



30

INNOVATIONS

Linking DRR with SDGs



**30 innovations linking Disaster Risk Reduction
with Sustainable Development Goals**

About this publication:

This publication is developed by a group of individuals from the International Institute of Disaster Science (IRIDeS) at Tohoku University, Keio University, the University of Tokyo, the United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS), and Church World Service (CWS) Japan in collaboration with the Association of Pacific Rim Universities (APRU) Multi-Hazards Program. The case studies of the 30 innovations were selected in a series of discussions with the group. The innovations are not limited to the 30 cases included in this publication.

This publication is not the official voice of any organizations and countries. The analysis presented in this publication is of the author of each innovation.

Team members:

Takako Izumi (IRIDeS, Tohoku University)
Rajib Shaw (Keio University)
Mikio Ishiwatari (The University of Tokyo)
Riyanti Djalante (UNU-IAS)
Takeshi Komino (CWS Japan)
Vibhas Sukhwani (Keio University)
Bismark Adu Gyamfi (Keio University)

How to refer this publication:

Please refer to this publication as follows:

Izumi, T.; Shaw, R.; Ishiwatari, M.; Djalante, R.; Komino, T., Sukhwani, V., Adu Gyamfi, B. (2020): 30 innovations for disaster risk reduction by IRIDeS, Keio University, the University of Tokyo, UNU-IAS, CWS Japan, Japan, 97 pages.

March 2020



This work is licensed under a Creative Commons Attribution-Non Commercial-Share Alike 4.0 International License.

Foreword

As we enter the new decade, it is becoming abundantly clear that greater commitment and accelerated action is urgently needed to help meet their commitments to combat climate change and reduce disaster risk. A transformation of this magnitude calls for new ways of thinking and operating, underscoring the need to promote innovation as a critical factor in the achievement of the 2030 Agenda, including the Sendai Framework and the Sustainable Development Goals.

Innovations might include technology-based solutions that help resource-constrained countries implement change at scale or community-based innovations that address local needs, or maybe applications of traditional and indigenous knowledge to solve modern problems. This wide diversity in innovation was well-captured in the “30 Innovations for Disaster Risk Reduction” publication which was released in May 2019 at the Global Platform for Disaster Risk Reduction.

Not surprisingly, countries and communities seeking to fast-track resilience-building have made a strong call for more examples and case studies of how innovation is helping to achieve tangible results in disaster risk reduction (DRR). Accordingly, I am pleased that this second volume of “30 Innovations” provides even more examples of innovative solutions and good practices that inspire us to think “outside the box” and test new ideas that will propel progress in reducing disaster and climate risk.

The second volume of “30 Innovations” is unique in that it links disaster risk reduction with the Sustainable Development Goals and highlights sector-based DRR innovations. These innovations emphasize the multi-sectoral dimensions of DRR and remind us that only a transversal, collaborative approach will allow us to achieve our common objective of mitigating risks. Just one example included in “30 Innovations” is the growing cooperation between DRR, climate change adaptation and environmental protection agencies, as demonstrated by the results of the 200-respondent survey included in the publication.

“30 Innovations” is a welcome addition to the set of tools that countries and communities need to address the challenges of increasing climate and disaster risks. The future of DRR needs to be innovative, sustainable, and people-centred if we are to succeed in tackling these global challenges and building resilience for all. “30 Innovations” is an important step helping to lead us in this direction.



Ms. Loretta Hieber Girardet
Chief, United Nations Office for Disaster Risk Reduction,
Regional Office for Asia and the Pacific

Preface

In recent years, the scale, pattern, and seasonal distribution of disasters have rapidly started to change due to such factor as climate change, environmental degradation, urbanization, high seismic and volcanic activities. To address these problems, the role of universities is critical as they are the public and private centers for research, innovation, science and technology. There are many ways that universities can contribute to the development of solutions.

In 2019, Japan was hit by extreme floods caused by a typhoon that did not only hit the seacoast, but the inland areas as well. This event demonstrated the crucial importance of a multi-hazards approach, of strengthening the capacity of disaster response and risk reduction. In addition, it necessitated updating our disaster risk reduction (DRR) countermeasures and applying both new and traditional ways to tackle these unexpected challenges.

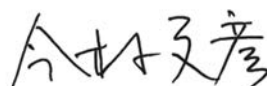
The Association of Pacific Rim Universities (APRU), which consists of 51 leading research universities of the Pacific Rim, established the Multi-Hazards Program jointly with Tohoku University in 2013. The International Research Institute of Disaster Science (IRIDeS), Tohoku University hosts the Program Hub to strengthen the collaborative research on disaster science and contribute to a policy making process based on data analysis. Tohoku University has been appointed as one of national designated universities in 2017 and has taken a lead in the organization of the 2017 and 2019 World Bosai Forums and of international collaborative research in disaster science.

The first publication of the “30 innovations” series showcased the most effective innovations. It highlighted that “innovations” not only include high-tech products but also approaches to create real and truly effective DRR innovations. When the first publication was launched at the Global Platform for DRR in Geneva in June 2019, the comments received from the audience were mostly on the need for identifying sector-based innovations. Therefore, the lists of the innovations are selected from 10 different sectors namely emergency response, health, gender, water, children, education, agriculture, early warning, disability, and livelihood.

These innovations were developed by different stakeholders at local, national, and international levels. Without collaboration with different stakeholders at this scale, real productive and effective innovations cannot be created. The ideas mostly come from local needs and capacities. As included in this publication, various innovative DRR measures already exist. However, in order to tackle new challenges, it is necessary to foster new ideas, technology, and innovation within a strong ecosystem of collaboration between individuals, business, universities, governments and international and regional organizations. The accessibility and relevance of these innovations is a key success measure. Universities and researchers are critical to exploring new solutions. There is more that needs to be done to implement these innovations and make them practically available to vulnerable communities across the region.



Christopher Tremewan
Secretary General,
Association of Pacific Rim Universities



Fumihiko Imamura
Director,
International Research Institute of Disaster
Science, Tohoku University

TABLE OF CONTENTS

30 INNOVATIONS LINKING DRR WITH SDGs

Foreword	01
Preface	03
Introduction	07
30 Innovations Linking DRR with SDGs	
EMERGENCY RESPONSE	09
01. Linking Cash and Voucher Assistance with Social Protection.....	10
02. Nationalized Cluster Coordination Mechanism.....	12
03. Certification of Humanitarian Agencies.....	14
04. My Timeline: Optimizing Emergency Evacuation Per Household.....	16
HEALTH	19
05. Participatory Monitoring of Health Security on Disaster.....	20
06. Mobile Clinics.....	22
07. Basic Package for Health Services.....	24
GENDER	27
08. Gender Perspective in Disaster Relief.....	28
09. Promoting Women Leadership in Humanitarian and Disaster Risk Reduction in Nepal ..	30
10. Developing Women Community Leaders: Building Capacity for Fijian Disaster Resilience...	32
WATER	35
11. Green Infrastructure.....	36
12. Integrated Water Resources Management.....	38
13. Small-scale Reservoir.....	40
CHILDREN	43
14. Games for Disaster Risk Reduction.....	44
15. DRR Educational Materials with a Cartoon Character.....	46
16. The First 1000 days.....	48
EDUCATION	51
17. Technical Vocational Education and Training.....	52
18. Museums/Memorials for Disaster Risk Reduction.....	54
19. Thematic Incubation Centre for Higher Education in Disaster Risk Reduction.....	56
AGRICULTURE	59
20. Floating Garden for Flood Risk Reduction.....	60
21. Multi-purpose Roof-top Garden.....	62
22. Digital Farming for Agricultural Sustainability	64
23. Sustainable Agriculture Kits for Terrace Agriculture.....	66
EARLY WARNING	69
24. Earthquake Guard: Earthquake Early Warning System	70
25. Water Battery for Flood Early Warning System.....	72
26. Flag-based Cyclone Early Warning System.....	74

DISABILITY 77

- 27. Disability-inclusive Disaster Risk Reduction 78
- 28. Accessible and Universal Design Standards 80

LIVELIHOOD 83

- 29. Ecosystem-based Disaster Risk Reduction 84
- 30. A Nexus approach toward Climate Change, Food Security, and Livelihoods 86

Summary of survey results: 30 innovations linking DRR with SDGs 89

APPENDIX 93

- Acknowledgement 94
- Project team 95

Introduction

While there is growing awareness and concern regarding climate change, with a lot of active discussions surrounding the issue, there is not much information on several other risks facing the world such as urbanization, an increase in natural hazards, an ageing society, food and water crises, prolonged conflicts, etc. Innovative solutions are required now more than ever to identify these issues and address them in an effort to build a resilient society.

A publication entitled “30 Innovations for Disaster Risk Reduction” was released at the Global Platform for Disaster Risk Reduction held in Geneva in May 2019, which stated that only high-tech tools should not be considered innovative and useful; rather, an appropriate strategy is imperative to change the current global situation and tackle the complexities of modern society.

This publication entitled “30 Innovations linking DRR with SDGs” is the second volume in the “30 Innovations” series, and includes an additional 30 innovations focusing on 10 sectors—Emergency response, Gender, Health, Agriculture, Water, Children, Education, Disabilities, Livelihood, and Early warning—to demonstrate the strong association between DRR and SDGs. These 10 sectors were selected following detailed discussions by a group of experts in DRR, taking into consideration the 17 SDGs. It is not possible to discuss and consider DRR without examining its association with other sectors. It demonstrates the nature of complexities surrounding the DRR issue, which should also focus on both natural and man-made hazards such as technological and chemical threats. Given that the discussion and consideration on DRR is becoming increasingly interdisciplinary and complex, a strong partnership and collaboration beyond sectors is urgently required.

In order to highlight the association between DRR and the 17 SDGs, each innovation in this publication highlights the most relevant SDG. For instance, most DRR innovations in this publication will contribute toward reducing poverty (Goal 1). Accordingly, this publication also seeks to highlight the strong association between DRR and SDGs, so that even those who have not been interested in the DRR issue could realize the need for promoting DRR activities for the successful implementation of SDGs, and could be encouraged to play an active role in DRR.

This year, the world is facing a potential risk of wildfire caused by climate change, human development, and other composite reasons. When we talk about the underlying causes and solutions, it should take into consideration various perspectives such as DRR, development, environment, forest reservations, agriculture, health, education, energy, sustainable economic growth, etc. It is obvious that tackling natural disasters is no longer an issue of disaster risk management.

Similar to the first volume, another survey was conducted on the most effective DRR innovations, which received 200 responses from academia, governments, the private sector, NGOs,

and international and regional organizations. The innovation that was selected as the most effective from the 30 listed items in this publication was “Ecosystem-based DRR” under the “Livelihood” section. Again, this is not a high-tech product, but rather an issue concerning the preservation of what we already have. In fact, of the top 10 innovations selected, only one high-tech product (Earthquake early warning system) was included. Most of them were approaches, systems/mechanisms and knowledge that already exist. It implies that it is not just high-tech products that require our attention and investment; rather, we should look into knowledge, materials, and approaches that are already available. We should consider how to maintain or channel these existing ideas, instead of focusing on developing expensive new technologies that require complicated procedures to apply.

30 INNOVATIONS LINKING DRR WITH SDGs

EMERGENCY RESPONSE

- 01.** Linking Cash and Voucher Assistance with Social Protection
- 02.** Nationalized Cluster Coordination Mechanism
- 03.** Certification of Humanitarian Agencies
- 04.** My Timeline: Optimizing Emergency Evacuation Per Household



Linking Humanitarian Cash and Voucher Assistance (CVA) and Social Protection (SP) has become a major policy and operational priority for concerned actors, as evidenced by joint commitments from donors¹, UN agencies² and NGOs³. These efforts have accelerated since the World Humanitarian Summit when social protection emerged as one of the ways to help strengthen the humanitarian and development nexus by addressing underlying poverty and vulnerability and supporting localization. CVA is particularly suited to this effort; given that, majority of non-contributory social assistance globally is cash-based⁴. There are options for humanitarians to link with social protection systems at preparedness,

response or recovery stages, and each require an understanding of the three building blocks of social protection systems namely: policy, coordination and financing, program design and administration. The considerations around these entry points and its potential for humanitarians to strengthen DRR through these investments are illustrated below with examples from Asia.

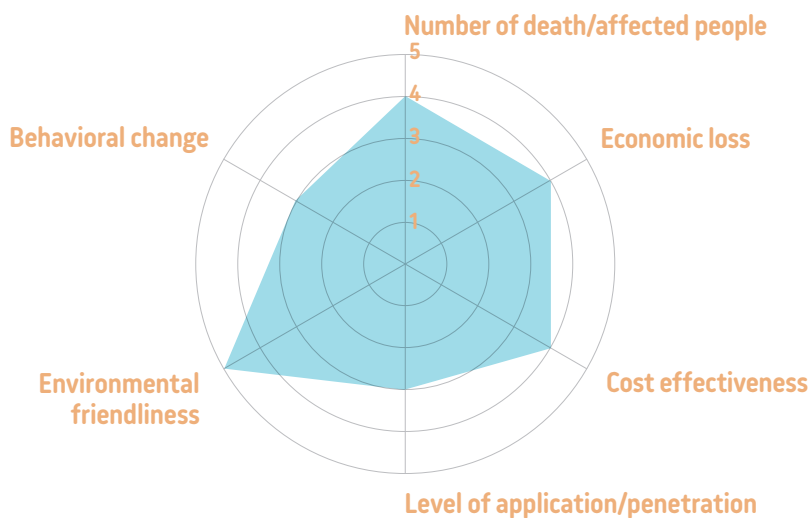
¹ <https://reliefweb.int/sites/reliefweb.int/files/resources/common-donor-approach-feb-19.pdf>:

² <https://reliefweb.int/sites/reliefweb.int/files/resources/2018-12-05-FINAL%20Statement%20on%20Cash.pdf>

³ <https://www.collaborativecash.org/our-approach>

⁴ <http://datatopics.worldbank.org/aspire/>

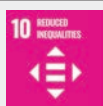
Assessment



Number of Death / Affected people	4	Cash assistance could mitigate secondary and tertiary impact of disasters.
Economic Loss	4	It directly eases economic hardship of the affected community.
Cost Effectiveness	4	It has a potential of reducing operational cost for bigger impact.
Level of Application / Penetration	3	More cases of cash assistance emerging.
Environmental Friendliness	5	It has no negative impact to the environment.
Behavioral Change	3	Assistance methodology is changing.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input checked="" type="checkbox"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input checked="" type="checkbox"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input checked="" type="checkbox"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input checked="" type="checkbox"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	

Most Relevant SDGs



From EU Guidance Package on Social Protection across the Humanitarian-Development Nexus – Philippines case study

How did it drastically change the existing DRR status and strategies? How is it innovative?

The options for linking CVA with social protection systems will differ depending on the objective of the humanitarian intervention, the stability of the context, and the maturity of the country's social protection system. In response to the Philippines Typhoon Haiyan in 2013, for example, the government launched an Emergency Cash Transfer (ECT) programme in collaboration with the World Food Program (WFP), by linking with the existing national social assistance scheme, "Pantawid". As a result, 105,000 beneficiaries of the programme received additional cash, on top of the usual transfer they received, whilst WFP implemented a parallel programme for new beneficiaries. More people were reached in the first two months through the ECT's existing system than the parallel program, supporting more rapid recovery, at a lower cost. The government, donors, humanitarian actors and the World Bank have since committed to investing ex-ante in joint capacity for cash emergency response, that links with, or takes advantage of the existing social protection system.

This and many other examples demonstrate that linking CVA and social protection has the potential to drastically change existing DRR strategies, by facilitating speed and scale of humanitarian response, and building on the Value for Money case for preparedness investments. More collaborative work is needed to exploit this potential, including identifying innovative funding mechanisms (such as forecast-based financing¹) that can bridge the nexus, and understanding the trade-offs of these investments.

Isabelle Pelly, Independent Consultant

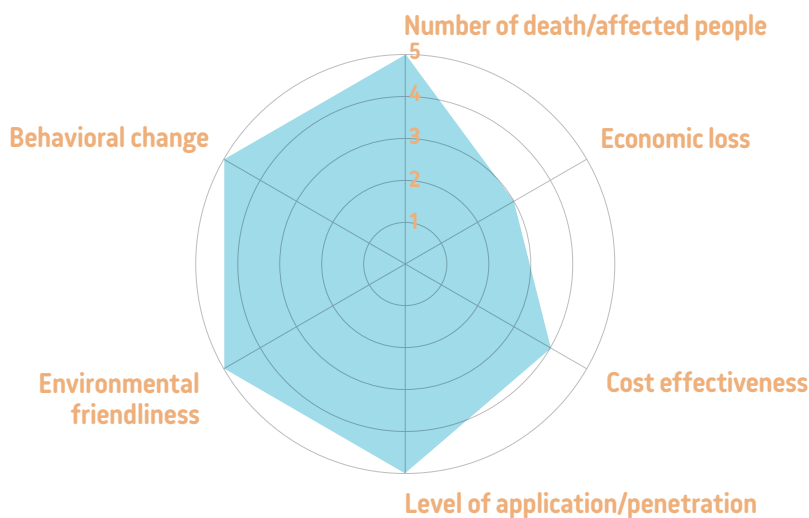
¹ <https://www.forecast-based-financing.org/2019/06/19/cash-forecast-based-financing-and-early-action-a-powerful-trinity>

The humanitarian cluster system is one of the important improvements to contemporary disaster management and humanitarian response, emerging from lessons of the 2004 Indian Ocean tsunami response. At that time, lack of adequate national and international regulations and the presence of too many uncoordinated players resulted in an overlap and duplication in the provision of assistance as well as unmet humanitarian needs (Telford & Cosgrave, 2007¹). Thus, in 2005, the Inter-Agency Standing Committee (IASC) and the United Nations Emergency Relief Coordinator

commissioned an effort to identify factors that hindered a speedy and effective humanitarian assistance and to propose strategies to improve timeliness of future humanitarian assistance. This led to the birth of the Humanitarian Reform Agenda, which aims to strengthen the response capacity (the humanitarian clusters) and to provide better humanitarian financing (the Central Emergency Response Fund/CERF).

¹ Telford & Cosgrave (2007). The international humanitarian system and the 2004 Indian Ocean earthquake and tsunamis. <https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1467-7717.2007.00337.x>

Assessment



Number of Death / Affected people	5	This initiative is being promoted but much effort will be required to be fully achieved the goal of reducing disaster effects and responds.
Economic Loss	3	This idea creates mechanisms for reducing economic losses.
Cost Effectiveness	4	It enhances cost effectiveness through coordination.
Level of Application / Penetration	5	The initiative emerges from global level with many implementations at National, Municipal and local levels.
Environmental Friendliness	5	It has no negative impact to the environment.
Behavioral Change	5	The approach is being adopted at different level which has the potential for behavioral change.



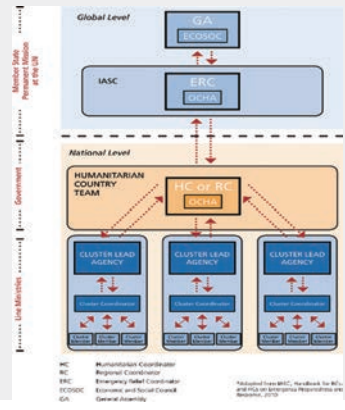
Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input checked="" type="checkbox"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input checked="" type="checkbox"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input type="checkbox"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input checked="" type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	

Most Relevant SDGs

1 NO POVERTY

11 SUSTAINABLE CITIES AND COMMUNITIES

17 PARTNERSHIPS FOR THE GOALS



How did it drastically change the existing DRR status and strategies? How is it innovative?

The aim of the cluster approach is to strengthen system-wide preparedness and technical capacity to respond to humanitarian emergencies and provide clear leadership and accountability in the main areas of humanitarian response. It is put place by the Inter-Agency Standing Committee (IASC) to assign and clarify the division of labor amongst organizations and define their roles and responsibilities within areas of humanitarian activity. Clusters are described as groups of humanitarian organizations, both UN and non-UN, in each of the main sectors of humanitarian action such as water, health, nutrition, logistics¹. Clusters are established as part of an international emergency response, based on an analysis of humanitarian needs and coordination capacity on the ground, and in consultation with national partners². It is an example of a concerted social innovation at global level, based on actual emergency response and humanitarian operations experiences. It has both global and national components.

The coordinated manner of humanitarian cluster approach encourages innovation amongst actors during disaster and its application generates many benefits. Thus; it ensures the coherence of mission objectives, reduces time and resources gap and increase coverage of humanitarian assistance. It also provides connectedness and continuation of assistance from emergency response to early recovery. The application of the approach has helped in coordination, stakeholder communication, resource mobilization and movement and many others when it was implemented in the 2005 earthquake in Pakistan, Yogyakarta earthquake in 2006³ and West Sumatra earthquake in 2009⁴.

