020. COVID-19 Response. 5 ways the UN is fighting 'infodemic' of misinformation. <https://www.un.org/en/un-coronavirus-communications-team/five-ways-united-nations-fighting-%E2%80%98infodemic%E2%80%99-misinformation>
- United Nations Secretary-General's (IEAG), A Word That Counts: Mobilizing The Data Revolution for Sustainable Development, November 6, 2014 (www.undatarevolution.org/report/)
- OECD Policy Responses to Coronavirus (COVID-19). The territorial impact of COVID-19: Managing the crisis across levels of government. <http://www.oecd.org/coronavirus/policy-responses/the-territorial-impact-of-covid-19-managing-the-crisis-across-levels-of-government-d3e314e1/>
- United Nations Global Pulse (2013). Big Data for Development: A primer. https://beta.unglobalpulse.org/wp-content/uploads/2013/06/Primer-2013_FINAL-FOR-PRINT.pdf
- UN/DESA Policy Brief #61: COVID-19: Embracing digital government during the pandemic and beyond. <https://www.un.org/development/desa/dpad/publication/un-desa-policy-brief-61-covid-19-embracing-digital-government-during-the-pandemic-and-beyond/>
- UN Women (2020). COVID-19: How to include marginalized and vulnerable people in risk communication and community engagement. https://reliefweb.int/sites/reliefweb.int/files/resources/COVID-19_CommunityEngagement_130320.pdf
- Whitelaw, S., Mamas, M. A., Topol, E., & Van Spall, H. G. (2020). Applications of digital technology in COVID-19 pandemic planning and response. The Lancet Digital Health. <https://www.thelancet.com/action/showPdf?pii=S2589-7500%2820%2930142-4>
- WHO (2020). Strengthening Preparedness for COVID-19 in Cities and Urban Settings. <https://www.who.int/publications/i/item/strengthening-preparedness-for-covid-19-in-cities-and-urban-settings>
- World Health Organization. (2019). Health emergency and disaster risk management framework. <https://www.who.int/hac/techguidance/preparedness/health-emergency-and-disaster-risk-management-framework-eng.pdf?ua=1>
- World Health Organization. (2017). A strategic framework for emergency preparedness.

	https://extranet.who.int/sph/sites/default/files/document-library/document/Preparedness-9789241511827-eng.pdf
Schedule	9:00-9:45: Presentation 9:45-10:00: Work Group
10:00-12:00	Module 2.1: Extending Our Reach and Expanding Our Capabilities
Content	<p>In this session, participants study a range of new technologies and innovations that are enabling public sector organizations to expand their sensing, planning, and operational capabilities. Unmanned vehicles, whether designed for aerial, terrestrial, or aquatic movement, are finding new application in almost every aspect of disaster risk management with examples including the remote study of land, water, and man-made features and facilities; the identification and monitoring of threatening hazards and conditions; the assessment of disaster damages and impacts; the expansion of information and communications technology (ICT) systems' reach; and the conduct of operational response and recovery tasks such as relief delivery. This relatively inexpensive and highly accessible technology has shown incredible potential across each of these areas, especially when coupled with advanced imaging (e.g., LiDAR) capabilities. Robotics, a grouping within which unmanned vehicles are often placed, includes a broad range of general and specialized operational capabilities that are helping to enhance disaster risk management capacities. Examples include search and rescue and access into environmentally hostile situations, environmental assessment, weather monitoring, and more. And through the use of increasingly sophisticated remote and in-situ imagery and sensing capabilities, planning and forecasting capabilities in support of DRR and resilience are moving at-risk and disaster-impacted communities towards more resilient futures.</p> <p>Discussion Topics:</p> <ul style="list-style-type: none"> ● The benefits that may be gained through incorporation of unmanned vehicle technology in each emergency management phase (multiple discussions). ● Features and attributes of robots that are particularly useful in the disaster setting. ● Value of LiDAR Program Data ● Benefits that may be gained through access to data collected using in-situ and remote sensing technologies, and the limits of such resources and systems.
Learning Outcomes	<ul style="list-style-type: none"> ● Strengthened capacity to request and utilize imagery produced using in-situ and remote sensing systems in order to better reduce the risk of, plan for, respond to, and recover from disasters. ● Ability to understand the current and planned capacity of robots and drones. ● Capacity to recognize pre- and post-disaster scenarios where unmanned vehicle technologies, robotics, or in-situ and remotely-sensed imagery can provide informational or operational support.
Key Readings	<ul style="list-style-type: none"> ● American Red Cross, et. Al. 2015. Drones for Disaster Response and Relief Operations. April. http://bit.ly/2VcAmdE. ● Paganini, Marc, and Ivan Petiteville. 2018. Satellite Earth Observation in Support of the SDGs. European Space Agency. http://bit.ly/35Dim0X