Mizan Bustanul Fuady Bisri, PhD, JSPS-UNU Post-doctoral Researcher

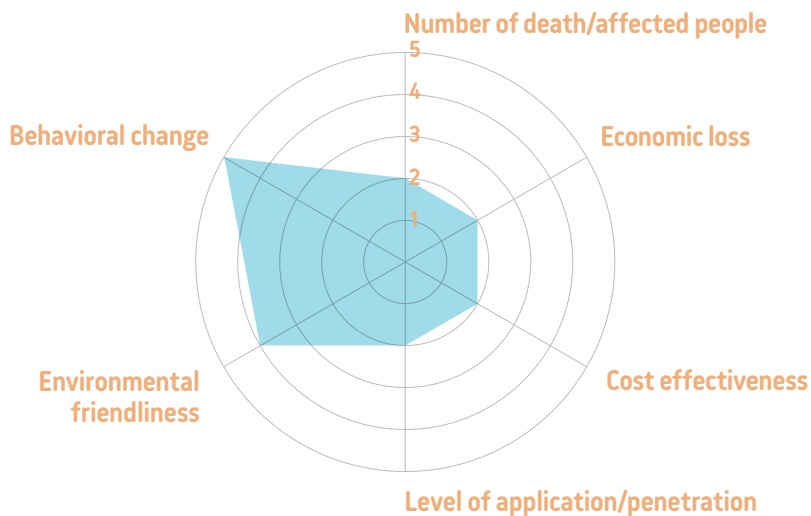
¹ <https://www.humanitarianresponse.info/en/about-clusters/what-is-the-cluster-approach>
² <https://www.humanitarianresponse.info/en/coordination/clusters/activation-and-deactivation-clusters>
³ http://ccouc.org/_asset/file/5westsumatra.pdf
⁴ https://www.sheltercluster.org/sites/default/files/docs/indonesia_west_sumatra_earthquake_2009_0.pdf



People show willingness, desire, enthusiasm and many other traits in several ways to prevent or alleviate the sufferings of others affected by unforeseen events, disasters or other circumstances. These acts are in response to humanitarian imperative that seeks to save lives and alleviate suffering. In order to foster coherence among actors in humanitarian actions, the Core Humanitarian Standard in Quality and Accountability (CHS) outline the commitments and principles from

which actors in humanitarian response can use for effective operations. The principles associated with CHS does not only help organizations improve, but also demonstrates a commitment of accountability to communities and people affected by crisis and during disasters response. In order to support the willingness and ability of some organizations to advance through verification process involved in humanitarian organization recognition, subsidy schemes and support options have been developed.

Assessment



Number of Death / Affected people	2	Contributes to enhancing organization's efforts as disaster responders.
Economic Loss	2	This initiative can boost the economic aspects in organizations.
Cost Effectiveness	2	There is less associated cost.
Level of Application / Penetration	2	This is being implemented across the globe.
Environmental Friendliness	4	It has no negative impact to the environment.
Behavioral Change	5	It offers learning mechanisms for all stakeholders involved.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input type="radio"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input type="radio"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input type="radio"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input checked="" type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	

Most Relevant SDGs



How did it drastically change the existing DRR status and strategies? How is it innovative?

First, the CHS has paved the way for the establishment of specialized organizations such as Humanitarian Quality Assurance Initiatives (HQAI). The HQAI is an independent third-party quality assurance services that provides certification by auditing organizations working with vulnerable and at-risk communities to enhance their capacities to provide standardized, measurable, quality and accountable humanitarian services. The provision of the certification by HQAI has attracted many organizations, individuals to the disaster management field, since the receipt of certification as a disaster responder opens access to funding from donor agencies and also demonstrates the individual/organization’s strength in disaster response activities and good governance.

The increase in disaster responders have over the years offered diverse services in disaster risk reduction and response. The Civic Force in Japan was formed wake of the Niigata Earthquake crisis of 2004 and have been involved in rescue operations since. Another is the Disaster Preparedness and Response Team of Pakistan, formed following the Pakistan earthquake in 2005. It has since been involved in in rescue operations such the Margalla Towers Collapse – Islamabad (2005), Road Traffic Collision on Sector G9, Islamabad etc. Many of these organizations have formed partnerships with other international and local agencies to reduce risks and also save lives. The certification has not only provided these opportunities but also expanded the capacities and coverage of organizations in assisting disaster hit areas or vulnerable individuals in need of relief actions.

Sawako Matsuo, Managing Director, Japan Quality and Accountability Network (JQAN)
Board of Director, Humanitarian Quality Assurance Initiative (HQAI)

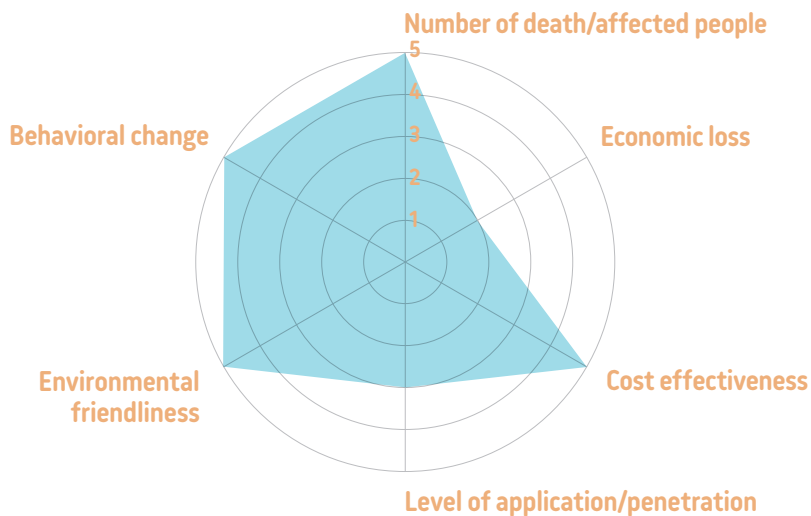


My Timeline: Optimizing Emergency Evacuation Per Household

'My Timeline' is a chronological household evacuation plan which includes: when to evacuate, who to evacuate, what to do after evacuation. The Timeline is useful for determining actions and responsibilities at each stage. Numerous disasters in Japan including the 2015 floods in Joso, the 2017 rains in Northern Kyushu Island as well

as the 2018 Western Japan floods have served as reminders of the importance of household evacuation preparedness. Municipalities across Japan have initiated the "My Timeline" tool to allow households to determine optimal evacuation timing and activity taking into consideration the different vulnerabilities of each family member.

Assessment



Number of Death / Affected people	5	My Timeline greatly reduces the number of deaths by ensuring each person is evacuated to a safe place at an optimal time.
Economic Loss	2	Each household is able to factor in diversifying economic risk to an extent.
Cost Effectiveness	5	It is very cost effective as each plan making is done at a household level.
Level of Application / Penetration	3	Municipalities who adopt the tool is increasing, but still not comprehensive enough.
Environmental Friendliness	5	It has no negative impact to the environment.
Behavioral Change	5	The concept promotes a paradigm change in optimizing evacuation at a household level.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input type="radio"/> Earthquake	<input checked="" type="radio"/> Response
<input type="radio"/> 1960s	<input checked="" type="radio"/> Flood	<input type="radio"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="radio"/> Typhoon/ Cyclone	<input type="radio"/> Mitigation
<input type="radio"/> 1980s	<input type="radio"/> Tsunami	<input checked="" type="radio"/> Preparedness
<input type="radio"/> 1990s	<input type="radio"/> Volcano	
<input type="radio"/> 2000s	<input checked="" type="radio"/> Landslides	
<input checked="" type="radio"/> 2010s	<input type="radio"/> Others	

Most Relevant SDGs



1 NO POVERTY



5 GENDER EQUALITY



17 PARTNERSHIPS FOR THE GOALS



My Timeline tool designed for school children by Shimodate River Office¹

¹ <https://mytimeline.river.or.jp/>

5-Level Warning System			
Warning Level	Action to take	Information provided by local government	Weather alerts issued by JMA
5	Must take measures to protect lives	Disaster information	Emergency warning
4	Must evacuate	Evacuation order / advisory	Landslide alert info. etc.
3	Elderly people must evacuate	Evacuation preparation information	Rain / flood / storm surge warnings etc.
2	Should check evacuation procedures	-	Rain / flood / storm surge advisories etc.
1	Should be on alert for disasters	-	-

How did it drastically change the existing DRR status and strategies? How is it innovative?

'My Timeline' has contributed to a mindset shift around disaster evacuation practices, emphasizing the need for individual household level evacuation preparation and timing. Households with an elderly, disabled or young infant may require more time than other households.

Japanese evacuation warning levels were simplified into 5 levels in 2019, as a way to speed up evacuations, thereby reducing casualties. For the first time, the warning system includes clear instructions tied to each level. For example, level 4 means all residents must evacuate, while the elderly and physically challenged must evacuate at level 3¹. The importance of self-help and mutual-support are widely recognized in Japan. In case of Western Japan floods in 2018, residents of Miyoshi District, Ozu City, Ehime Prefecture were able to evacuate effectively because they had been promoting mutual support initiatives before the disaster, such as preparing evacuation plans and conducting evacuation drills under the direction of local disaster risk management leaders².

Yukiko Maki, CWS Japan
Takeshi Komino, CWS Japan

¹ <https://www3.nhk.or.jp/nhkworld/en/news/backstories/587/>

² http://www.bousai.go.jp/en/documentation/white_paper/pdf/PI1-1.pdf

30 INNOVATIONS LINKING DRR WITH SDGs

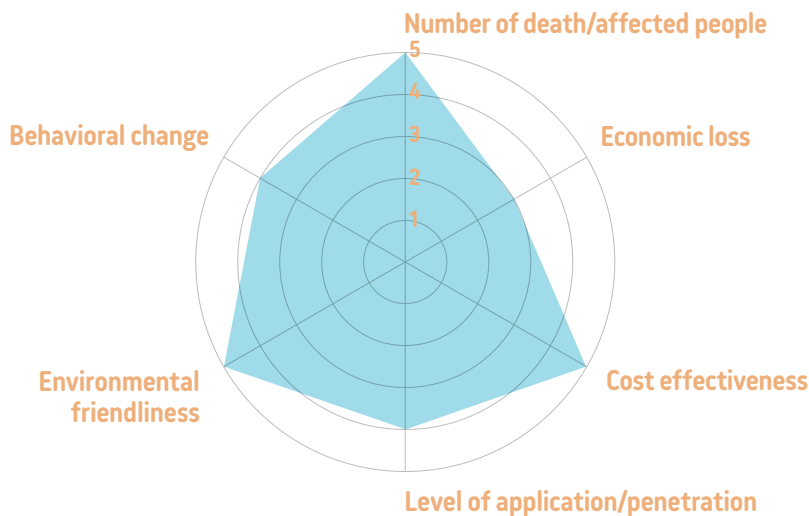
HEALTH

- 05. Participatory Monitoring of Health Security on Disaster
- 06. Mobile Clinics
- 07. Basic Package for Health Services

The state of health, water, sanitation, food, and other environmental conditions are crucial relief and recovery efforts during disasters. Access to the right information and swift response can save many lives in disaster events. Participatory Monitoring of Health Security on Disaster is one approach that aims at implementing healthcare procedures through information gathering and relay from disaster hit area to the relevant health actors. Health and environmental status assessment are undertaken by local residents who usually possess the in-depth knowledge of the affected area. The sharing of collected health information is done

through real-time communication with government and international relief agencies (health clusters) in order to ensure timely decision-making on health risk reduction. Monitoring is undertaken through crowdsourcing by engaging community nurses, health volunteers and stakeholders in this active engagement process. This process enables improvement in delivering quality healthcare and brings sustainability to communities through health improvement. 'EpiNurse Nepal', which started in 2015 after Nepal Earthquake, is one of the examples of this monitoring system.

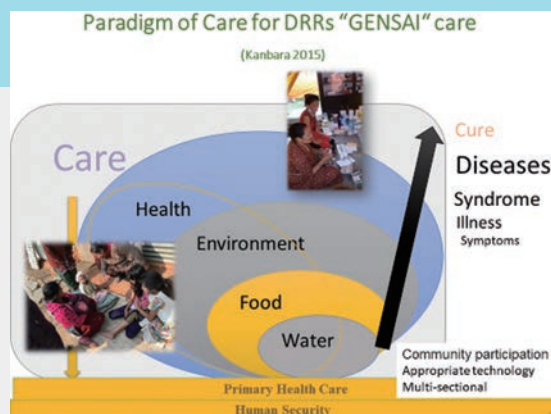
Assessment



Number of Death / Affected people	5	With routine monitoring, health security is maintained.
Economic Loss	3	Participatory Monitoring for health security may not have a direct contribution to economic loss it reduces the dispatching costs, and monitoring health insurance together can allow accounting for health expenses.
Cost Effectiveness	5	Participation of local residents makes it cost-effective.
Level of Application / Penetration	4	Widely applicable.
Environmental Friendliness	5	It has no negative impact to the environment.
Behavioral Change	4	Creates public health awareness.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input checked="" type="checkbox"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input checked="" type="checkbox"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input checked="" type="checkbox"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input checked="" type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	

Most Relevant SDGs



How did it drastically change the existing DRR status and strategies? How is it innovative?

When disaster occurs, the immediate concern is how to care for people in the open field and how to reach out to other populations in need. One of the critical challenges for health responders is to make data to generate reasonable information to help communities recover from the impact of the disaster and prevent possible epidemics. There is a participatory approach that mobilizes domestic health professionals and community local health members like nurses and health volunteers to take urgent steps to make use of available and disaggregated data and set up information systems in order to make rapid health assessments and gather more information to prevent outbreaks. This approach contributes to a realistic and fast monitoring tool for collecting community health status to be shared in a speedy and accurate manner. It also helps to develop a sustainable network as social capital to ensure that no one is left behind in disaster risk reduction.

An example of is the Epi-Nurse Nepal. Under this program, Nurses are trained on rapid health assessment and the use of open source mapping and referral system. It also Includes surveillance system to help gather information on the ground to inform health interventions especially during disasters. Days after the devastating earthquake on April 25, 2015, Nursing Association of Nepal (NAN) were able to send team of nurses to affected areas such as: Sindhupalchowk (Thulobhotang, Chautara, Melamchi), Jiri, Dhading to deliver medicine, rice, food, clothes, water, soup¹. Their prompt actions save many lives and they continue to be crucial part in the health system of Nepal.

Sakiko Kanbara, RN, Ph.D. Professor, University of Kochi, Founder, EpiNurse

¹ Kanbara Sakiko (2016): Participatory Surveillance on evacuation site by local nurses and ICT in Nepal in Shaw R., Izumi T., Shi P., Lu L., Yang S., Ye Q. (2016): Asia Science Technology Status for Disaster Risk Reduction, published by IRDR, Future Earth and ASTAAG, Beijing, China, p. 83

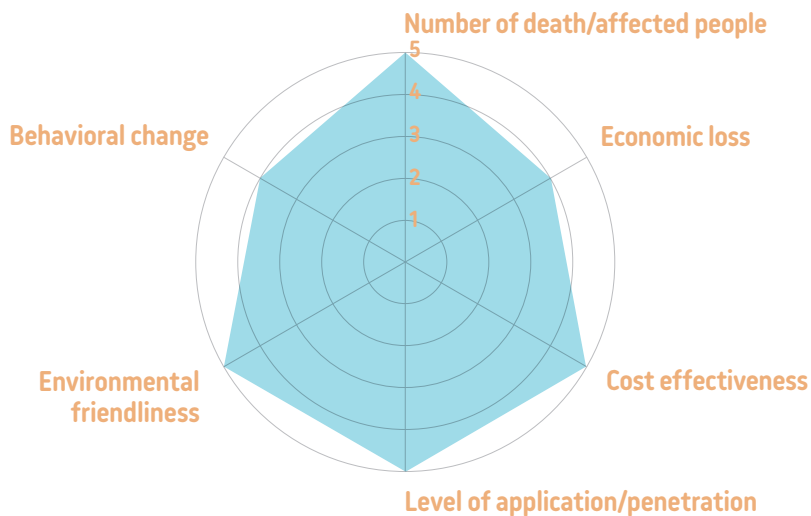


Mobile Clinics

Mobile Clinics consist of traveling health practitioners who provide basic healthcare services to communities in inaccessible areas and are particularly vulnerable to disasters. Besides providing primary health services, Mobile Clinics also facilitate disaster risk reduction training,

promote reproductive health and family-planning, immunization and many others health services. Mobile clinics overcome barriers to access and build trust to reduce disparities, minimize health risks and reduce healthcare costs.

Assessment



Number of Death / Affected people	5	The program provides services that improve the quality of health as well as offer guidance to reduce effects of disasters.
Economic Loss	4	The population is able to make informed decision based on information received to safeguard their economic risk.
Cost Effectiveness	5	Application of the program requires low investment and is able to reach wider audience at community level.
Level of Application / Penetration	5	The use of Mobile Clinics is being spread across many areas throughout Bangladesh.
Environmental Friendliness	5	It has no negative impact to the environment.
Behavioral Change	4	The program is still new to some people.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input checked="" type="checkbox"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input checked="" type="checkbox"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input type="checkbox"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input checked="" type="checkbox"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	

Most Relevant SDGs



How did it drastically change the existing DRR status and strategies? How is it innovative?

Mobile Clinics are an efficient innovation to provide healthcare to areas where health infrastructures are inadequate to respond to a large number of people. This is important in a country like Bangladesh, which is highly disaster prone with large low-income and poorly educated populations living in poorly-developed rural, slum areas and refugee camps which struggle to afford health care costs. Mobile Clinics offer opportunities to meet health needs by providing services such as individual/family tracking, screening of disease, primary health care services and follow-up, referral services.

Mobile Clinics also offer disaster risk reduction and awareness trainings, effectively reducing mobility and mortality rates across in Bangladesh. The Dhaka Community Hospital Trust applied this innovation in the Rohingya refugee camps in Cox's Bazaar, Bangladesh. Its application has also been supported by many international and humanitarian donor organizations. Mobile clinics are reaching many other areas with urgent needs in Bangladesh. Mobile Clinics contribute to the reduction of vulnerabilities in less privileged communities by providing basic health care to reduce mortality rates as well as promote effective vulnerability reduction measures against disasters.

Md. Golam Mostofa, Director, Project & Research, Dhaka Community Hospital Trust

Dr. Md. Fuadul Islam, Innovation Project Manager, Udhvabani (Innovation) Lab

Bangladesh, Project & Research, Dhaka Community Hospital Trust

Sadia Samad Mow, Monitoring Evaluation & Learning Manager, Udhvabani (Innovation)

Lab Bangladesh, Project & Research, Dhaka Community Hospital Trust

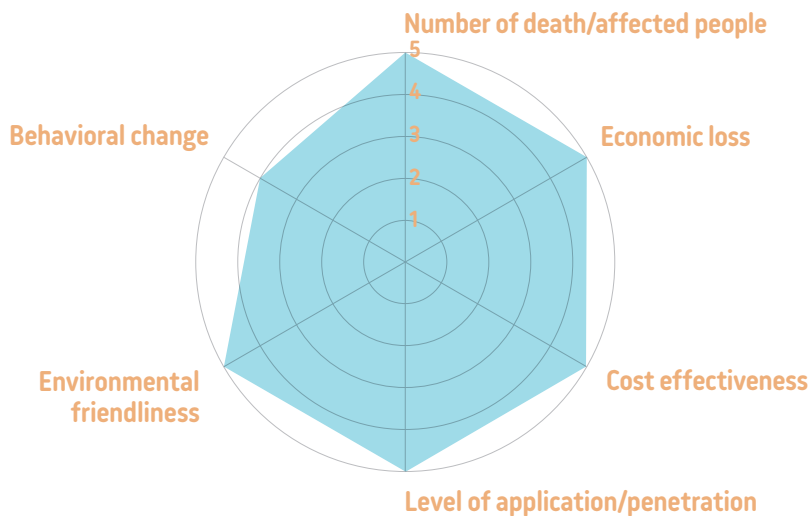


Basic Package for Health Services

Decades of war and conflicts demolished many systems and infrastructures in Afghanistan including health system. Ministry of Public Health developed the Basic Package for Health Services (BPHS) in 2002 with the support of its donors including WHO, World Bank, USAID and European Community. The BPHS is a comprehensive standardized package that provides equal access to quality primary health care services across Afghanistan. It emphasizes on making significant improvement and impact in the health sector and health service delivery in the country through cost effectiveness approach.