Schedule	9:00-10:30: Presentation 10:30-12:00: Work Group
12:00-13:00	Lunch Break
13:00-17:00	Site Visit Innovative Technologies for DRR and Resilience in Practice
Content	Participants will visit a facility that utilizes one or more of the innovative technologies detailed in Module 4 (Innovative Technologies Overview).
Learning Outcomes	<ul style="list-style-type: none"> Enhanced knowledge on innovative technologies for DRR and resilience in practice.
Schedule	13:00-17:00: Site visit
17:00-17:15	Day 2 Wrap-up and Reflection
Day 3: Practical and Planned Application of Emerging Technology and Innovation for DRR and Resilience	
9:00-11:00	Module 2.2: Changing How We Make and Acquire Things

<p>Content</p>	<p>In this session, participants explore how new technological advancements and innovations in manufacturing and construction are improving our abilities to prevent disasters from happening and recovering successfully from them when they do. Additive manufacturing, more commonly known as 3-D printing, offers an astounding range of support options for disaster risk management and resilience building efforts. The cost to 3-D printing technology has fallen to a point that enables access by almost any organization. With additive manufacturing capabilities, response organizations are finding there is less need to stockpile unique or as-needed items given these can be manufactured on site and can even be customized. An expanding range of raw materials that may be used for this form of manufacturing further expands the possible uses, including foods, medicines, and medical supplies. The scale of utility has likewise expanded as larger printers have been developed, with capabilities for the printing of vehicles and even homes now within the realm of possibility. Science, technology, and innovation have also improved the materials of construction themselves. Self-healing buildings, materials that alleviate natural forces, materials that produce energy, and others are improving mitigation options and increasing the prospects for community resilience. Utilization of new construction materials and techniques is helping to ensure that replacement and new buildings are better able to withstand future events, and robotics, 3-D printing, and other mechanisms are making the rebuilding process faster and more cost efficient.</p> <p>Discussion Topics:</p> <ul style="list-style-type: none"> ● Use of manufactured goods in the disaster context. ● Country-specific advantages and disadvantages related to additive manufacturing. ● The suitability of 3D printed homes. ● Innovative materials champions. ● Use of semi-permanent quick-setup shelters. ● Promoting research and development of new materials.
<p>Learning Outcomes</p>	<ul style="list-style-type: none"> ● Ability to identify where access to 3-D printing technology will support planning and/or operations ● Enhanced knowledge about new construction materials and methods, including when and where they are appropriate, and the benefits gained through their application.
<p>Key Readings</p>	<ul style="list-style-type: none"> ● OCHA. 2015. Shrinking the Supply Chain: Hyperlocal Manufacturing and 3D Printing in Humanitarian Response. http://bit.ly/2Y9cJUI. ● Kuckelhaus, Markus. 2016. 3D Printing and the Future of Supply Chains. DHL Trend Research. http://bit.ly/2PgrGAb. ● World Economic Forum. 2016. Shaping the Future of Construction: A Breakthrough in Mindset and Technology. Reference 220416. http://bit.ly/32ZLHAs.
<p>Schedule</p>	<p>9:00-10:00: Presentation 10:00-11:00: Work Group</p>