The BPHS package includes both curative and preventive health care services and it a good foundation for health system recovery in the country. It raises awareness on disease prevention while providing services on maternal health, immunization, public nutrition, communicable disease, mental health, and many more. The package also standardizes classification of its health facilities and relevant services in 6 levels, from a smaller health facility such as health posts to a larger health facility as district hospital.

Assessment



Number of Death / Affected people	5	The program has significantly improved quality of health and reduced mortality rates.
Economic Loss	5	The program through its training has also improve the financial situation of the many people.
Cost Effectiveness	5	Its terms of its deliverables, this program is cost effective.
Level of Application / Penetration	5	This initiative is being applied in many aspects within the Afghan system.
Environmental Friendliness	5	It has no negative impact to the environment.
Behavioral Change	4	This initiative has offered a positive behavioral change because it is community and local based approach.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input checked="" type="checkbox"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input checked="" type="checkbox"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input checked="" type="checkbox"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input checked="" type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input checked="" type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	

Most Relevant SDGs



How did it drastically change the existing DRR status and strategies? How is it innovative?

BPMS is a well-designed mechanism that facilitated the standardization of healthcare provision and gave a clear and strategized direction to healthcare improvement in Afghanistan. The implementation of BPMS facilitated activities of all stakeholders within the health sector and offered coordination and consistency in providing quality health services. This effort increased health coverage and accessibility from 10% to 80% through a provincial cluster approach. BPMS was able to facilitate the training of community midwives, male and female nurses in most villages within the provinces. This was done through the establishment of midwifery schools in each region of the country.

There are other strides in the health sector since the introduction of BPMS in Afghanistan in 2002. There is an increase in Ante-Natal Care (ANC) rates from 7% to 59% and increase immunization rates from 49% to 70%, modern contraceptive rates from 5% to 20%, skilled birth attendant rates from 12.8% to 58.8%. Maternal Mortality rates have declined from 1600 /100,000 to 143/100,000 life birth and under 5 mortality rates have reduced from 257/1000 to 59 /1000. Similarly; there has been improvement in personal hygiene practices such as hand washing, awareness and prevention of communicable diseases and a wider use of mosquitoes net. These practices have increased mitigation and preparedness against disease and improved the health conditions of the people. Furthermore, there is the establishment of community-based outfits, which provide health services to sustain and strengthen local communities. The outfit collaborate with other health volunteers and as disaster responders, they are usually quick to any events related to health risks and needs. Since BPMS focuses on cost effective prevention and community-based health care services, it is able to enhance community resilience through disease prevention and other health related countermeasures.

Nejabat Khan Safi, Associate Director, Community World Service Asia

30 INNOVATIONS LINKING DRR WITH SDGs

GENDER

- 08.** Gender Perspective in Disaster Relief
- 09.** Promoting Women Leadership in Humanitarian and Disaster Risk Reduction in Nepal
- 10.** Developing Women Community Leaders: Building Capacity for Fijian Disaster Resilience

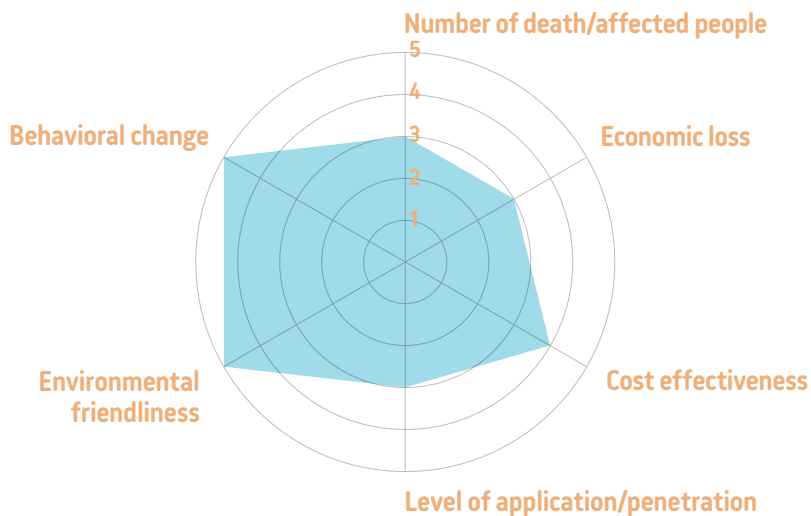


Gender Perspective in Disaster Relief

The importance of gender perspectives in disaster relief began to draw attention in early 1990s when the world realized that, disasters do not affect everyone equal either in developed and developing countries. The worst effect is always experienced by the people in vulnerable areas and situations. From gender perspectives, women's experiences and outputs in disasters management have always been invisible. Therefore, policies, plans and programs have always been built and implemented

from the viewpoint of male leaders. This however has been changing in recent years. Thus, the Hyogo Framework for Action and the Sendai Framework for Disaster Risk Reduction have emphasized the involvement of women as major stakeholders at levels of disaster management within communities. Many governments understand the importance of including gender perspectives in their policies, but still struggle to translate them into action at the community level.

Assessment



Number of Death / Affected people	3	Formulation of gender integrated disaster management plan is the first step. It is important to empower both men and women for saving their life in times of disaster through trainings.
Economic Loss	3	By utilizing both men and women resources, community can protect their assets.
Cost Effectiveness	4	For empowering women, it is necessary to prepare some cost for the first step.
Level of Application / Penetration	3	Many governments understood the importance of gender perspectives, but it still has many challenges for implementation for local government and community people.
Environmental Friendliness	5	It has no negative impact to the environment.
Behavioral Change	5	It required to change mindset of gender concept in the society.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input checked="" type="checkbox"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input checked="" type="checkbox"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input type="checkbox"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input checked="" type="checkbox"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input checked="" type="checkbox"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input type="radio"/> 2010s	<input type="checkbox"/> Others	

Most Relevant SDGs



How did it drastically change the existing DRR status and strategies? How is it innovative?

Since the Hanshin-Awaji Earthquake (known as the Kobe earthquake) in 1995, Japan has experienced numerous large scale disasters including the Great East Japan Earthquake in 2011, the Kumamoto Earthquake in 2016, and western Japan heavy rain disaster in 2018. After the disasters, local government have the primary role to establish emergency shelters for the affected people, but these are expected to be handled by local disaster management volunteers, or voluntary neighborhood disaster prevention organizations. As the society retains traditional gender roles, (in which men are believed to be leaders and women support these leaders and work), evacuation shelters are typically run by mostly elderly male leaders who often overlook the needs of women including the provision of sanitary items, toiletries', well-sized underwear, a private change space, prevention of Gender-based Violence (GBV). Various preparedness measures can be taken to enhance the involvement of gender perspectives in disaster relief, such as increasing the number of female members on the Disaster Prevention Council, which formulate local disaster management plans and a shelter management manual. The process of formulating these items can be important opportunities to increase female participation. For example, in Miki City in Hyogo Prefecture, the number of female members of the Disaster Prevention Council increased from 8.1% to 30% for the revision of the local disaster management plan. Before the disaster prevention meeting for finalizing the revision of local disaster management plan, a series of workshops were held with female council members and local women's organizations, and amendments were made after discussing what kind of gender perspectives should be mentioned in the plan. Based on the revision of disaster management plan, a study seminar was organized for all staff, and several seminars were held for community members to share the importance of gender integrated disaster management. The inclusion of all gender perspectives enhance disaster relief and recovery efforts and promote self-awareness to reducing vulnerabilities after disasters.

Yoko SAITO (yoko.saito@kwansei.ac.jp), Institute of Disaster Area Revitalization,
Regrowth and Governance, Kwansei Gakuin University

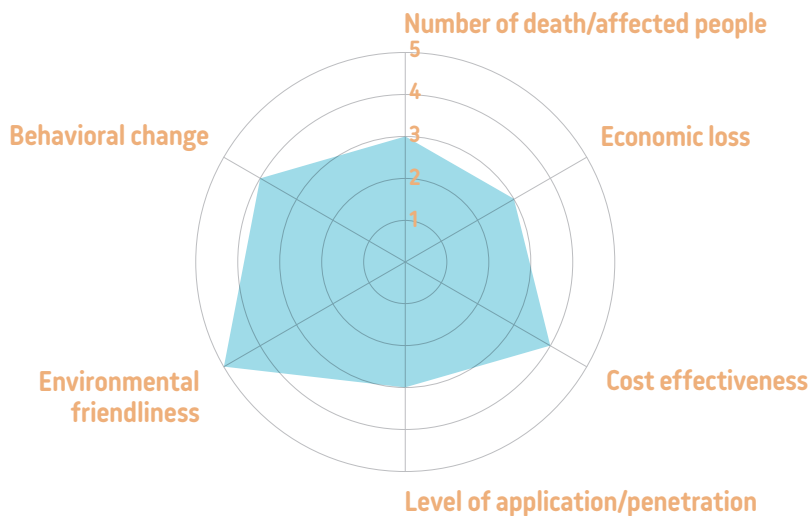


Promoting Women Leadership in Humanitarian and Disaster Risk Reduction in Nepal

Prevailing gender inequalities in Nepal and many parts of the world render women and girls more vulnerable to the impact of disasters. The impacts of disasters and crises are not gender-neutral, as there is evidence to suggest that, when disasters strike and humanitarian crises unfold, women and girls bear most of the impacts. In disaster events, women and girls experience higher mortality, exclusion from humanitarian services and decision-making processes, increased levels of gender-based violence, and loss of livelihoods especially during emergencies. However, women are often the first responders to crises, and are integral element to the

survival and resilience of families and communities. It is therefore vital to empower women from federal level to community level. To this effect, the “Women Humanitarian Platform (WHP), Nepal” was established by women professionals working in the humanitarian sector, Disaster Risk Reduction (DRR), and climate change sectors to promote women leadership for effective response in time of disaster and resilience development at various levels (Federal, Province, Local and Community). WHP also conducts discourses on women issues during emergencies.

Assessment



Number of Death / Affected people	3	The activities contribute to improve women's capacity in DRR.
Economic Loss	3	Women can reduce economic loss in the society.
Cost Effectiveness	4	The activities require limited costs.
Level of Application / Penetration	3	Activities are expanding to the local level.
Environmental Friendliness	5	Negative impacts are minimal.
Behavioral Change	4	Women can become the agent of change in DRR.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input checked="" type="checkbox"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input checked="" type="checkbox"/> Recovery
<input type="radio"/> 1970s	<input type="checkbox"/> Typhoon/ Cyclone	<input checked="" type="checkbox"/> Mitigation
<input type="radio"/> 1980s	<input type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input type="checkbox"/> Volcano	
<input type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input checked="" type="radio"/> 2010s	<input type="checkbox"/> Others	

Most Relevant SDGs



Women Humanitarian Platform members in posing photo after the meeting on 5th November 2019

How did it drastically change the existing DRR status and strategies? How is it innovative?

Women are most often considered as the vulnerable group during disasters. However, the empowerment of women in recent times has generated the perceptions that, they can also become agents of change. There are several examples in Nepal from national level to local level where women have been important contributors to search and rescue efforts, relief distributions, and psychosocial counselling. The establishment of WHP in Nepal reinforces the empowerment of women by bringing the few female professionals in humanitarian action and DRR into a common platform to provide opportunities for members to share knowledge, skills and experiences. DRR efforts require motivation and capacity building and as such; this platform builds synergies to offer support to women professionals and others. Their efforts also extend to others such as, local and community leaders in humanitarian response and DRR.

The platform has already developed its action plan to empower female humanitarians and at the same time, there is also a representation of more than 40% females elected into local government offices. The platform which is currently at the federal level will extend its network to collaborate with provincial and local level governments to conduct action research in the sector of humanitarian response and also support in policy review and gap identification. The platform would be used to conduct different dialogues focusing on existing and emerging issues of young girls, women, girl child and elderly women during emergency. The platform will also advocate for the recognition of efforts and contribution of females in humanitarian service within in Nepal and beyond. WHP is the first platform that is established in Nepal to empower women to lead effective and efficient humanitarian response by identifying, mapping and acknowledging women humanitarians in DRR.

Krishna Karkee (kkarkee@gmail.com), Coordinator, Women Humanitarian Platform, Nepal
Centre for Disaster Management Studies, Nepal

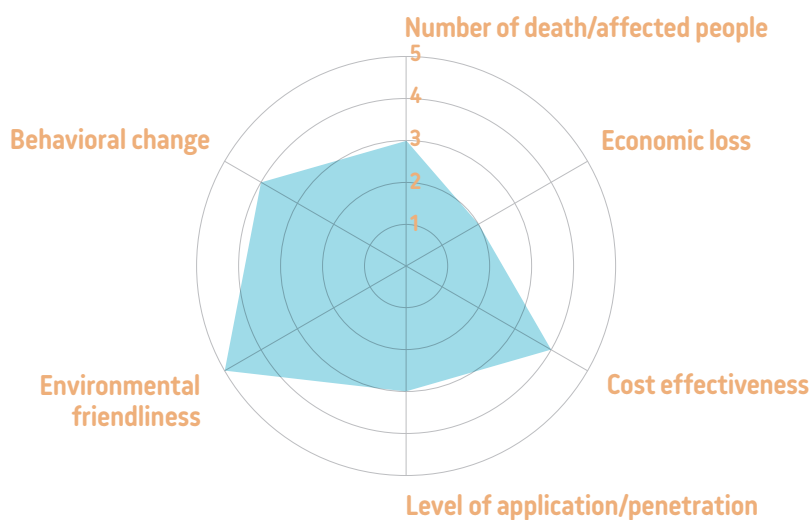


Developing Women Community Leaders: Building Capacity for Fijian Disaster Resilience

Rural and remote communities in Fiji are highly vulnerable to hazards. As community leaders, women have high potential to contribute to disaster resilience. Therefore, it is important to build their capacities in disaster risk assessment, preparedness, response and recovery. The International Training Center for Authorities and Leaders (CIFAL) through its affiliate; CIFAL-Newcastle at the University of Newcastle, as part of a global United Nations Institute for Training and Research (UNITAR) support network, has collaborated with local stakeholders

in Fiji to provide training-of-trainers (ToT) as well as support to empower female leaders in disaster resilience. A team of policewomen were trained in the ToT, and were further provided with training package and support to run other training courses. This demonstrates that, capacity building initiatives for disaster resilience can be implemented effectively when there is a local interest, engagement and participation.

Assessment



Number of Death / Affected people	3	It is not proven yet but it will contribute to reducing the numbers.
Economic Loss	2	It is not proven yet but it will contribute at certain level to reducing the amount.
Cost Effectiveness	4	Not very costly, can be implemented in rural areas of developing countries with simple materials. The initial start-up training can be a bit high, but then reduces.
Level of Application / Penetration	3	This is yet to be assessed, but a high level of interest was evident.
Environmental Friendliness	5	It has no negative impact to the environment.
Behavioral Change	4	Certain level of effectiveness in behavioral change, however, the key challenge remains for sustaining the initiative beyond the initial stage.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input type="radio"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input type="radio"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input type="radio"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input checked="" type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	

Most Relevant SDGs



How did it drastically change the existing DRR status and strategies? How is it innovative?

This project was targeted primarily for female leaders, and as such the participants in both training courses were mostly women (70-75%). Working in partnership with local policewomen allowed the involvement and participation of women from the communities. However, there were participation of a number of men in the courses, from agencies and the rural community representatives. The training was based on an inclusive approach to strengthening the partnership between women and men for achieving disaster resilience. The uniqueness and innovative aspects of this training was the use of the contextualized training packs derived from local consultations and workshops. The pack was tested in the village training course and was found adequately user-friendly and appropriate for rural context. The ToT concept was unique in Fiji, particularly in the context of rural communities there.

The training events were evaluated positively by the participants, and they realized the value of such training programs especially because of the heavy involvement of women and the effort for disaster resilience. The need for more training programs on women and disaster resilience in Fiji was highly encouraged by the training participants. It is as yet not possible to identify the long-term impacts of this initiative, but it was clear from the training that the women participants had great potential to contribute towards future initiatives, and the training brought awareness to the community of the importance of the role of women in disaster risk reduction, which also spread by word-of-mouth to surrounding communities.

Iftexhar Ahmed (ifte.ahmed@newcastle.edu.au). Associate Professor, School of Architecture and Built Environment, University of Newcastle, Australia
T. Gajendran, G. Brewer and H. Giggins, University of Newcastle, Australia

30 INNOVATIONS LINKING DRR WITH SDGs

WATER

11. Green Infrastructure
12. Integrated Water Resources Management
13. Small-scale Reservoir

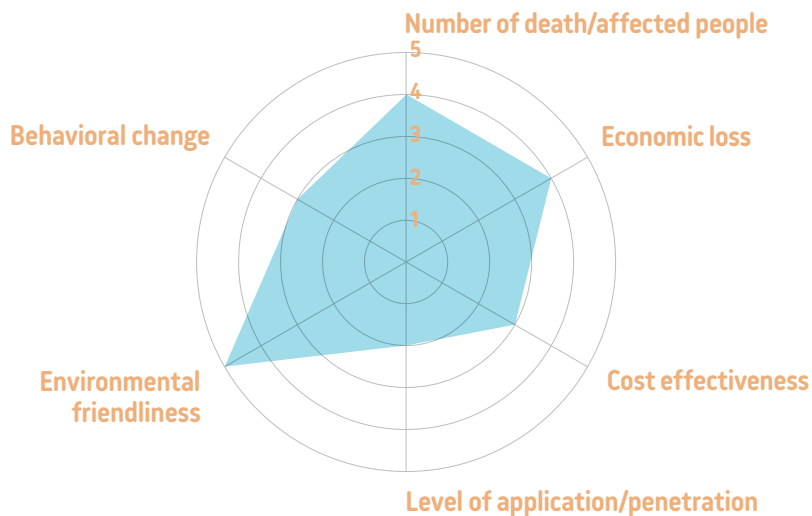


Green Infrastructure

Green infrastructure (GI) is regarded as the sustainable management strategy of land and infrastructure by using multiple ecosystem services. Conventional infrastructure is sometimes referred to as “grey infrastructure” and used for a single-purpose. GI, however, aims to not only help manage disasters but also conserve nature, delivering environmental, social, and economic benefits. The GI concept is still an early concept and therefore does not yet have a clear definition. In the US, GI seeks to reduce and treat urban stormwater. In other areas,

such as EU countries and In Japan, GI is considered as sustainable and resilient infrastructure for disaster management using natural functions. For example, wetlands around rivers work as both retarding basins and natural habitats. In reality, the measures only with natural functions have limited DRR functions and can be unreliable. Therefore, mixing conventional grey structure and GI, sometimes referred to as hybrid infrastructure (or approach), is useful for sustainable and reliable DRR.

Assessment



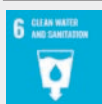
Number of Death / Affected people	4	GI can be expected to reduce victims.
Economic Loss	4	With resilient nature, the cost of recovery could be saved, and natural capitals are conserved.
Cost Effectiveness	3	GI is considered as low-cost measure; however, because of technological immaturity, it sometimes needs more cost.
Level of Application / Penetration	2	Practice of GI is still in the early stage.
Environmental Friendliness	5	GI is the eco-friendly measures.
Behavioral Change	3	It enhances behavioral change gradually on government as well as diverse stakeholders.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input checked="" type="checkbox"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input checked="" type="checkbox"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input checked="" type="checkbox"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input checked="" type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	



Wetland created for flood control in the Hino River, Fukui, Japan

Most Relevant SDGs



How did it drastically change the existing DRR status and strategies? How is it innovative?

DRR as well as human daily life are important factors when considering infrastructure for development. An ecologically friendly infrastructure has the potential to improve quality of life and as such; has gained attention within the build environment profession. GI is one such approach that utilizes nature, natural process and mechanism for infrastructure development and city planning (or land use). GI does not only utilize or restore nature, but also develop economy and society.

River restoration is a good example of GI. For instance, the excavation of river channels; a typical flood control technology of DRR, can create or restore wetland environment that works as both a habitat and a beautiful landscape. These restored habitats often attract fishes, birds, storks and many other wetland wildlife. They also generates new economic opportunities by creating attractive waterfronts which attract tourists, restaurants and other economic activities. Effective implementation of GI can also stimulate effective city planning by restoring balance within a city's ecosystem.

The introduction of the GI paradigm requires people to reconsider infrastructure management and DRR strategies. GI requires long term investment and collaboration of multiple sectors including public and private partnership. The concept of GI has not prevailed yet because it is a relatively new approach and there are limited good practices. Further studies are expected to promote eco-friendly and sustainable DRR with GI.

NAKAMURA Keigo (nakamura-k573bs@pwri.go.jp), Head of River Restoration Team and Director of Aqua Restoration Research Center, Public Works Research Institute



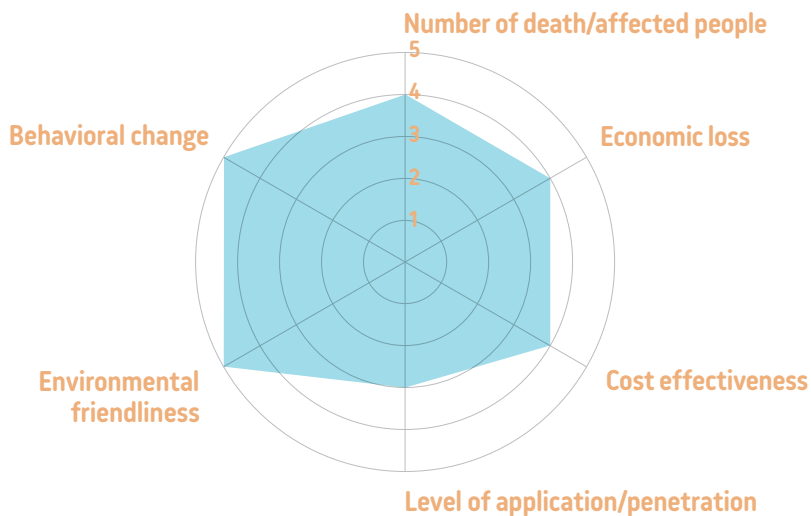
Integrated Water Resources Management

The concept of Integrated Water Resources Management (IWRM) was consolidated in the Dublin Principles in 1992, and has changed the existing basic notion of water resources management. IWRM reflected in “Agenda 21” and was adopted by the United Nations Conference on Environment and Development in 1992. The concept of IWRM has been developed based on the experiences and empirical evidences from actors and practitioners engaged in engaged in local level activities. The Global Water Partnership (GWP), a global action network to foster IWRM founded in 1996, defined IWRM as a “process which promotes the coordinated

development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems”¹. IWRM is now incorporated in the Sustainable Development Goals (SDGs). This notwithstanding, water resource problems persist, with a need for greater practical implementation of IWRM.

¹ Integrated Water Resources Management in Action. WWAP, DHI Water Policy, UNEP-DHI Centre for Water and Environment. 2009. <https://www.un.org/waterforlifedecade/iwrm.shtml>

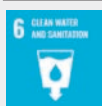
Assessment



Number of Death / Affected people	4	Integrated flood and drought management is one of the effective directions to reduce the number of death/affected people.
Economic Loss	4	IWRM acts as an engine in carrying out countermeasures based on the social consensus building although it takes time.
Cost Effectiveness	4	It does not require significant resources but takes time to democratically coordinate stakeholders and build social consensus.
Level of Application / Penetration	3	IWRM is already commonly accepted, but its effective implementation is still an issue.
Environmental Friendliness	5	IWRM restores balance in the ecosystem and promotes effective environmentally friendly activities.
Behavioral Change	5	the approach of IWRM promotes change in attitude towards the environment.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input type="radio"/> Earthquake	<input type="radio"/> Response
<input type="radio"/> 1960s	<input checked="" type="radio"/> Flood	<input type="radio"/> Recovery
<input type="radio"/> 1970s	<input type="radio"/> Typhoon/ Cyclone	<input checked="" type="radio"/> Mitigation
<input type="radio"/> 1980s	<input type="radio"/> Tsunami	<input checked="" type="radio"/> Preparedness
<input checked="" type="radio"/> 1990s	<input type="radio"/> Volcano	
<input type="radio"/> 2000s	<input checked="" type="radio"/> Landslides	
<input type="radio"/> 2010s	<input type="radio"/> Others	

Most Relevant SDGs



Welfare and Happiness

How did it drastically change the existing DRR status and strategies? How is it innovative?

IWRM provides the following three services: 1) utilizes and conserves water for people, industries, farms and natural environment, 2) removes or stores excess water to protect human and nature against water disasters, and 3) builds social consensus under constraints and conflicts to coordinate trade-offs among various water purposes. The implantation of IWRM process encourages the integration and control of both natural and man-made water resource systems for the benefit of humans and environment. This is particularly important when applying structural and non-structural measures in development and DRR approaches. Climate change has led to an intensive rainfall which has accelerates floods and sediment disasters. On the other hand, climate change has also increased the intensity of drought occurrence. Increasing droughts result in poor harvest in rain-fed agriculture and the lack of water irrigation often leads to water scarcity and water conflicts. Natural and man-made water systems must be accommodating enough to meet the needs of these strained natural water resources.

The “local context” is critical when it comes to solving water resource problems. These may be related to water use (water supply, sewerage, health, agriculture and hydro-power supply), environment (basin conservation, water quality, ecosystem and waterfront) or disaster risk (flood, inundation and sediment related hazard). We also may see conflicts among sectors and stakeholders. Climate Change impacts to nature and societies have gradually become obvious. Therefore, the problem could be solved through Multi-Stakeholders Partnership (MSP) and consensus building. In situations where there is a lack of agreement or consensus to proposed solutions due complexities of problems and stakeholders’ relation, lessons and leverages drawn from the experiences could be revised and for future engagements. This is a problem-solving-oriented approach under IWRM concept called “Practical IWRM”.

Kenji NAGATA, Senior advisor on water resources and disasters, JICA

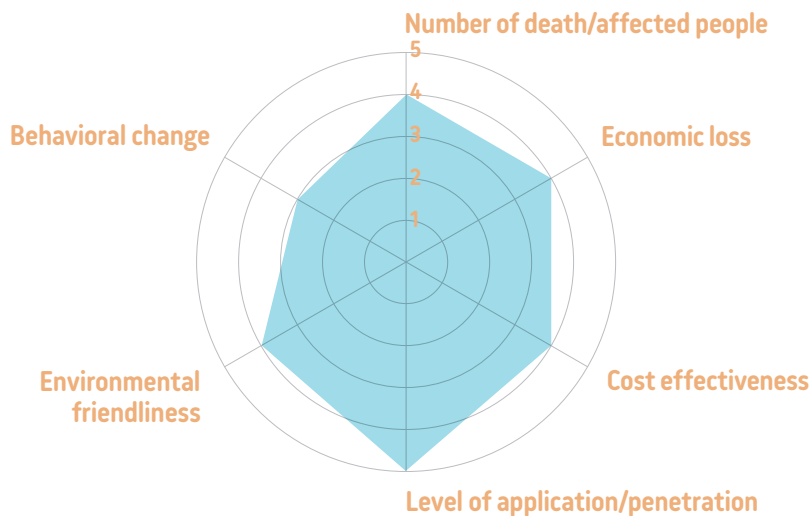


Small-scale Reservoir

A small-scale reservoir, in parallel with direct intake from rivers and abstraction from wells/springs, have been utilized since ancient times as an effective water resources development method. Today, small-scale reservoirs serve multiple benefits. Water that is stored in a reservoir in rainy season is used in dry season by adapting to seasonal changes in precipitation and river discharge and mitigating drought impacts. Many small-scale reservoirs are utilized to supply

irrigation and livestock water as well as drinking and domestic water. They may be also utilized for micro-hydropower generation. Moreover, they can play a role as a flood regulation pond to temporarily store flood water. Small-scale reservoirs especially in urban areas are put to practical use for not only flood measures and rainwater harvesting but also a biotope of natural ecosystem that a wide variety of creatures live in.

Assessment



Number of Death / Affected people	4	One small-scale reservoir can do a little but the many can do much.
Economic Loss	4	Water stored in small-scale reservoirs can contribute to people's healthy lives, agricultural production and flood mitigation.
Cost Effectiveness	4	A small-scale reservoir can be constructed near residential areas. Its construction cost is relatively low.
Level of Application / Penetration	5	A small-scale reservoir has a long history and has been applied all over the world. Moreover, the new function such as a biotope and underground water storage is being proposed.
Environmental Friendliness	4	The "small-scale" is environmentally friendly.
Behavioral Change	3	A small-scale reservoir follows the concept of "local production for local consumption", and can avoid unnecessary conflict on water.

Era	Type	Stage
<input checked="" type="checkbox"/> Before 1960s	<input type="checkbox"/> Earthquake	<input type="checkbox"/> Response
<input type="checkbox"/> 1960s	<input checked="" type="checkbox"/> Flood	<input type="checkbox"/> Recovery
<input type="checkbox"/> 1970s	<input type="checkbox"/> Typhoon/ Cyclone	<input checked="" type="checkbox"/> Mitigation
<input type="checkbox"/> 1980s	<input type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="checkbox"/> 1990s	<input type="checkbox"/> Volcano	
<input type="checkbox"/> 2000s	<input type="checkbox"/> Landslides	
<input type="checkbox"/> 2010s	<input checked="" type="checkbox"/> Others	



Small-scale reservoir in Japan (Okazaki City) derived from website

Most Relevant SDGs

6 CLEAN WATER AND SANITATION

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

11 SUSTAINABLE CITIES AND COMMUNITIES

14 LIFE BELOW WATER

How did it drastically change the existing DRR status and strategies? How is it innovative?

There are two types of small-scale water reservoirs. The first is a “pond” which is made by excavating existing natural land depression area to a much deeper depth to increase the storage capacity of water volume. Ring levees are usually used around pond. The pond stores water transferred from rivers/wadis or qanats/springs through a canal. It is mostly constructed on plain areas near settlements. Therefore, it often has risks of eutrophication with fertilizer from farmlands, household wastewater and livestock excretion. The second is “a reservoir” that is made with an earth dam banking up across a river or wadi. The reservoir is constructed in hilly areas, and its water quality is generally good because they are usually made away from human activities and other pollutants.

Reservoirs provide many benefits and are useful in many ways. For instance; the Deccan Plateau in India, is a worldwide cotton production area characterized less rainfall. However, a number of small-scale irrigation reservoirs have been constructed to boost the cotton production. The mountainous regions of Central China is also a world-famous small-scale irrigation reservoirs area. The semi-arid regions of middle-east is equally taking advantage of small-scale reservoirs to store water from wadis and qanats. In Africa, the “Hafir” in Sudan, which has a diameter of between 70-250 m and heights of up to 7 m, is a small-scale reservoir of rainwater or wadi water and is important in supplying drinking/irrigation/livestock water. In Japan annual rainfall abounds but fluctuates in seasons, and quickly flows down to the sea due to steep topography and short rivers. Thus, small-scale reservoirs have been developed and constructed as a national project since the seventh century. There are presently 200,000 small-scale reservoirs. Small-scale reservoirs are also utilized in urban areas to restrain flood runoff and to store rainwater for multipurpose use. An underground water storage facility can effectively leverage its upper land. A pre-engineered storage reservoir made with plastic material is environment-friendly, low cost and has short construction periods as comparing to concrete-made storage facility. Small scale reservoirs have advantages of not only storing and supplying waters but can also be used to control water distribution and paths to prevents flooding and other water related disasters.

Kenji NAGATA, Senior advisor on water resources and disasters, JICA

30 INNOVATIONS LINKING DRR WITH SDGs

CHILDREN

14. Games for Disaster Risk Reduction
15. DRR Educational Materials with a Cartoon Character
16. The First 1000 days

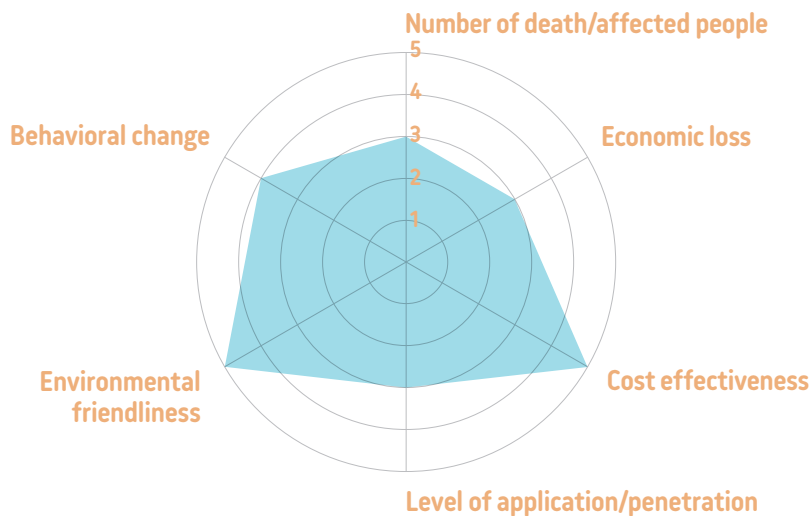


Games for Disaster Risk Reduction

Numerous games have been developed to teach, engage and involve children in disaster risk reduction. The games are designed to educate children about how best to prepare themselves for multiple disasters by providing an opportunity to participate in a variety of activities including hazard and threat identification, drills, evacuation planning, home adjustments, search and rescue training, and risk communication. As agents of change, it is hoped that children can in turn, share this knowledge and educate their family and wider communities.

Examples include the “Tsukumor Expedition-Escape the Disaster Island”, an original board game in which the player becomes a member of the Tsukumol expedition team, and must escape from an island facing numerous disasters. A similar DRR board game called Riskland, was developed in Viet Nam. Similar to “snakes and ladders” (known as “chutes and ladders” in some countries) the Vietnamese adaptation includes illustrations from schoolchildren that depict local geography to teach about climate change and local environmental threats, such as flooding and winds.

Assessment



Number of Death / Affected people	3	Used for education, disaster preparedness and prevention, thus potentially reducing disaster impacts.
Economic Loss	3	It can be used to create awareness to reduce economic loss.
Cost Effectiveness	5	Highly cost effective.
Level of Application / Penetration	3	Gradually being adopted.
Environmental Friendliness	5	It has no negative impact to the environment.
Behavioral Change	4	High level of effectiveness in behavioral change.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input type="radio"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input type="radio"/> Recovery
<input checked="" type="checkbox"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input type="radio"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	

Most Relevant SDGs



Stop Disasters Game! (UN ISDR, 2009)

How did it drastically change the existing DRR status and strategies? How is it innovative?

Meaningful participation is best developed through practice. DRR concepts may seem abstract to many children who have not experienced disasters, but games provide the kind of experiential learning that engage children in a memorable and fun way. They have also been found to help children socialize, develop skills, knowledge and self-efficacy and boost their confidence to discuss disasters with peers and family¹.

Children's vulnerability in the face of disasters is well established, yet their involvement and mobilization during and after are also considered critical to community resilience¹. Informed and engaged children may be better able to protect themselves and others. The importance of risk education to reduce the impacts of disasters has been proven on many occasions, with the example of the Kamaishi schools during the 2011 Great East Japan Earthquake (GEJE) and subsequent tsunami the most well-known. Despite heavy impacts numerous casualties in this coastal city, all 3000 school children evacuated to higher ground, and are recognized for taking appropriate and decisions while helping the more vulnerable². Techniques for experiential learning, such as games, are some of the best ways to help promote children's knowledge, awareness and survival.

Jessica Alexander, Independent Consultant

¹ Involving children in disaster risk reduction: the importance of participation, Betty Pfefferbaum, Rose L. Pfefferbaum, and Richard L. Van Horn, Eur J Psychotraumatol. 2018; 9(sup2): 1425577. Published online 2018 Feb 5

² OECD: Disaster risk reduction education in Japan, Tools for Risk Governance.

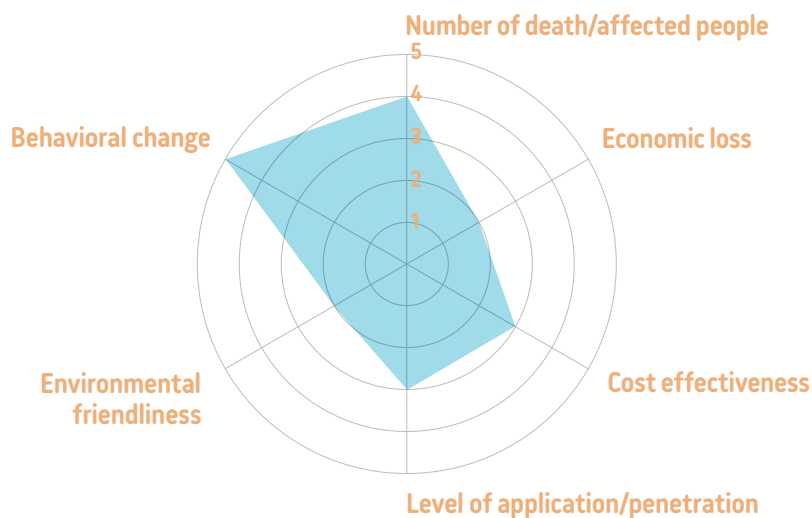


DRR Educational Materials with a Cartoon Character

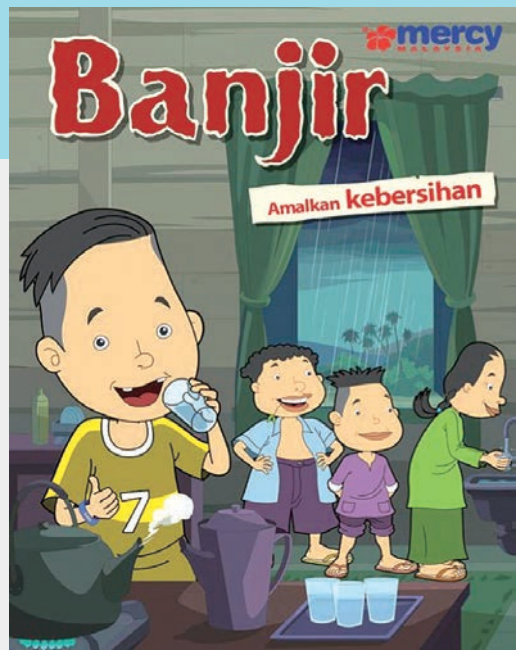
Disaster Risk Reduction (DRR) and different hazards are serious topics for children, and creativity is needed in attracting their attention. MERCY Malaysia, an international NGO in Malaysia, has developed a set of DRR educational materials with very a popular cartoon character among children called “Bola kampung” created by Animesia Studio SDN BHD. The collaboration aimed

to increase the capacity of primary and secondary school children to respond to disaster through the School’s Preparedness Program. Characters of a popular cartoons series are used to convey disaster preparedness messages, even for public announcements on television. The cartoon was on a video, posters, workbooks, flashcard games and board games, and successful at attracting children.

Assessment



Number of Death / Affected people	4	With enhancement of children’s awareness on DRR contributed to reduce the impact.
Economic Loss	2	It is uncertain whether how much it contributed to reduce economic loss.
Cost Effectiveness	3	As long as it is possible to gain the pro-bono service, the cost effectiveness will be extremely high. But if not, it will be expensive.
Level of Application / Penetration	3	It depends on the collaboration with the private sector and other stakeholders. If the company was convinced to work together, the level of application could be high.
Environmental Friendliness	2	It has no negative impact to the environment.
Behavioral Change	5	It has increased children’s knowledge on DRR and impacted behavioral change.



Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input type="radio"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input type="radio"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input type="radio"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input checked="" type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	

Most Relevant SDGs



How did it drastically change the existing DRR status and strategies? How is it innovative?

This is also a good example highlighting the importance of collaboration between the private sector and NGO. The animation company rendered the right to use of the character to the NGO on a pro-bono basis. Animesia was convinced that the program would be impactful, in line with their CSR direction and result in more exposure and a healthy image for their animation character and brand. Ultimately, the program built a strong corporate image and brought more opportunities in business development by working with an NGO.

This initiative was innovative mainly in two ways: using the popular cartoon character for DRR education to attract children's attention; and successful pro-bono collaboration between the private sector and an NGO. The private sector gained increased publicity and visibility, and this became a good promotion for them. While the private sector may believe it will take additional efforts and resources to initiate and be involved in a project that they have never participated in, it is not always the case. They can explore the way to make the best use of their existing products and expertise, and for that purpose, the support and approach by NGOs and other stakeholders are crucial to gain advice and guidance as the private sector often does not realize how their products can make contribution to DRR. The collaboration with an NGO and the private sector made this innovation possible.