11:00-12:00	Module 2.3: Connecting People, Things, and Technology
Content	<p>The interconnectedness of people to people, people to things, and things to things, coupled with improved capacity to transfer information electronically, is changing how risks and disasters are managed. New communications technologies, namely fifth generation (5G) cellular network data transmission, are allowing devices to collect and transmit information on a previously-unimaginable scale. Expansion of existing technologies for new uses, as is occurring with SMS texting, is further improving crisis, emergency, and risk communication, including between citizen responders and their governments. Mesh networks are expanding the reach of existing infrastructure and helping to manage in situations where infrastructure doesn't exist or has been impacted by disasters. The nature of information collected is also expanding on account of the transmission capacity. New infrastructure systems and linkages are expanding access even in situations where traditional networks are nonexistent, damaged, or otherwise nonfunctional. Distributed ledger ('blockchain') technology, is also helping in this regard, namely through the improvement of availability and fidelity of disaster-related information, and in the process is solving many longstanding problems related to transparency and equitable relief and recovery as well as supporting more effective planning and disaster financing.</p> <p>Discussion Topics:</p> <ul style="list-style-type: none"> ● The computer in your pocket. ● Cloud computing versus e-Government. ● How can cloud computing enhance disaster risk management? ● What can and should be connected to the internet of things? ● IoT-based training needs. ● Disaster risk management uses of distributed ledger technology.
Learning Outcomes	<ul style="list-style-type: none"> ● Ability to explain how 5G and IoT are improving hazard monitoring, alert, and warning. ● Increased understanding of the information management and sharing capabilities afforded by new and emerging technologies. ● Ability to incorporate distributed ledger technology into relief and recovery plans and policies.
Key Readings	<ul style="list-style-type: none"> ● GSMA. 2017. Blockchain for Development: Emerging Opportunities for Mobile, Identity, and Aid. GSM Association. http://bit.ly/2LJJOLO. ● World Economic Forum. 2019. Realizing the Internet of Things: A Framework for Collective Action. WEF White Paper. http://bit.ly/2oMrVto. ● Eze, Kelechi G., Matthew N. O. Sadiku, and Sarhan M. Musa. 2018. 5G Wireless Technology: A Primer. Roy G. Perry College of Engineering, Texas A&M University. http://bit.ly/2ZboTnt ● Ray, Partha Pratim, Mithun Mukherjee, and Lei Shu. 2017. Internet of Things for Disaster Management: State of the Art and Prospects. IEEE Access. October 12. http://bit.ly/2N3Oi74.
Schedule	11:00-11:30: Presentation

	11:30-12:00: Work Group
12:00-13:00	Lunch Break
13:00-15:00	Module 2.3: Connecting People, Things, and Technology (Continued)
Schedule	13:00-14:00: Presentation 14:00-15:00: Work Group
15:00-17:00	Module 2.4: Improving Data Analysis and the Presentation of Information
Content	<p>Data and information are collected through myriad channels and means in advance of, during, and in the aftermath of a disaster, and new and innovative technologies are significantly expanding the pool of options. Once collected, data remains of little value without the capacity to assess, analyze, and report it in a manner that supports effective decision-making. In this session, participants look at how advanced computing capacity and software options are being used to analyze massive quantities of data collected on grand scales ('big data') to support decisionmakers, and how those same systems are enabling wider access to visualization of data and information usable even by practitioners with little to no training in geographic information systems use. Through artificial intelligence and machine learning, computers are expanding their utility in this regard. Advanced imaging in the form of virtual and augmented reality, is allowing information to be communicated and learning to occur in ways that improve cognition while reducing unnecessary risks to trainees and practitioners. These new technologies are increasing the conceptual capacity and forecasting abilities of planners and responders alike.</p> <p>Discussion Topics:</p> <ul style="list-style-type: none"> ● Big Data in government. ● Data sources and stakeholders. ● Mobile phone data. ● Local data partners. ● New data for disaster risk management analysis. ● The limits of artificial intelligence. ● Risk acceptability for AI solutions. ● Using predictive analysis to support resilience. ● Why use virtual reality?
Learning Outcomes	<ul style="list-style-type: none"> ● Ability to incorporate existing big data analysis systems into planning and response. ● Understanding of the range of big data that is being collected by different stakeholders, and the importance of data standards and open data policies to support its use in disaster risk management. ● Comprehension of artificial intelligence and machine learning, including what these related technologies are doing to improve the capabilities of disaster risk reduction practitioners. ● Ability to understand how virtual and augmented reality are increasing cognition and improving resilience.

<p>Key Readings</p>	<ul style="list-style-type: none"> ● Global Facility for Disaster Risk and Reduction. 2018. Machine Learning for Disaster Risk Management. World Bank. Guidance Note. http://bit.ly/2oLonaW. ● West, Darrell M. 2018. What is Artificial Intelligence? Brookings Institution. October 4. http://bit.ly/2AGL9Dm. ● Yu, Manzhu, Chaowei Yang, and Yun Li. 2018. Big Data in Natural Disaster Management: A Review. Geosciences. George Mason University. http://bit.ly/2pBfUav. ● Botha, Marc. 2019. The Limits of Artificial Intelligence. Medium. Towards Data Science. February 11. http://bit.ly/3aqfYwN.
<p>Schedule</p>	<p>15:00-16:00: Presentation 16:00-17:00: Work Group</p>
<p>17:00-17:15</p>	<p>Day 3 Wrap-up and Reflection</p>
<p>Day 4: Practical and Planned Application of Emerging Technology and Innovation for DRR and Resilience</p>	
<p>9:00-10:00</p>	<p>Module 2.4: Improving Data Analysis and the Presentation of Information (Continued)</p>
<p>Schedule</p>	<p>9:00-9:30: Presentation 9:30-10:00: Work Group</p>
<p>10:00-12:00</p>	<p>Module 2.5: Humans as a Resource</p>
<p>Content</p>	<p>Citizens are assuming an increasingly critical role in the informational aspects of society, and social activities themselves, through the many mechanisms for interconnectedness and communication that have been developed. Social media and the prevalence of communications technologies including mobile phones is enabling individuals to support pre- and post-disaster response and recovery operations, both of official responders and the actions of other citizens and organizations. Through participation in research and other studies, citizens are contributing to the generation and improvement of information and are helping to support different aspects of disaster risk management including monitoring, notification, assessment, crisis communication, and other functions. Citizens are also contributing indirectly through the prevalence of social media, which response organizations can utilize to improve situational awareness. Social media organizations are likewise tapping into their unique access to support emergency operations and situational awareness by communicating with their members and subscribers.</p> <p>Discussion Topics:</p> <ul style="list-style-type: none"> ● Engagement for resilience. ● What can you crowdsource? ● When VGI makes sense. ● Using VGI for exposure and vulnerability mapping. ● Incentives for citizen science.