Takako Izumi, International Research Institute of Disaster Science (IRIDeS), Tohoku University



The First 1000 days

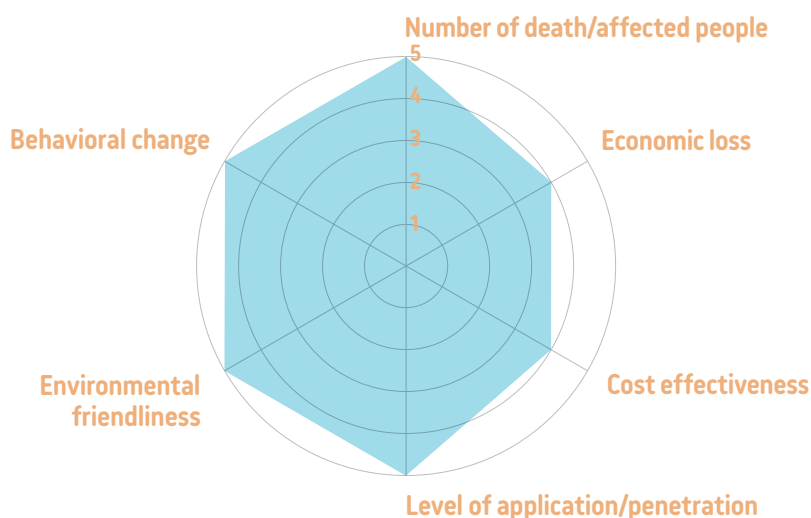
At least 1 in 3 children under 5 years of age is undernourished or overweight, and 1 in 2 suffers from hidden hunger, undermining the capacity of millions of children to grow and develop to their full potential¹. The importance of focusing on the first 1000 days of life has been widely recognized, because it is a crucial period for a child's growth and development. Under-nutrition, usually seen as slower than expected growth², can occur before

birth, as early as the second trimester of gestation. Studies have found that the nutritional status of mother and the child from conception through the first two years of life are important factors contributing to under-nutrition and stunting in childhood.

¹ <https://www.unicef.org/media/60806/file/SOWC-2019.pdf>

² <http://www.who.int/childgrowth/standards/en/>

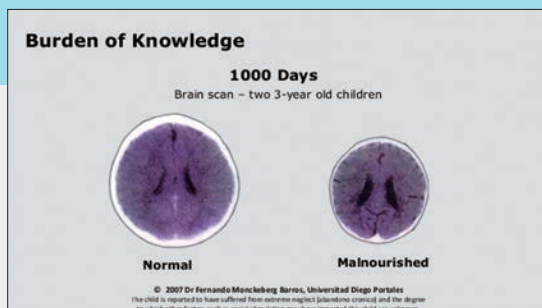
Assessment



Number of Death / Affected people	5	The concept significantly uplifted early childhood interventions in many countries.
Economic Loss	4	Not only does it address critical nutrition needs of children, it also ensures healthy population and workforce.
Cost Effectiveness	4	Early and comprehensive intervention is more cost effective than relying on emergency feeding measures.
Level of Application / Penetration	5	It has widespread application globally.
Environmental Friendliness	5	It has no negative impact to the environment, and it creates linkages of broader environmental factors and nutrition deficiency.
Behavioral Change	5	It leads to comprehensive measures rather than tackling nutrition issue as a silo.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input type="radio"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input type="radio"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input checked="" type="checkbox"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input checked="" type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	

Most Relevant SDGs



How did it drastically change the existing DRR status and strategies? How is it innovative?

DRR strategies often include adaptation to increasing disaster risks in the field of food security, WASH and access to health services which also affect nutrition intake of the affected population. As necessary building blocks for nutrition, they indirectly contribute to the nutrition status of children and women of childbearing age by directly affecting the quantity and quality of food they are eating (dietary intake) and health status (infectious disease). Therefore, nutritional deficiency can not only be addressed with a feeding program, but through a holistic approach.

The focus on 1000 days since the birth has led to adoption of various initiatives that aim to increase nutrition intake during early childhood. These include access to health services and related maternal and childcare practices that include health-seeking behavior linked to dietary intake. They ensure, in addition to adequate amounts of food, a balanced and diverse diet with adequate nutrients. Access to quality health services also contributes to reducing the incidents of infectious diseases and other health risks. For example, West Timor in Indonesia has a high prevalence of infectious disease which correlates with a very low proportion of households with access to protected wells or tap water and high rates of open defecation. Such conditions worsen the stunting issue the country faces, and as a response, Indonesia has set out National Strategy to Accelerate Stunting Prevention which targets pregnant mothers and children under the age of 2 need to simultaneously access key services. These services include basic immunization, breastfeeding, dietary diversity, drinking water and sanitation, early childhood education, food insecurity measurements where they live, and a birth certificate to make sure they are in the system. Convergence of these key services is low in Indonesia¹. The renewed focus on ‘first 1000 days’ of life is however increasingly contributing to enhance community resilience against stunting and other forms of malnutrition, in lines with Sendai framework for disaster risk reduction.

Takeshi Komino, CWS Japan, Asian Disaster Reduction and Response Network (ADRRN)

¹ <https://www.worldbank.org/en/news/feature/2018/06/26/indonesia-fights-stunting-commitment-convergence-and-communities>

30 INNOVATIONS LINKING DRR WITH SDGs

EDUCATION

17. Technical Vocational Education and Training
18. Museums/Memorials for Disaster Risk Reduction
19. Thematic Incubation Centre for Higher Education in Disaster Risk Reduction

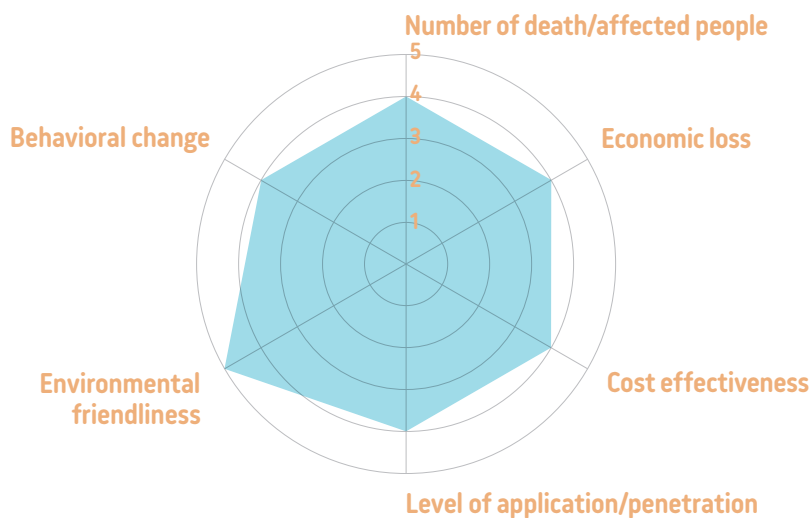


Technical Vocational Education and Training

Technical and Vocational Education and Training (TVET) aims to provide knowledge and skills to individuals, organizations and the regional society that enable them to facilitate inclusive and sustainable socio-economic and environmental development. According to UNESCO, TVET comprises formal, non-formal and informal learning, which integrates all sectors of education, adult training and lifelong learning so as to address regional, national, individual, industry and community needs for social development.

TVET can be linked to regional or national accreditation framework that recognizes and certifies experts who are either already active players or those who are aspiring to build a career in their relevant fields. Formal qualifications benchmarked against international standards can ensure and further improve the quality of such training programs that could encourage professionals to further improve their knowledge and skills.

Assessment



Number of Death / Affected people	4	While the program provides knowledge and skills that aim to reduce casualties from disasters, it may take time to actually see the effects in the field.
Economic Loss	4	Better capacity in disaster preparedness and response can reduce economic loss in case of future disaster events.
Cost Effectiveness	4	Integrated approach of CCA/DRR can improve cost effectiveness of actual implementation.
Level of Application / Penetration	4	Accreditation of PacTVET programs have significantly increased the level of penetration at the regional level.
Environmental Friendliness	5	There is no negative impact on the environment.
Behavioral Change	4	Social behavioral change could take more time. However, the recognition of 'resilience' as an industry in the Pacific will lead to the professionalization of practitioners.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input type="radio"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input type="radio"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input type="radio"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input checked="" type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	



(Image Source: <https://psd-tvet.de/wp/>)

Most Relevant SDGs



1 NO POVERTY



10 REDUCED INEQUALITIES



17 PARTNERSHIPS FOR THE GOALS

How did it drastically change the existing DRR status and strategies? How is it innovative?

The Pacific Region is one of the most vulnerable regions in the world affected by both hydrometeorological (cyclones, droughts, landslides, floods) and geological (volcanos, earthquakes, tsunamis) hazards. In 2016, the Pacific Island Forum Leaders adopted the Framework for Resilient Development in the Pacific (FRDP) as the regional agenda for building climate and disaster resilience. The lack of local capacity and expertise as well as absence of professional training programs has been noted as one of the barriers for realizing the goals mentioned in FRDP. In this light, the Pacific Technical and Vocational Education and Training on Sustainable Energy and Climate Change Adaptation (PacTVET) was developed and implemented with the objectives below.

- Assess national training needs in CCA/DRR and existing informal and formal training courses.
- Develop and implement benchmarks, competency standards and courses on Training of Trainers (ToT) and create a pool of national trainers.
- Develop and establish training courses and support facilities within TVET institutions.
- Strengthen networking among CCA/DRM stakeholders.

PacTVET is jointly implemented by the Pacific Community (SPC) and University of South Pacific (USP) and has developed and delivered regional qualifications accredited by the SPC's Educational Quality and Assessment Programme (EQAP). The programs do not only certify existing practitioners and trainers, but also encourage students and young professionals to become future leaders in the field of CCA/DRR. In line with FRDP, PacTVET has also been offering need-based and Pacific specific programs that integrate climate change and DRR issues. Such approach can improve efficiency and effectiveness of CCA/DRR measures in which many are known to be overlapping in activities and funding.

Dr. Shohei Matsuura, Japan International Cooperation Agency (JICA)

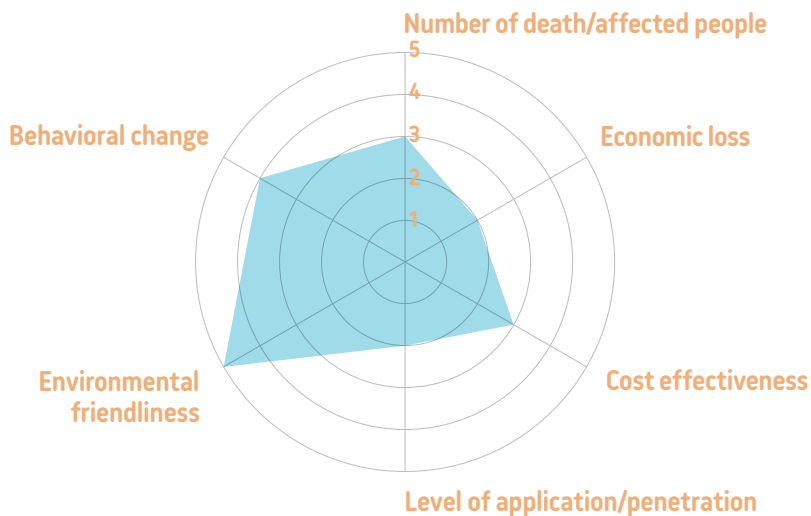


Museums/Memorials for Disaster Risk Reduction

Numerous initiatives in Japan seek to raise disaster awareness by preserving and passing on the lived experiences and lessons from disasters. Two of the most prominent museums dedicated to this goal are the Tokyo Rinkai Disaster Park, and Kobe's Great Hanshin-Awaji Earthquake memorial museum. Both museums have accumulated a wealth of information about disaster preparedness and present it to viewers in engaging, accessible and memorable formats. Through realistic recreations, the museums

recreate the look, feel and sound of post disaster areas. They have also created libraries to collect, preserve and provide public access to photographic and audio-visual documentation, artefacts and footage. Storytellers are also present who provide individual accounts of what happened to them and their communities before and after the disaster. The key aim of these initiatives is to share disaster-related lessons and encourage further discussions and efforts for DRR.

Assessment



Number of Death / Affected people	3	These initiatives help raise community awareness about disaster situations and promote preparedness for future events.
Economic Loss	2	They have limited impact on economic loss.
Cost Effectiveness	3	This approach is rather costly and needs external support, especially for developing countries.
Level of Application / Penetration	2	These initiatives are emerging as effective means of enhancing disaster preparedness; however, their application is currently low.
Environmental Friendliness	5	There is no negative impact on environment.
Behavioral Change	4	It effectively leads to a certain level of behavioral change, however, the key challenge remains for actual evacuation behavior.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input type="radio"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input type="radio"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input type="radio"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input checked="" type="checkbox"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	

Most Relevant SDGs



How did it drastically change the existing DRR status and strategies? How is it innovative?

In the wake of disasters, survivors repeat that they never thought they or their families could be impacted, despite living in countries highly prone to natural hazards. Disaster awareness is surprisingly low even in countries like Japan where their occurrence is frequent and there are strong investments in disaster preparedness and management. Initiatives such as museums and memorials ensure that multiple experiences of disaster are catalogued and preserved and passed on to future generations. These efforts help establish a culture of disaster preparedness, wherein people can share what happened to them, gain new knowledge about disasters and keep a record of the city before and after the disaster.

Through museums, people who may have never lived through disasters can better understand the viewpoint of the victims and their legacy. The importance of self-help and mutual support emerged in the wake of the 1995 Great Hanshin-Awaji Earthquake when it was found that the overwhelming majority of people were rescued by ordinary citizens. These memorials stimulate people's ability to imagine it happening to them, and to better understand how they should prepare and what may be required of them should a disaster happen.

Numerous memorials and smaller museums have opened to remember the March 11, 2011 Great East Japan Earthquake like The Iwate Tsunami Memorial Museum, and the Minamihama Connecting Hall. Initiatives such as 'National Disaster Prevention Day', are also held yearly in Japan, on September 1st, which draws crowds to memorialize the 1923 Great Kanto Earthquake. An array of programs such as the annual International Forum on Telling Live Lessons from Disasters, festivals and seasonal events, emergency simulations and drills are organized through government, private sector, community members and non-profit organizations (NPOs) to instill disaster preparedness and educate citizens on how to prepare.

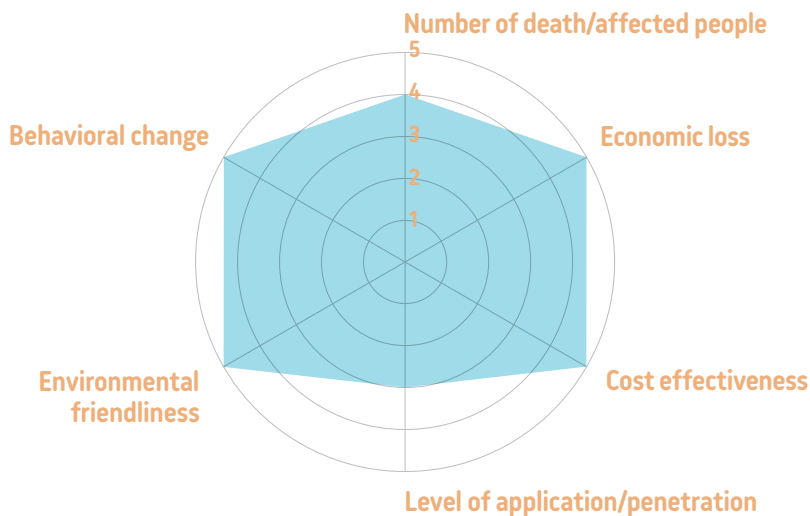
Jessica Alexander, Independent Consultant

The private sector is emerging as an important stakeholder in DRR and sustainability policies. Engaging the private sector as a part of the multi-stakeholder partnership is one of the key points of confluence in various global policy frameworks including the Sendai Framework for Disaster Risk Reduction, Sustainable Development Goals, Paris Declaration and The New Urban Agenda.

Establishing an incubator within universities to mentor and encourage future entrepreneurs helps translate these targets into meaningful actions and

also create opportunities for active engagement of private sector in disaster risk reduction. It also serves as an entrepreneur development center that helps new and startup ideas/ initiatives to develop by providing services such as management training, capital funding options and also handhold in providing other support in the initial phase of a setup. The themes vary from disaster risk reduction, safety, sustainable development, women entrepreneurship, conflict and peace, heritage risk management etc.

Assessment



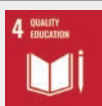
Number of Death / Affected people	4	The idea of thematic incubators is rather new; however it can provide innovative solutions to decrease the number of people affected.
Economic Loss	5	The incubation services create entrepreneurial wealth adding to economic prosperity.
Cost Effectiveness	5	It is very cost effective as one incubation center can create multiple economic avenues.
Level of Application / Penetration	3	The incubation center for DRR is being set up in a few universities and institutes of higher education.
Environmental Friendliness	5	The incubation center creates ideas for environmental protection and sustainability.
Behavioral Change	5	The incubation center brings in the attitude of entrepreneurship in the people.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input checked="" type="checkbox"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input checked="" type="checkbox"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input checked="" type="checkbox"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input checked="" type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	



Incubation Centre: Women Entrepreneurship in Disaster Risk Reduction: Mody University and RIKA India Pvt Ltd.

Most Relevant SDGs



How did it drastically change the existing DRR status and strategies? How is it innovative?

The incubator center mentors and trains young entrepreneurs to bring innovation into the field of disaster management and climate change through new products, services and by integrating research into this process. This entails developing start-ups with business development and marketing strategies, visibility of the product, linking and scaling opportunities in the DRR domain. The incubator facilitates the conversion of research activity into entrepreneurial ventures. The database of research can be accessed, customized, scaled, reinvented to provide actionable innovative solutions for disaster risk reduction.

The incubator provides 'Start to Scale' support for socio-economic and technology entrepreneurship. It provides different functions at different stages. During the **inception phase**, brainstorming activities like hackathons and awareness workshops are undertaken. During the **establishment phase**, mentoring, funding and technical support is provided. At the third stage which is called **sunset phase**, global collaborations and funding from international sources is channeled. It can further undertake capacity building programs like training programs for NGOs, municipal offices and corporates to align their work with risk reduction, safety and resilience. It also supports the MSMEs to learn and nurture their ideas, thereby building capacities at the local level. Such support is essential for survivability of the entity in face of hardships due to disasters and climate change, as well as to build on business opportunities on disaster risk reduction approaches, tools, innovations.

An incubation center has already been launched at Mody University, a women's university in India (Sikar, Rajasthan) in collaboration with Resilience Innovation Knowledge Academy (RIKA) India Pvt Ltd. This incubation center aims at leadership and entrepreneurship for women in the field of disaster risk reduction. It cuts the vulnerabilities at various levels by empowering the women and increasing their number in the DRR sector. Further, such thematic incubators can be developed aimed at various sustainability linked goals and also cater to specific social group of a society.

Ranit Chatterjee (ranit13@gmail.com), RIKA, India
Sukhreet Bajwa, (bajwa.sukhreet@gmail.com) RIKA, India and
Rajib Shaw (shaw@sfc.keio.ac.jp) Keio University, Japan

30 INNOVATIONS LINKING DRR WITH SDGs

AGRICULTURE

20. Floating Garden for Flood Risk Reduction
21. Multi-purpose Roof-top Garden
22. Digital Farming for Agricultural Sustainability
23. Sustainable Agriculture Kits for Terrace Agriculture

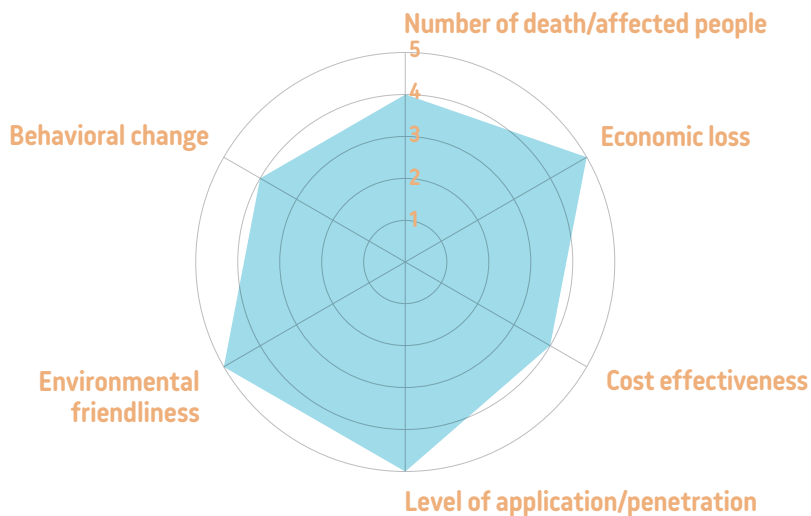


Floating Garden for Flood Risk Reduction

A floating garden is a type of hydroponics system, which employs floating beds on the surface of water as the foundation for growing plants and crops without soil. The use of aquatic plants such as Tapapana, Dulalilata and Khudipana to construct floating beds dates back a few thousand years. This traditional cultivation is an environment-friendly technique to utilize the natural resources of wetlands to grow vegetables and other crops almost all year-round. Preparation of the floating garden using aquatic plants of no economic value

is an indigenous knowledge-based innovation for overtaking environmental and climatic disadvantages. It dates back a few thousand years in southern Bangladesh where it has sustainably generated goods and services. Over the years, the practice has undergone dynamic environmental and socio-economic changes while adapting to the latest technologies of managing crops, selection of appropriate and tolerant varieties, and cultivation techniques.