	<ul style="list-style-type: none"> Promoting citizen science for community resilience.
Learning Outcomes	<ul style="list-style-type: none"> Capacity to utilize social media for expanded situational awareness in disasters, and to conduct two-way information sharing with the public. Ability to understand how crowdsourcing and citizen science supports risk-informed decision-making.
Key Readings	<ul style="list-style-type: none"> Studies on Participatory Early Warning Systems (P-EWS): Pathways to Support Citizen Science Initiatives. <i>Frontiers in Earth Science</i>. November 6. http://bit.ly/2JOkfPn. UN Asian and Pacific Training Centre for Information and Communication Technology for Development and the Asian Disaster Preparedness Center. 2018. Reference Document on Social Media for Disaster Risk Management. http://bit.ly/2v07nRn.
Schedule	10:00-11:00: Presentation 11:00-12:00: Work Group
12:00-13:00	Lunch Break
13:00-17:00	Big Data Analysis Training
Description	Participants will receive a 4-hour training in GIS Analytics and Big Data Analysis. Participants will receive a practitioner account that enables them to use the platform for disaster risk management purposes on completion of the course.
Schedule	13:00-17:00: Training
17:00-17:15	Day 4 Wrap-up and Reflection
Day 5: Implementation of Emerging Technologies and Government Innovation for DRR and Resilience	
9:00-12:00	Module 3.1: Implementing and Financing Technology Solutions
Content	In this session, participants explore the mechanisms by which community and national government planners identify, access, and implement technology solutions and innovations. Instructional materials will cover the various stakeholders involved in the implementation process, and the requirements and mechanisms for expanding access to technologies as beneficiary or user. Materials will focus on many of the key requirements for adopting emerging technologies, such as data preparedness, public education and staff training, and systemization and standardization, among others. Participants will also explore the mechanisms through which countries and communities may finance emerging technologies adoption and maintenance. Explored options will include technology funds, partnership with the private sector, official development assistance, and others. Development partnerships,

	<p>agreements, and knowledge transfer platforms that support innovative technologies uptake and adoption will also be covered in this session.</p> <p>Discussion Topics:</p> <ul style="list-style-type: none"> ● Capacity domains in the context of emerging technology (multiple discussions on this topic). ● Stakeholder roles and responsibilities. ● Why do countries need STI policy?
Learning Outcomes	<ul style="list-style-type: none"> ● Enhanced ability to recognize and understand the roles that different stakeholders play in the adoption and use of emerging technologies. ● Increased knowledge of the requirements countries and communities face before a technology is adopted, during its use, and for long-term maintenance of the capacity. ● Strengthened capacity to recognize and assess risks associated with the adoption of emerging technologies. ● Increased capacity to assess, prioritize, and pursue financing options to address emerging technology needs. ● Increased awareness of regional and global partnerships and efforts aimed at expanding access to and uptake of emerging technologies, including South-South and triangular cooperation.
Key Readings	<ul style="list-style-type: none"> ● Raymond, Nathaniel and Ziad Al Alchkar. 2016. Data Preparedness: connecting data, decision-making and humanitarian response. Harvard Humanitarian Initiative. http://bit.ly/30CoWBf ● Woodward, Aylin. 2018. When It Comes to Natural Disasters, Technology Has an Unavoidable Dark Side. Futurism. February 1. http://bit.ly/2YZX1Ln ● Sawahel, Wagdy. 2018. Technology Transfer Boost for LDCs. University World News. June 12. http://bit.ly/2N32dLe ● United Nations. 2016. Knowledge Sharing for DRR Science for the Implementation of the Sendai Framework: The Role of Knowledge Hubs. UN Office for Disaster Risk Reduction. ● Gray, Vanessa. 2019. Key Recommendations for Using Disruptive Technologies to Manage Disasters. ITC4SDG. http://bit.ly/2KxIMZe.
Schedule	<p>9:00-11:00: Presentation</p> <p>11:00-12:00: Work Group</p>
12:00-13:00	Lunch Break
13:00-15:00	Module 3.2: Technology Gaps and Challenges to Implementation of Government Innovation for DRR and Resilience
Content	<p>In Session 2, participants will explore the problems associated with emerging technologies that are largely to blame for disparities in their use between different regions and countries. Materials will look deeper into the roots of the 'digital divide' consider how such gaps can work in a country's favor in terms of 'leapfrogging' existing capacity. Institutional barriers to access, uptake, and utilization will be examined, from the public institutions that support them to the ability of the emergency management community to</p>