Assessment



Number of Death / Affected people	4	It can help to provide food in flood affected areas.
Economic Loss	5	This strategy can increase economic benefit in low land areas.
Cost Effectiveness	4	Structures constructed with aquatic plants are cost effective.
Level of Application / Penetration	5	It is highly affordable at community and national level.
Environmental Friendliness	5	It does not have any negative impact on environment.
Behavioral Change	4	It can make behavioral changes of the government and stakeholders.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input type="radio"/> Earthquake	<input type="radio"/> Response
<input type="radio"/> 1960s	<input checked="" type="radio"/> Flood	<input type="radio"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="radio"/> Typhoon/ Cyclone	<input checked="" type="radio"/> Mitigation
<input type="radio"/> 1980s	<input type="radio"/> Tsunami	<input checked="" type="radio"/> Preparedness
<input checked="" type="radio"/> 1990s	<input type="radio"/> Volcano	
<input type="radio"/> 2000s	<input type="radio"/> Landslides	
<input type="radio"/> 2010s	<input checked="" type="radio"/> Others	



Most Relevant SDGs



How did it drastically change the existing DRR status and strategies? How is it innovative?

The floating garden is an environment-friendly cultivation system with or without soil where no chemical fertilizers or pesticides are used. The floating bed technique does not require irrigation, chemical fertilizers or pesticides cost but relies on labor to prepare the bed and to carry out other intercultural operations (weeding, mulching etc.), which are half the cost compared to traditional cultivation cost in land. The system has established a considerable diversity of crops which align to the wetland ecosystem in monsoon and winter season as well as providing food and livelihood security for local communities. Even in adverse situation like floods, farmers can grow seedlings, vegetables, spices, etc. on the floating bed which ensures early market to get good price of seedlings and vegetables.

Every year, new floating beds need to be prepared for cultivation of crops and vegetables in submerged lands during monsoon. After harvesting of vegetables in floating bed, farmers are also using these beds as organic fertilizers for their next cultivation in winter season. Just before winter season, they break the old floating beds and mix these with the soil as organic fertilizers for their next cultivation in winter season.

Floating garden technique does not require any such infrastructures as well as any further capital investment. It is very cost effective, as most of the raw materials are free of cost and readily available in the locality, although the preparation requires huge physical inputs. According to a report by Ministry of Agriculture¹, the productivity of floating vegetables cultivation is estimated to be ten times higher than on a similar sized land-based cultivation.

Md. Anwarul Abedin (masumagriculture@yahoo.com), Bangladesh Agriculture University

¹ <http://www.fao.org/3/a-bp777e.pdf>



Multi-purpose Roof-top Garden

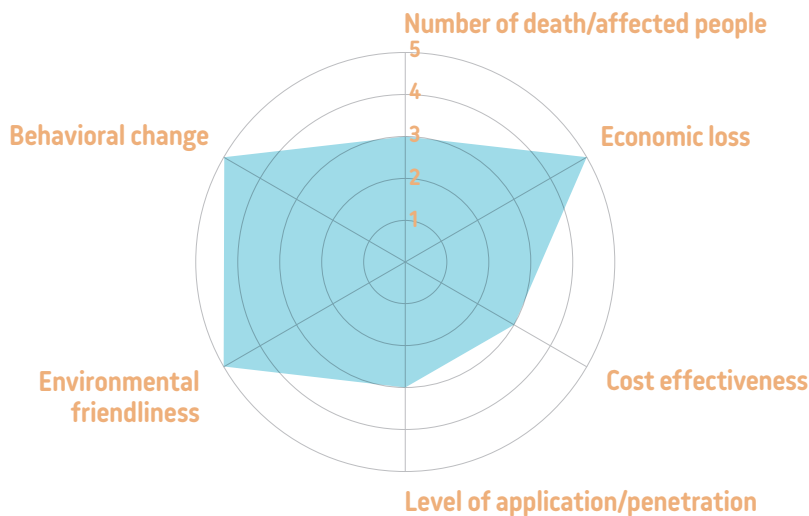
A rooftop garden is one that is situated on the roof of a building. There are fascinating projects and initiatives on rooftop gardens throughout the world. One particular example is that of Singapore, where inorganic hydroponics is considered as a more appropriate farming option than conventional soil culture in the government housing buildings. They have higher yield, lower labour requirements and need only lightweight systems, which can be easily assembled over an existing roof¹. Flowers, fruits, vegetables, medicinal, spices, condiments and ornamental plants can be grown on rooftop

garden. About 60 varieties of fruits and vegetables are produced in Bangladesh but not all types can be produced on the rooftop. The types and mix are chosen in the city depending upon individual and household food preferences, availability of seeds types that can be grown on the rooftop, climate characteristics and availability of soils.²

¹ Safayet, M. et al. (2017). Present practice and future prospect of rooftop farming in Dhaka city: A step towards urban sustainability. <https://doi.org/10.1016/j.jum.2017.12.001>

² Shariful Islam, K.M. (2004). Rooftop Gardening as a Strategy of Urban Agriculture for Food Security: The Case of Dhaka City, Bangladesh. <https://doi.org/10.17660/ActaHortic.2004.643.31>

Assessment



Number of Death / Affected people	3	It contributes to healthy environment and partially contributes in healthy food supply for the households.
Economic Loss	5	This strategy can significantly increase economic benefits.
Cost Effectiveness	3	Initially, it involves few infrastructures cost, then it is good to run.
Level of Application / Penetration	3	It is only affordable for the people; who have suitable rooftop.
Environmental Friendliness	5	No negative impact on environment.
Behavioral Change	5	It can make behavioral changes of the government and stockholders.



Era	Type	Stage
<input type="radio"/> Before 1960s	<input type="radio"/> Earthquake	<input type="radio"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input checked="" type="checkbox"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input checked="" type="checkbox"/> Mitigation
<input type="radio"/> 1980s	<input type="radio"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input type="radio"/> Volcano	
<input checked="" type="checkbox"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	

Most Relevant SDGs



How did it drastically change the existing DRR status and strategies? How is it innovative?

There are numerous benefits to a rooftop garden, most notably the increase in property value, food production, carbon sequestration, and the improvements in air quality. The carbon sequestration and air quality benefits are very insignificant for individual rooftop gardens, however these benefits would be more meaningful if calculated for numerous roof gardens covering a large portion of a city. Further, a portion of household demand for vegetables, fruits, spices and condiments, flowers and aesthetic gratification could be fulfilled through the rooftop garden. The practice of rooftop gardening is gaining increasing prominence at global level, as people are nowadays more anxious about the quality of fruits and vegetables bought from the market, due to the increasing use of hazardous pesticides and chemicals.

Agricultural lands surrounding the city areas are increasingly been converted to residential, commercial or industrial land uses for developmental purposes. Thus, it reduces the possibility to grow more and different agricultural food products in the periphery of urban areas. Additionally, the increasing use of hazardous chemicals and inorganic fertilizers and pesticides. is increasing health concerns in urban areas. To address these wide-ranging issues, the practice of rooftop farming can serve as potential solution to enhance food security and public health. It can help to meet the growing food demands while reducing the household expenditure for buying vegetable and fruit. It will also contribute to creating healthy atmosphere and low carbon society by localizing the flow of food products.

Md. Anwarul Abedin (masumagriculture@yahoo.com), Bangladesh Agriculture University

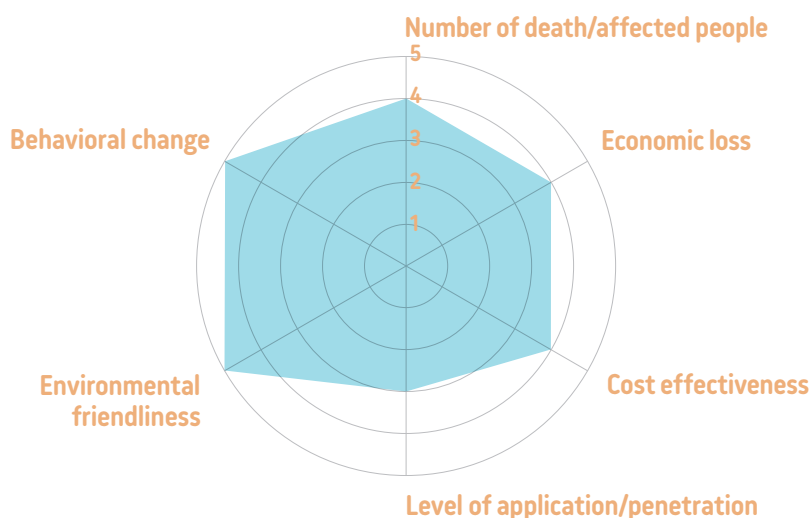


Digital Farming for Agricultural Sustainability

'Digital farming' technology developed in Japan facilitates effective utilization of water and fertilizers, by utilizing state-of-the-art technologies like sensors, The Internet of Things (IoT) and Artificial Intelligence (AI). It is based on the technique of 'Fertigation,' originated in Israel. 'Fertigation' helps to reduce water consumption by using narrow pipes to add correct amount of water and fertilizer at the roots of the growing crops based on the nutrient deficiencies of plants. Real-time

data about the crops for specific environmental variables like temperature, humidity, soil moisture etc. is collected through the IoT platform based on soil and light sensors. The collected information is then analyzed by employing AI which have accumulated knowhow of skilled cultivators to make decisions about enhancing crop yields, reducing water demands and producing quality crops. The technology has wide-ranging potential as it is highly efficient and labor saving.

Assessment



Number of Death / Affected people	4	The technique is increasingly being practiced around the world to enhance agricultural sustainability; however, the approach is still new.
Economic Loss	4	Digital farming reduces the amount of water and fertilizer required for crop production thereby reducing the economic loss.
Cost Effectiveness	4	Although the long-term benefits of this technique are very significant, the initial costs are high.
Level of Application / Penetration	3	The technique has very high potential to enhance agricultural production, however the current outreach is limited due to high costs.
Environmental Friendliness	5	Helps to reduce soil erosion, reduces the amount of water and fertilizer used, increases the nutrients absorbed by the plants.
Behavioral Change	5	The technique offers new insights to the farmers that enhances their ability to make informed decisions and subsequently implement them.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input type="radio"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input type="radio"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input checked="" type="checkbox"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input checked="" type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	



(Source: <https://www.omanobserver.om/lonely-furrow-little-pay-dirt-for-organic-farming-in-japan/>)

Most Relevant SDGs



How did it drastically change the existing DRR status and strategies? How is it innovative?

The growing resource demands for water, energy, manpower etc. have become a serious concern for agricultural sustainability worldwide. However, scientific and technological advances in recent years present new possibilities for making agriculture more efficient and sustainable. Developed countries like Japan are already employing new technologies in form of ‘Digital farming’ to ensure sustainable utilization of available resources. The technique has provided an innovative solution to Japan’s demographic challenges like rapidly aging population and labour shortage. The advanced technologies have helped to improve agricultural production, reduce costs and facilitate a safer work environment.

In the case of Miyagi Prefecture in Japan, seriously affected by the 2011 Tohoku earthquake, digital farming has helped revitalize the strawberry production in a sustainable manner. The technique has helped farmers to be more precise in their use of pesticides and fertilizers as well as mitigate certain environmental impacts. While the technique has already started to deliver results in Japan, it is also spreading to other countries like Vietnam, China and elsewhere in Asia¹. The technique is expected to bring a huge change in future of agricultural production as it demonstrates extreme potential even in areas with limited access to water. In reference to the case of Miyagi Prefecture, digital farming provides technological solutions not only to achieve Sustainable Development Goals but also to ‘Build Back Better’ in recovery, rehabilitation and reconstruction as emphasized in the Sendai Framework for Disaster Risk Reduction. Against the changing climatic conditions, digital farming therefore has a wide-ranging potential for transforming agricultural production and ensuring resource utilization in a sustainable manner around the world.

Vibhas Sukhwani (vibhassukhwani003@gmail.com), Keio University, Japan
Rajib Shaw (shaw@sfc.keio.ac.jp), Keio University, Japan

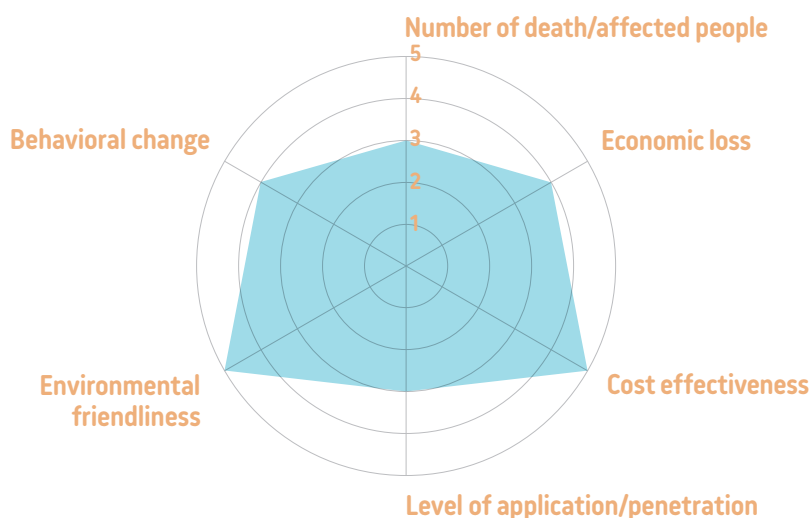
¹ <https://www.japan.go.jp/technology/innovation/digitalfarming.html>

Terraced agriculture was practiced for centuries by the Inca and the Mayan civilizations in South America, who constructed terraces to have a nutrient-rich layer of soil on top of water-retaining clay soils and a layer of stones, which provided drainage for the system. The method is still being used for food production in several regions in China, Nepal, Indonesia, Vietnam, and the Philippines¹. The Sustainable Agriculture Kits (SAK) project was initiated by a team in the University of Guelph to address the specific issues of farmers in

Nepal, such as aging population, poverty, illiteracy and limited access to machinery and agricultural services. Under this project, low cost tools and solutions were collected in a commercial menu of options from which farmers could choose to purchase single or multiple items. The team utilized existing distribution networks, such as agro-dealers, food and machinery traders, to effectively reach out to farmers.

¹ <https://www.worldatlas.com/articles/what-is-terrace-farming.html>

Assessment



Number of Death / Affected people	3	Failed crops can lead to hunger and decreased public health in the communities.
Economic Loss	4	This method enhances food production against floods and droughts, and ensures a more steady income.
Cost Effectiveness	5	The method aims to ensure food security for the whole community and to provide an alternative to expensive or labor-intensive solutions.
Level of Application / Penetration	3	The initial stages of the project focused only on the farmers who needed assistance. Scaling up will allow the method to reach more people.
Environmental Friendliness	5	The method improves soil quality and does not harm the local ecosystem. It also enhances yields and increases the amount of nutrients in plants.
Behavioral Change	4	Through this technique, farmers are able to enhance their productivity by regulating which areas to remain dry and which ones to be moist. If not managed well, the systems might get flooded during heavy rainfalls and result in dangerous mudslides.



Era	Type	Stage
<input checked="" type="checkbox"/> Before 1960s	<input type="checkbox"/> Earthquake	<input type="checkbox"/> Response
<input type="checkbox"/> 1960s	<input checked="" type="checkbox"/> Flood	<input type="checkbox"/> Recovery
<input type="checkbox"/> 1970s	<input type="checkbox"/> Typhoon/ Cyclone	<input checked="" type="checkbox"/> Mitigation
<input type="checkbox"/> 1980s	<input type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="checkbox"/> 1990s	<input type="checkbox"/> Volcano	
<input type="checkbox"/> 2000s	<input type="checkbox"/> Landslides	
<input type="checkbox"/> 2010s	<input checked="" type="checkbox"/> Others	

Most Relevant SDGs



1 NO POVERTY



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



15 LIFE ON LAND

How did it drastically change the existing DRR status and strategies? How is it innovative?

The SAK project aimed to increase agricultural productivity, improve access to services and markets, improve nutrition, and inform policies. Initial consumer surveys were conducted to understand the most pressing needs and in which locations. Initial trials of the new approach also took place, working with test farmers before scaling up to the larger area. Picture guidelines on how to use the offered products and solutions were provided to those who did not have access to education. The private sector was engaged in developing and distributing the tools and solutions to the farmers at an affordable price.

A diagnostic system, the GlnLux, was developed by the University of Guelph to measure the output of symbiotic nitrogen fixation in legumes in order to develop strategies for optimizing yields and protein level in the grown vegetables for the purpose of improving nutrition in the communities. Simpler technological methods, such as using drip irrigation and water harvesting ponds were also introduced to support farmers in times of prolonged droughts. At the end of the test phase, a consumer feedback survey was conducted (through cell phones).¹ This approach allowed for consumer needs assessment, testing, feedback and readjusting of the solutions to select those methods which are most efficient and sustainable.

As climate change is threatening agriculture production, farmers around the world have started looking at innovative ways to enhance food production. Terraced farming allows for nutrients to flow from one level to the next, instead of being washed away during rainfalls, as well as for retaining the water and using it for the production of water-intensive crops, such as rice. Projects such as SAK are providing innovative means to facilitate terrace farming by proving low-cost solutions, while catering to different groups in the society irrespective of their education levels. This method also allows for improved preparedness in cases of droughts or floods.

Aleksandrina V. Mavrodieva (almavrodieva@gmail.com), Keio University, Japan
Rajib Shaw (shaw@sfc.keio.ac.jp), Keio University, Japan

¹ Pudasaini et al. (2019). Innovations for Terrace Farmers in Nepal and Testing of Private Sector Scaling Up Using Sustainable Agriculture Kits and Stall-Based Franchises: Final Report. IDRC.

30 INNOVATIONS LINKING DRR WITH SDGs

EARLY WARNING

24. Earthquake Guard: Earthquake Early Warning System
25. Water Battery for Flood Early Warning System
26. Flag-based Cyclone Early Warning System



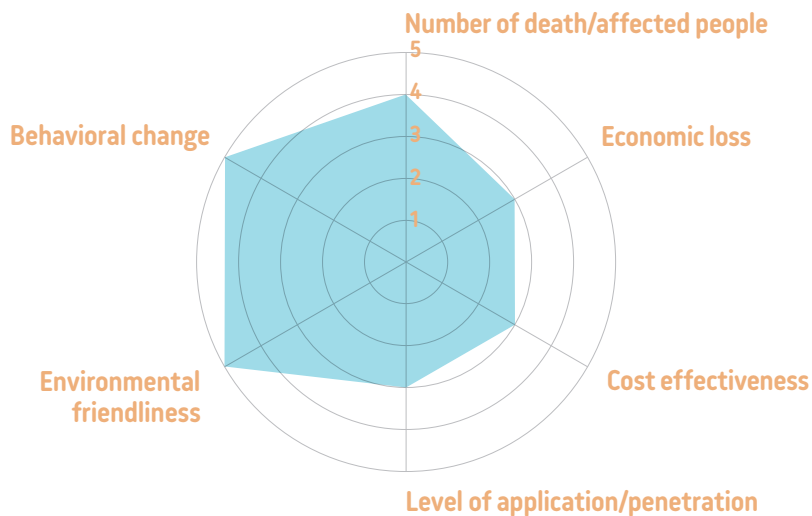
Earthquake Guard: Earthquake Early Warning System

Advances in science and technology have demystified the secrets of earthquakes. However, their sudden occurrence leaves almost no time for preparedness. This causes massive destruction in terms of economic loss, human lives, infrastructural damage etc.

With intense research and development, Challenge has launched Earthquake Guard (EQG) which is an earthquake sensor alarm and equipment. The built-in accelerometer detects P wave and issues earthquake alert before the arrival of strong shaking by S wave. EQG has a specialized

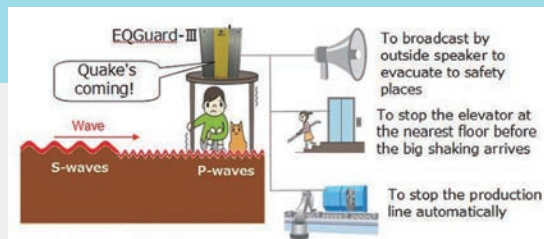
software to distinguish between earthquake and living noise generated near EQG, which prevents issuing of erroneous alert. EQG issues alert in multiple languages such as, Japanese, English, Chinese, Korean, Indonesian, Persian, Turkish, Spanish, Portuguese, Russian and Arabic. It can send signals to control the connected equipment like broadcasting facility, elevator, production facility etc. in accordance with the estimated seismic intensity level of the earthquake. Its only requirements are internet and power source.

Assessment



Number of Death / Affected people	4	Early Warning in earthquake leads to evacuation to safety leading to reduction in number of people affected.
Economic Loss	3	By shutting down critical infrastructure like gas, power, further risk of loss due to fire etc. is minimized.
Cost Effectiveness	3	It is a medium cost solution but a great investment in DRR
Level of Application / Penetration	3	It can be used in important instalments like schools, hospitals.
Environmental Friendliness	5	It is completely environmentally friendly causing no harm to the surroundings.
Behavioral Change	5	Earthquake early warning leads to timely response creating a culture of safety and resilience.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input checked="" type="checkbox"/> Response
<input type="radio"/> 1960s	<input type="checkbox"/> Flood	<input type="checkbox"/> Recovery
<input type="radio"/> 1970s	<input type="checkbox"/> Typhoon/ Cyclone	<input type="checkbox"/> Mitigation
<input type="radio"/> 1980s	<input type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input type="checkbox"/> Volcano	
<input type="radio"/> 2000s	<input type="checkbox"/> Landslides	
<input checked="" type="radio"/> 2010s	<input type="checkbox"/> Others	



Most Relevant SDGs

1 NO POVERTY

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

11 SUSTAINABLE CITIES AND COMMUNITIES

How did it drastically change the existing DRR status and strategies? How is it innovative?

A few seconds to a minute of advance earthquake warning allows people and systems to take actions to protect life from an earthquake. The EQ guard can automatically shut down critical infrastructure like elevators, power, gas supplies and also stops the production line at factories. This prevents the occurrence of cascading hazards. The automated early warning and public broadcast saves the crucial seconds in early warning dissemination and create scope for evacuation to safety. It also displays the area map of the impact thereby guiding evacuees to the nearest safe location.

The earthquake guard is a great investment for important public places like schools, hospitals, transport hubs and industrial production units. At community level, the EQ guard will allow the citizens the window of time to adequately taking action for safety, thus helping to create a culture of safety and informed decision making. Hence it strengthens the DRR capacities at local levels by providing warnings at the site level. The installation of EQ guard will support active community participation into disaster governance through simulation drills and trainings. It will also serve for achieving the targets of the Sendai Framework for Disaster Risk Reduction by enhancing community resilience and investment in resilience.

Sasaki Kazuo ksasaki@challengego.co.jp, Challenge Co. Ltd., Japan
 Sukhreet Bajwa, (bajwa.sukhreet@gmail.com) RIKA, India
 Ranit Chatterjee (ranit13@gmail.com), RIKA, India
 Rajib Shaw (shaw@sfc.keio.ac.jp) Keio University, Japan

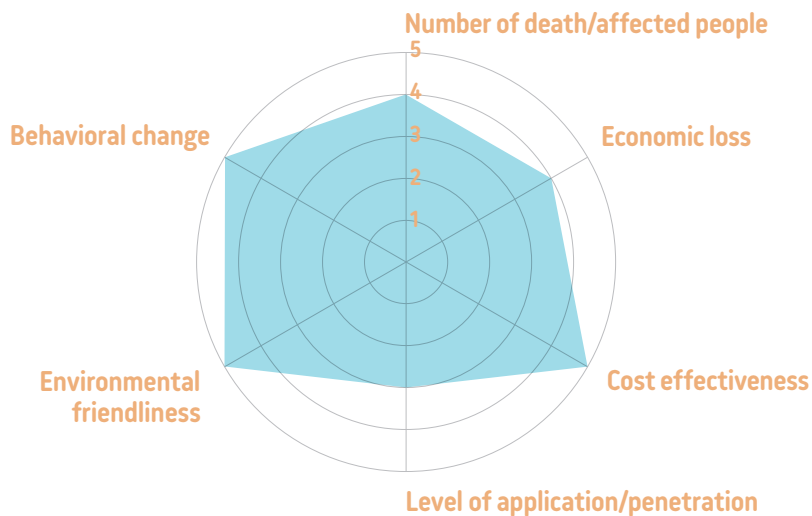


Water Battery for Flood Early Warning System

Floods are a recurrent phenomenon, which cause huge loss of life and damage to livelihood, property, infrastructure and public utilities. To counter the emerging climate-related flood risks, Water Batteries serve as an innovative solution for on-site automated early warning dissemination. These batteries generate electricity when soaked in water. The mechanism is simple; when water level rises, pre-set batteries gets soaked at the marked flood level of river water table, and then soaked

the batteries generate electricity. The electricity turns on the emergency evacuation signal lights indicating the community to take shelter in higher and safe places. The lights signal different types of warnings depending on the level of water. The water batteries can be installed in areas where the flooding risk is high for the communities residing near rivers or canals. There is also a provision for data transmission system to the line agencies and concerned authorities.

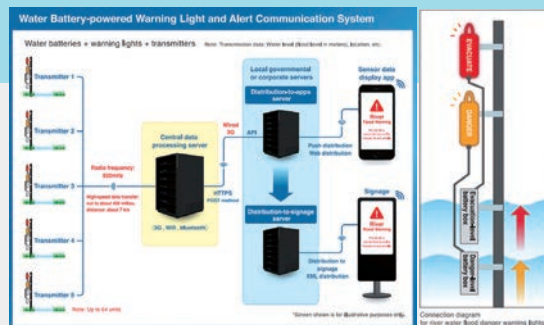
Assessment



Number of Death / Affected people	4	Timely Early Warning leads to evacuation to safety leading to reduction in number of people affected.
Economic Loss	4	Early Warning gives time for preparedness thereby reducing the extent of economic loss at community and society level.
Cost Effectiveness	5	It is a low-cost solution for early warning and with low maintenance cost in comparison to other flood warning systems.
Level of Application / Penetration	3	It can be used in rivers and canals in both urban and rural areas but its usage needs to be more widespread.
Environmental Friendliness	5	It is completely environmentally friendly causing no harm to the surroundings.
Behavioral Change	5	Widespread usage of the early warning can lead to a culture of trust on early warning and timely response as part of community behavior at large.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input type="radio"/> Earthquake	<input checked="" type="checkbox"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input type="checkbox"/> Recovery
<input type="radio"/> 1970s	<input type="radio"/> Typhoon/ Cyclone	<input type="checkbox"/> Mitigation
<input type="radio"/> 1980s	<input type="radio"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input type="radio"/> Volcano	
<input type="radio"/> 2000s	<input type="radio"/> Landslides	
<input checked="" type="radio"/> 2010s	<input type="radio"/> Others	

Most Relevant SDGs



How did it drastically change the existing DRR status and strategies? How is it innovative?

An effective early warning system can prevent physical and economic impacts of disasters thus upholding the targets set forth by Sendai Framework for Disaster Risk Reduction. The water level warning systems help to protect people from dangers of flood and also to achieve Sustainable Development Goals by increasing awareness and reducing inequality in information access. It is a low-cost solution for providing timely early warning to the local residents, particularly in areas where systematic early warning is not installed. It provides early warning at the community level strengthening the last mile dissemination of risk information.

It is widely acknowledged that risk communication and information dissemination components of early warning systems have not kept pace with the advancement in forecasting technologies. While sophisticated systems for detection and monitoring of hazards have been installed, the 'last mile' connectivity to the community at risk still depends upon manual systems. On the other hand, at community level, factors like exposure to risks, community's risk perception, time of warning dissemination, community's trust in the warning messages and individual's last-minute pursuit of protection of assets together are possible contributing factors for procrastination of early and positive action. With the use of water batteries, the warning first reaches the local citizens where it is generated thereby increasing the community trust levels on warning systems. The provision of data transmission also empowers the local self-governing bodies with adequate risk information. The current system of warning levels is hierarchical with flood level monitoring agencies informing the higher officials and then information being passed down to the last governing unit. The water batteries, however, provide the information at the site of hazard without any time delay. It is a powerful tool to strengthen Community Based DRR. It also has the potential to get imbibed in the local cultural practice of early warning and resilience.

Kishimoto T., Fujiwara N. Teijin Frontiers Co. Ltd., Japan
 Sukhreet Bajwa, (bajwa.sukhreet@gmail.com) RIKA, India
 Ranit Chatterjee (ranit13@gmail.com), RIKA, India
 Rajib Shaw (shaw@sfc.keio.ac.jp) Keio University, Japan

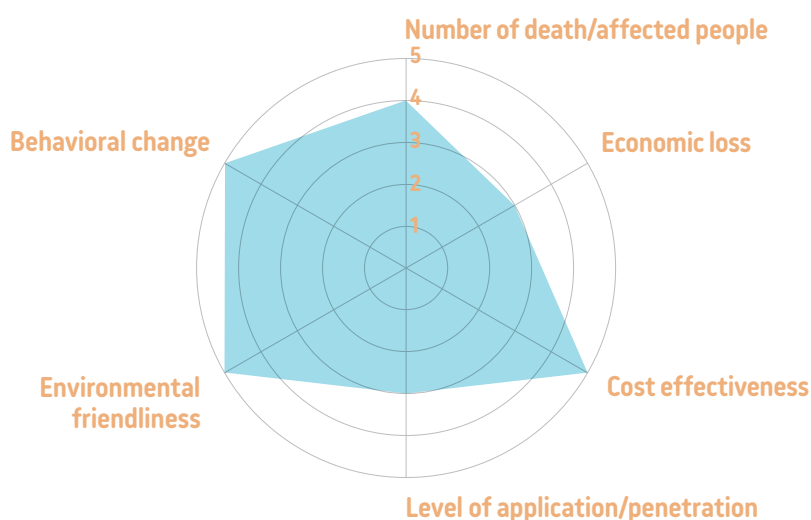
Flag-based Cyclone Early Warning System

Bangladesh Meteorological Department (BMD) uses a number of signals, inherited from British India, to indicate the severity of weather conditions. These signals were primarily meant for maritime sailors and are therefore difficult to understand for local communities. To address this issue, the Cyclone Preparedness Program (CPP) in Bangladesh introduced the Flag-based Early Warning Systems that simplifies communication of early warning messages based on colored flags. Every time a cyclone approaches Bangladesh, CPP volunteers communicate the early warning messages received

from BMD to the local communities by hoisting colored flags at important places like ports, cyclone shelters, public buildings etc. The whole range of Maritime Port signals are demonstrated in forms of three flags. The first flag (caution) corresponds with signal 1 to 3, second flag (danger) corresponds with signal 4 to 7 and the third flag (great danger) corresponds with signal 8 to 11¹.

¹ <https://reliefweb.int/report/bangladesh/field-discussion-guide-cyclone-early-warning-procedures>

Assessment



Number of Death / Affected people	4	Flag based Early Warning System (EWSs) are a newly developed means of risk communication, however they are very effective.
Economic Loss	3	Flag based EWSs provide adequate lead time for preparedness thereby saving human lives and reducing the extent of economic loss.
Cost Effectiveness	5	It is a low-cost solution for communicating early warnings to disaster-prone communities, in comparison to other flood warning systems.
Level of Application / Penetration	3	Although, the method is highly efficient, it has certain limitations like limited visibility in night time that need to be overcome.
Environmental Friendliness	5	Flag-based EWSs are an environmentally friendly measure based on flags, causing no harm to the surroundings.
Behavioral Change	5	Simplified flag-based signals enhance the understanding of EWSs and therefore facilitate timely response and adequate action.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input type="radio"/> Earthquake	<input checked="" type="checkbox"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input type="radio"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input type="radio"/> Mitigation
<input type="radio"/> 1980s	<input type="radio"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input type="radio"/> Volcano	
<input type="radio"/> 2000s	<input type="radio"/> Landslides	
<input checked="" type="radio"/> 2010s	<input type="radio"/> Others	

Most Relevant SDGs

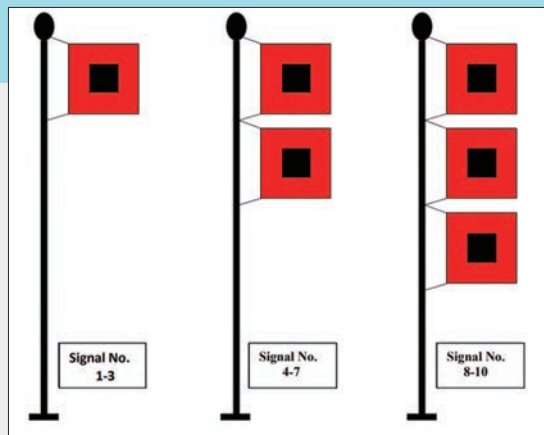


Figure: Colored flags and corresponding maritime port signals (Source: A good practice of CPP, Published by CPP in 2013)

How did it drastically change the existing DRR status and strategies? How is it innovative?

Against the growing frequency and intensity of disasters, the timely communication of early warning messages to all relevant stakeholders is important. Considerable progress has been made in the ‘Monitoring and Forecasting’ technologies of EWSs, however the element of ‘risk communication’ continues to hinder their effectiveness during disaster situations. Advanced technologies today provide timely predictions of forthcoming disasters; however, these predictions are not useful until and unless the information reaches the public in a simplified manner. Factors like varying risk perception, language barriers, socio-economic conditions, illiteracy, poor communication infrastructure etc. pose significant challenges to ensuring adequate actions by the community members.

Flag-based EWSs introduced by CPP have proven to be an innovative method to bridge the communication gap between scientific agencies and the vulnerable communities. Local communities in Bangladesh may have a limited understanding of the complicated early warnings received through mobile phones and other electronic media, but flag-based risk communication is enhancing the efficiency of EWSs. The simplified warning messages by local volunteers based on colored flags helps reach the entire society irrespective of age, gender, literacy etc. as they are easily understood and accessible, as also emphasized in the Sendai Framework for Disaster Risk Reduction. In view of that, Flag based EWSs are effectively serving as an efficient and cost-effective means to enhance disaster preparedness and management, especially in developing countries where the implementation of hard-infrastructure based approaches may be constrained due to limited resources.

Vibhas Sukhwani (vibhassukhwani003@gmail.com), Keio University, Japan
Rajib Shaw (shaw@sfc.keio.ac.jp), Keio University, Japan

30 INNOVATIONS LINKING DRR WITH SDGs

DISABILITY

- 27. Disability-inclusive Disaster Risk Reduction
- 28. Accessible and Universal Design Standards

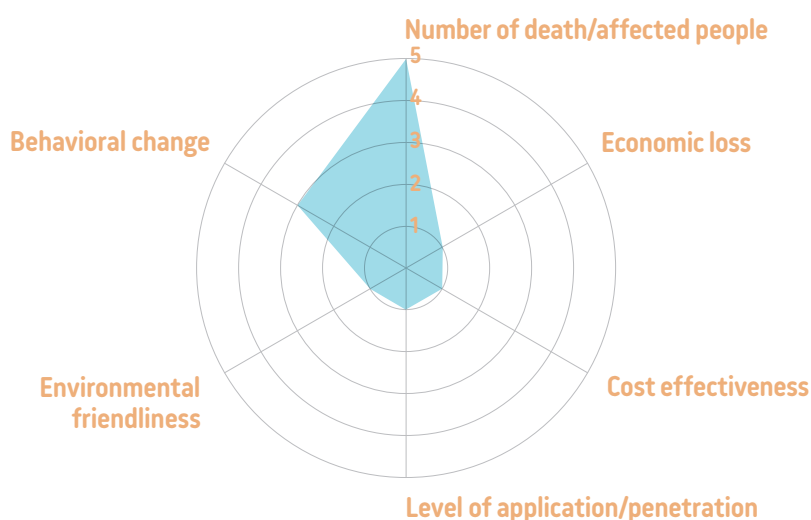
There are approximately one billion people (15 percent of the world's population), who experience some form of disability, of whom 2-4 percent experience significant difficulties in functioning (WHO¹). Eighty percent of these people live in developing countries, according to the UN Development Program². Women with disabilities experience multiple disadvantages and exclusions, due to both their gender and their disability (Disabled World). Recent research has shown that people with disabilities are four times more likely to die in a disaster than people without disabilities.

They are still largely unaccounted for in most disaster risk reduction (DRR) plans and policies in many places. Despite being a highly vulnerable group, the specific needs, concerns and capacities of persons with disabilities are often 'invisible' and not appropriately integrated into disaster risk management activities.

¹ https://www.who.int/disabilities/world_report/2011/report/en/

² <https://www.un.org/development/desa/disabilities/resources/factsheet-on-persons-with-disabilities.html>

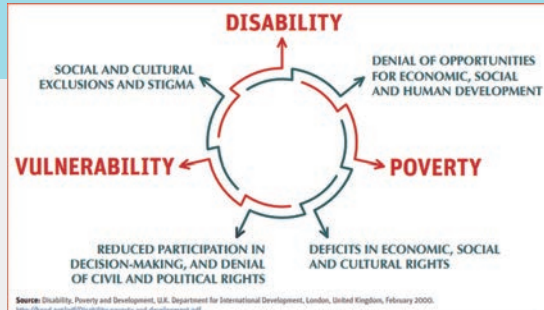
Assessment



Number of Death / Affected people	5	The outmost aim of Disability-inclusive Disaster Risk Reduction (DiDRR) is to reduce the number of deaths from disasters.
Economic Loss	1	Economic loss is not yet considered in DiDRR.
Cost Effectiveness	1	Cost effectiveness is not yet considered in DiDRR.
Level of Application / Penetration	1	While there is global recognition on this, only few most vulnerable countries are beginning to consider DiDRR.
Environmental Friendliness	1	Environmental friendliness is not yet considered in DiDRR.
Behavioral Change	3	While there is global recognition on this, only few most vulnerable countries are beginning to consider DiDRR. However, behavioral change will be greatly achieved if DiDRR is implemented.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input checked="" type="checkbox"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input checked="" type="checkbox"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input checked="" type="checkbox"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input checked="" type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	

Most Relevant SDGs



How did it drastically change the existing DRR status and strategies? How is it innovative?

Considerable progress on disability inclusion in DRR policy has been made in the recent years. The United Nations Convention on the Rights of Persons with Disabilities (UNCRPD), signed in 2007, promotes the full integration of persons with disabilities in societies. The Incheon Strategy 2013-2022 to 'Make the Right Real' for Persons with Disabilities in Asia and the Pacific was launched in late 2012 to chart the new course of action for the Asian and Pacific Decade of Persons with Disabilities. The Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030 also mandates the inclusion of people with disabilities in DRR, a significant stride forward in terms of promoting the rights of people with disabilities at the international level. In the SFDRR, persons with disabilities were referenced both directly and indirectly as part of the preamble, the guiding principles, the priorities for action, and the role of stakeholders. Specifically, the formation of Disability inclusive DRR Network (DiDRRN), is notable in Asia and the Pacific. In the Philippines, Disabled Persons' Organizations build advocacy networks for Disaster Risk Management (DRM). In Indonesia, there is joint advocacy towards a disability inclusive DRR policy. The theme for 2013 of the International Day for Disaster Reduction (13 October) is Living with disabilities and disasters. Moreover, the key principles to inclusive disaster risk management include: ENABLING persons with disabilities to take up active roles as DRM actors, ENGAGING persons with disabilities in DRM efforts, EXTENDING the leverage through joint advocacy efforts towards inclusive DRM.

Riyanti Djalante (DJALANTE@unu.edu) , United Nation University (UNU-IAS), Japan

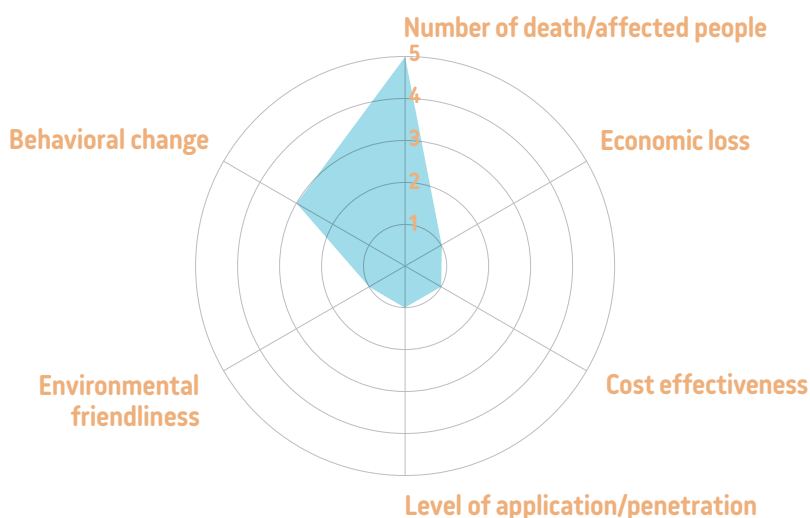


Accessible and Universal Design Standards

Universal access refers to the ability of all people to have equal opportunity and access to a service or product, regardless of social class, ethnicity, ancestry or physical disabilities. Universal design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. Practically, it is about the design of buildings, products or environments to make them accessible to all people, regardless of age, disability or other factors.