	<p>reach the ‘last-mile’ of delivery. In this session, participants also explore the impacts of technology use, understanding that implementation and/or access rarely comes without some cost.</p> <p>Discussion Topics:</p> <ul style="list-style-type: none"> ● Regulations and policies guiding drone use. ● Implementation risks. ● Cybersecurity.
Learning Outcomes	<ul style="list-style-type: none"> ● Increased understanding of the primary barriers to access, adoption, and utilization of emerging technologies, including the strength of public institutions, institutional knowledge and brain-drain, political challenges and policy restrictions, public investment problems, donor rigidity, infrastructure dependencies, and more. ● Increased appreciation for the requirements for maintaining adopted technologies, including financial costs, staff training, and cascading dependencies.
Key Readings	<ul style="list-style-type: none"> ● Aid and International Development Forum. 2018. The Digital Divide is Closing: Worlds Least Developed Countries on Track for Universal Internet. http://bit.ly/2MfZVZP ● Almarzooqi, Ahmed. 2017. Infusing Technology Into Third World Countries. International Center for Global Leadership. http://bit.ly/2XWwi0J. ● Kellen, Vince. 2019. Difficulties and Challenges of Data Democratization. Cutter Business Technology Journal. January 2. http://bit.ly/2OVCOFW ● Pew Research Center. 2015. Internet Seen as Positive Influence on Education but Negative Influence on Morality in Emerging and Developing Nations. http://bit.ly/303DoT1. ● Saez, Catherine. 2018. 4 of 5 People in LDCs Can Access Mobile Networks, But Are Not Using Internet. Intellectual Property Watch. January 24. http://bit.ly/32xKcKk
Schedule	<p>13:00-14:00: Presentation</p> <p>14:00-15:00: Work Group</p>
15:00-16:00	Module 3.3: Measuring Progress: Monitoring and Evaluation of Implementation Efforts
Content	<p>In this final module, participants will consider what monitoring and evaluation requirements exist in terms of emerging technologies access, adoption, and use, and how those requirements may be addressed. Materials will apply the goals and priorities of the Sendai Framework and the Sustainable Development Goals as international standards against which evaluation may be measured, but also provide alternate measures and methods.</p> <p>Discussion Topics:</p> <ul style="list-style-type: none"> ● Value of global goals and indicators. ● Data collection methods.

	<ul style="list-style-type: none"> ● Evaluation of emerging technologies.
Learning Outcomes	<ul style="list-style-type: none"> ● Increased understanding of monitoring and evaluation methods that are relevant to the adoption and use of emerging technologies. ● Developed capacity to more effectively identify and plan for monitoring and evaluation needs when planning for emerging technologies use.
Key Readings	<ul style="list-style-type: none"> ● Kusek, Jody Zall and Ray C. Rist. 2004. Ten Steps to a Results-Base Monitoring and Evaluation System. A Handbook for Development Practitioners. The World Bank. http://bit.ly/37Je1Jb ● UNDRR. 2016. The Science and Technology Roadmap to Support Implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030. 29 February. http://bit.ly/2V9bsxy. ● UNDESA, 2019. SDG Indicators – UN STATS. http://bit.ly/2OOqDbA ● UNDP. 2009. Handbook on Planning, Monitoring, and Evaluation for Development Results. http://bit.ly/2PfDBiF. ● Wagner, Lynn. 2018. Getting to 2030: Tracking SDG Indicators for Evidence of Implementation Progress. March 29. http://bit.ly/2N11ZUO.
Schedule	15:00-16:00: Presentation and Wrap-up
16:00-17:00	Course Evaluation by Participants & Closing Session