The seven principles of Universal Design include: 1) Equitable Use, 2) Flexibility-in-Use, 3) Simple and Intuitive Use, 4) Perceptible Information, 5) Tolerance for Error, 6) Low Physical Effort, and 7) Size and Space for Approach and Use. There are in addition eight goals for universal design namely, 1) Body Fit, 2) Comfort, 3) Awareness, 4) Understanding, 5) Wellness, 6) Social Integration, 7) Personalization, and 8) Cultural Appropriateness.

Assessment



Number of Death / Affected people	5	The outmost aim of Accessible and Universal Design Standards (AUDS) is to reduce the number of deaths from disasters.
Economic Loss	1	Economic loss is not yet considered in AUDS.
Cost Effectiveness	1	Cost effectiveness is not yet considered in AUDS.
Level of Application / Penetration	1	While there is global recognition on this, only few most vulnerable countries are beginning to consider AUDS as part of their DRR strategies.
Environmental Friendliness	1	Environmental friendliness is not yet considered in AUDS.
Behavioral Change	3	While there is global recognition on this, only few most vulnerable countries are beginning to consider AUDS. However, behavioral change will be greatly achieved if AUDS is implemented.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input type="radio"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input checked="" type="checkbox"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input checked="" type="checkbox"/> Mitigation
<input checked="" type="checkbox"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	

Most Relevant SDGs



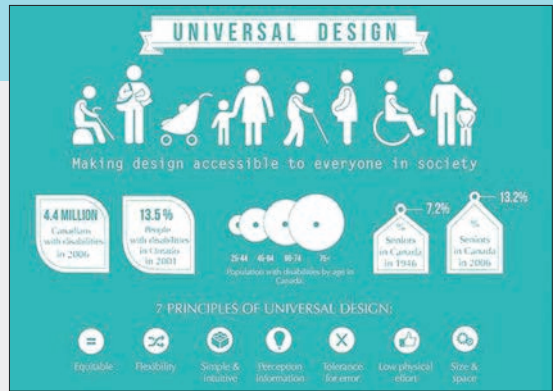
1 NO POVERTY



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



Source: <https://www.behance.net/gallery/Universal-Design-Infographic-11242185>

How did it drastically change the existing DRR status and strategies? How is it innovative?

The infusion of disability-related terms and concepts such as accessibility, inclusion, and universal design was significant throughout the Sendai Framework for Disaster Risk Reduction. During disaster response, persons with a disability are often excluded from accessing emergency support and essential services such as food distribution, medical care, shelter and water, sanitation and hygiene (WASH) facilities. The inclusion of ‘Accessible and Universal Design Standards’ (AUDS) into post-disaster response work contributes towards a barrier-free environment and an inclusive society. It ensures the design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by all people regardless of their age, size, ability or disability. Accessibility audits and assessments by people with disabilities could be streamlined in the building permit issuance process to identify practical design solutions. Seismic retrofitting programs could address risk mitigation other standards including safety and disability access.

Disasters provide an opportunity to build back better, safer and more accessible for all. They also offer the possibility to incorporate universal design principles into new construction. At city level, it is proposed that a ‘placemaking’ approach with universal design principles need to be adopted. City-makers should work collaboratively with communities including people of all abilities, genders, and ages, when designing public spaces to accommodate their needs and strengthen links between diverse population groups. Cities that are rebuilding after disasters could facilitate design ‘charrettes’ (collaborative design workshops) with disability and other groups to promote inclusive universal design practices.

Riyanti Djalante (DJALANTE@unu.edu) , United Nation University (UNU-IAS), Japan

30 INNOVATIONS LINKING DRR WITH SDGs

LIVELIHOOD

29. Ecosystem-based Disaster Risk Reduction

30. A Nexus Approach toward Climate Change, Food Security, and Livelihoods



Ecosystem-based Disaster Risk Reduction

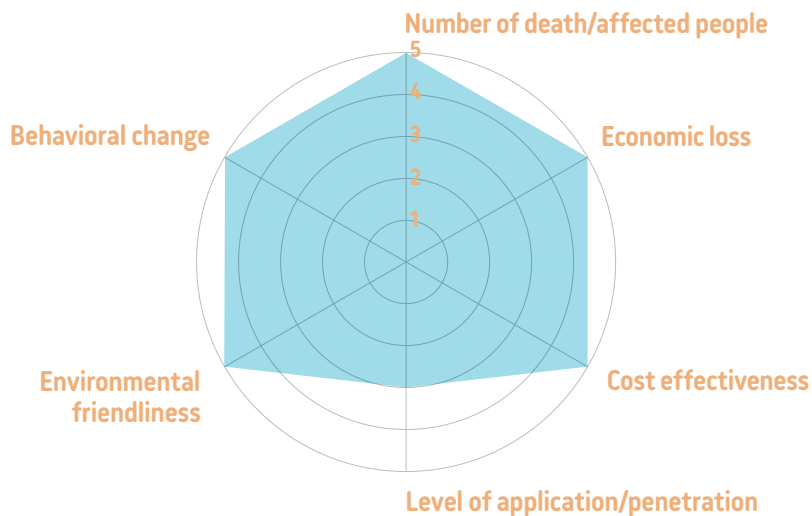
Ecosystem-based disaster risk reduction (Eco-DRR) is the sustainable management, conservation and restoration of ecosystems to provide services that reduce disaster risk by mitigating hazards and by increasing livelihood resilience¹. Ecosystem services are broadly categorized into 4 functions namely: 1) provisioning services such as the production of food and water, 2) regulating services such as the control of climate and disease, 3) supporting services such as nutrient cycles and oxygen production, and 4) cultural services, such as spiritual and recreational benefits. Ecosystems

are central to disaster risk reduction for five main reasons: 1) they serve as a source of livelihood, 2) they provide protection against natural disasters, 3) healthy environment is more resilient to natural hazards, 4) disasters degraded ecosystems, and 5) scarce environmental resources often contribute to conflicts and human insecurity².

¹ http://www.env.go.jp/en/nature/asia-parks/pdf/wg2/APC_WG1-06_Radhika%20Murti.pdf

² <https://www.iucn.org/ja/node/24786>

Assessment



Number of Death / Affected people	5	The presence of ecosystems can greatly help to reduce number of deaths / affected people.
Economic Loss	5	Economic loss can be strongly prevented with the presence and protection of the ecosystems.
Cost Effectiveness	5	Ecosystem-based DRR approach can be cost effective due to the multiplier effects it brings through CCA, livelihoods, culture, economy.
Level of Application / Penetration	3	Environmental degradation is globally occurring. While nature-based solutions such as eco-based DRR is emerging, it is only implemented partially.
Environmental Friendliness	5	This approach utilize nature at its core.
Behavioral Change	5	There is global movement on putting nature at the center of global environmental change, marked by the United Nations General Assembly declaring 2021–2030 the UN Decade on Ecosystem Restoration.



Mangrove as one of the Super Solutions toward Disaster Risk Reduction, Climate Change Adaptation, Livelihood and Biodiversity. (Source: UNEP)

Era	Type	Stage
<input type="radio"/> Before 1960s	<input type="radio"/> Earthquake	<input type="radio"/> Response
<input type="radio"/> 1960s	<input checked="" type="radio"/> Flood	<input checked="" type="radio"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="radio"/> Typhoon/ Cyclone	<input checked="" type="radio"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="radio"/> Tsunami	<input type="radio"/> Preparedness
<input type="radio"/> 1990s	<input type="radio"/> Volcano	
<input checked="" type="radio"/> 2000s	<input type="radio"/> Landslides	
<input type="radio"/> 2010s	<input checked="" type="radio"/> Others	


Most Relevant SDGs



1 NO POVERTY



14 LIFE BELOW WATER



15 LIFE ON LAND

How did it drastically change the existing DRR status and strategies? How is it innovative?

Well-managed ecosystems, such as wetlands, forests and coastal systems have multiple benefits. They act as natural infrastructure, reducing physical exposure to multiple hazards and increasing socio-economic resilience of people and communities by sustaining local livelihoods and providing essential natural resources such as food, water and building materials. The degradation of these ecosystems are a major driver of disaster risk and a key component of disaster vulnerability.

Maintaining the health and resilience of key ecosystems enhances disaster resilience. In recovery operations, strengthening environmental management and addressing environmental risks can be used as opportunity to build back better. In the context where conflict over natural resources is high, environmental protection and restoration are important on top of crisis prevention.

Mangrove rehabilitation and coral reef restoration have been the two most well-known examples of Eco-DRR. Mangroves along coastal areas provide physical protection from storms and act as carbon reservoirs. They also provide a resource base for local livelihoods and income generation. For example, the Sundarbans region along the coast of India and Bangladesh has the largest expanse of contiguous mangrove forests in the world, stretching for 10,000 square kilometers. Aside from coastal protection, the mangroves in the Sundarbans provide nursery habitat for fish and other animals and support other important ecosystem services. The Sundarbans are prone to severe cyclones and storm surges. Eco-DRR measures in the Sundarbans include protection and management of mangrove ecosystems, reducing their vulnerability to climate change and sea level rise and enabling this highly populated area to benefit from coastal protection.

Riyanti Djalante (DJALANTE@unu.edu) , United Nation University (UNU-IAS), Japan

A Nexus approach toward Climate Change, Food Security and Livelihoods

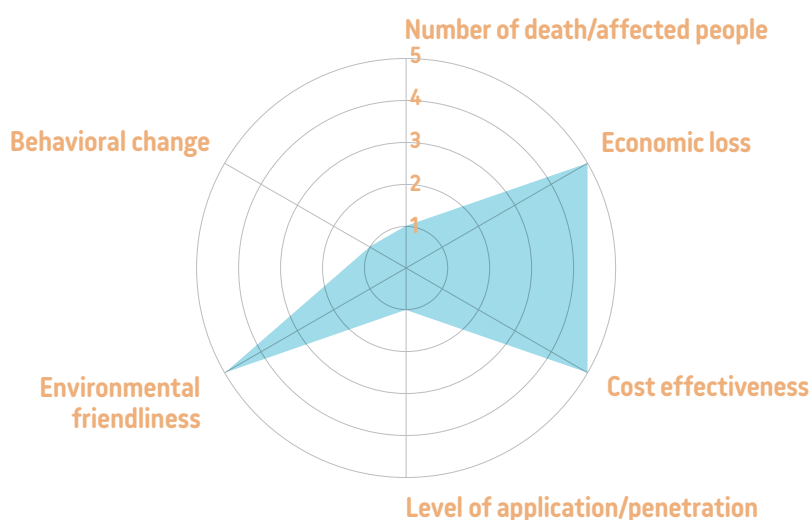


Pacific island countries are particularly vulnerable to climate change due to their geographical positioning and socio-economic characteristics. Almost 80 percent of the population relies on agriculture and fisheries as sources of livelihoods and food security. Countries in the Pacific must build holistic resilience to climate change and consider the interlinkages between climate change, food security and livelihoods.

The nexus approach takes into consideration the interrelatedness and interdependencies of

agriculture, climate change and human societies. It can help to minimize trade-offs and potential conflicts between human societies and natural environment. It can serve for maximizing benefits by enhancing efficiency in agriculture and fisheries sectors in the countries they serve, and hence minimizing the negative impacts of climate change on the food security and economic livelihood. Agricultural adaptation practices include improved crop management and increased investment in agricultural research and extension.

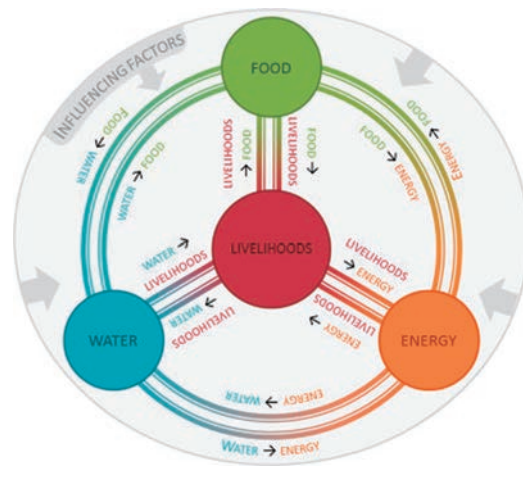
Assessment



Number of Death / Affected people	1	The Nexus approach does not deal with reduction of number of deaths.
Economic Loss	5	The nexus approach put livelihood in its core which is strongly relevant in reducing the economic loss especially at the community level.
Cost Effectiveness	5	Cost effectiveness is ensured since the Nexus approach looks are maximizing synergy and minimizing trade-offs.
Level of Application / Penetration	1	The Nexus approach is only new, introduced in early 2010s.
Environmental Friendliness	5	Environmental friendliness is ensured when maximizing outputs from water, food and livelihood.
Behavioral Change	1	The Nexus approach does not deal directly with behavioral change.

Era	Type	Stage
<input type="radio"/> Before 1960s	<input checked="" type="checkbox"/> Earthquake	<input checked="" type="checkbox"/> Response
<input type="radio"/> 1960s	<input checked="" type="checkbox"/> Flood	<input checked="" type="checkbox"/> Recovery
<input type="radio"/> 1970s	<input checked="" type="checkbox"/> Typhoon/ Cyclone	<input checked="" type="checkbox"/> Mitigation
<input type="radio"/> 1980s	<input checked="" type="checkbox"/> Tsunami	<input checked="" type="checkbox"/> Preparedness
<input type="radio"/> 1990s	<input checked="" type="checkbox"/> Volcano	
<input type="radio"/> 2000s	<input checked="" type="checkbox"/> Landslides	
<input checked="" type="radio"/> 2010s	<input checked="" type="checkbox"/> Others	

Most Relevant SDGs



The Nexus approach between water, energy, food and livelihood (Source: Biggs et al., 2015¹)

¹ Biggs et al. (2015) Sustainable development and the water–energy–food nexus: A perspective on livelihoods. <https://doi.org/10.1016/j.envsci.2015.08.002>

How did it drastically change the existing DRR status and strategies? How is it innovative?

The nexus approach provides a comprehensive and integrated assessment of the key sectors subjected to disasters and climate change. It can be applied at multiple spatial scales and institutional levels and enhance policymaking for sustainable development agendas. International agencies are utilizing this approach in their programming throughout the Pacific Island states. As for example, The World Bank and The Asian Development Bank, through their program on Climate Change, Food Security, and Socioeconomic Livelihood in Pacific Islands¹, examines strategies to minimize trade-offs and maximize resources. Further, the FAO project on Climate Change and Food Security in the Pacific Island states² examines strategies to address food security and poverty reduction in the face of climate change and energy security. It attempts to bring to the core, food security threats associated with climate change in food production and supply environments, as well as the broader livelihood and ecological changes that will occur as a consequence.

Riyanti Djalante (DJALANTE@unu.edu), United Nation University (UNU-IAS), Japan
Morgan Wairiu, The University of the South Pacific, Fiji

¹ <https://www.adb.org/sites/default/files/publication/175046/climate-change-food-security-pacific.pdf>

² <http://www.fao.org/tempref/docrep/fao/012/i1262e/i1262e00.pdf>

Summary of survey result

Summary of survey results: 30 Innovations under 10 sectors

The online survey related to the 30 Innovations for DRR publication was conducted from 9th January to 25th January 2019. In total, 200 responses were received from 32 different countries around the world. The respondents for the online survey comprised of mixed representation from all age and gender groups. The breakdown of their affiliation is as follows: University / Research Institute (93), Government (48), NGOs (28), Private sector (19), International organizations (6), and others (6). One of the key questions in the online survey asked participants to select three most effective innovations from the total 30 Innovations categorized under 10 sectors. The top ten innovations selected by the survey respondents were as follows:

Top Ten Innovations		Sector
1.	Ecosystem-based Disaster Risk Reduction (Eco-DRR)	Livelihood
2.	Integrated Water Resources Management (IWRM)	Water
3.	Earthquake Guard: Earthquake Early Warning System	Early warning
4.	A Nexus approach toward climate change, food security, and livelihoods	Livelihood
5.	Nationalized Cluster Coordination Mechanism	Emergency response
6.	Green Infrastructure	Water
7.	Mobile clinics	Health
8.	My timeline: Optimizing emergency evacuation per household	Emergency response
9.	Technical Vocational Education and Training (TVET)	Education
10.	Disability-inclusive Disaster Risk Reduction (Di-DRR)	Disability

The ten most effective DRR innovations identified from the online survey are from seven different sectors of Livelihood (Eco-DRR and Nexus approach), Water (IWRM and Green Infrastructures), Early Warning (Earthquake Guard), Emergency Response (Nationalized Cluster Coordination Mechanism and My Timeline), Health (Mobile Clinics), Education (TVET) and Disability (Di-DRR). While Eco-DRR and Nexus approach have recently gained global prominence in the wake of climate change, it is particularly interesting to note that the significance of Disability-inclusive DRR has also been widely recognized through this survey. Markedly, most of the ten DRR innovations are closely linked to Sustainable Development Goals (SDGs), that highlights the key role of sustainability aspects in DRR innovations.

It is important to understand that the effectiveness of these innovations is based on several factors depending on the social, economic,

environmental and Institutional context that varies in different countries. The sectors of Livelihood, Water and Emergency Response were found to have multiple representation in ten most effective innovations of DRR. On other hand, three specific sectors of Agriculture, Children and Gender were found to be comparatively less recognized, as they did not make it to top ten. This underlines that DRR innovations are varyingly recognized and community perception plays an important role. While, innovations like Digital farming are demonstrated to be highly efficient and labor saving in Agriculture sector, it is evident from the survey results that their global outreach is limited, and it is not widely recognized. Accordingly, more emphasis should be given to developing DRR innovations in these least recognized sectors, as well as enhancing their public outreach and wider impact around the world.

Appendix

Acknowledgement

We would like to extend our deepest gratitude to everyone who responded to the second survey on the innovations for DRR. Furthermore, we greatly appreciate the tremendous contributions of Ms. Jessica Alexander and Ms. Sayaka Kobayashi, who helped make this publication more professional, attractive, and meaningful. Without their efforts, this publication would not have been possible.

Project team

Takako Izumi

Associate Professor, International Research Institute of Disaster Science (IRIDeS), Tohoku University



She also serves as Program Director of the Multi Hazards Program under the Association of Pacific Rim Universities (APRU), which comprises 50 universities and academic institutes in the Pacific Rim. Her research interests include international and regional frameworks/strategies for disaster risk reduction (DRR), international humanitarian assistance, and DRR initiatives at the local and community levels. She was appointed as a member of UNISDR's Asia Science Technology and Academia Advisory Group (ASTAAG) in May 2015.

Previously she worked for an international NGO in Malaysia and UN agencies such as UN Habitat, UN Office for the Coordination of Humanitarian Affairs (UNOCHA), and UN Office for the Recovery Coordinator for Ache and Nias (UNORC) to assist the recovery efforts after the Indian Ocean Tsunami. She holds Ph.D. in Global Environmental Study from Kyoto University, Japan.

Rajib Shaw

Professor, Graduate School of Media and Governance, Keio University



He is also the Senior Fellow of Institute of Global Environmental Strategies (IGES) Japan, and the Chairperson of SEEDS Asia and CWS Japan, two Japanese NGOs. Earlier, he was the Executive Director of the Integrated Research on Disaster Risk (IRDR) and was a Professor in Kyoto University. His expertise includes disaster governance, community-based disaster risk management, climate change adaptation, urban risk management, and disaster and environmental education. Professor Shaw is the Chair of the United Nations Science Technology Advisory Group (STAG) for disaster risk reduction; and also the Co-chair of the Asia Science Technology Academic Advisory Group (ASTAAG). He is also the CLA (Coordinating Lead Author) for Asia chapter of IPCC's 6th Assessment Report. He is the editor-in-chief of the Elsevier's journal "Progress in Disaster Science", and series editor of a Springer book series on disaster risk reduction. Prof. Shaw has published more than 45 books and over 300 academic papers and book chapters.

Mikio Ishiwatari

Visiting Professor, Graduate School of Frontier sciences, The University of Tokyo



He is also Senior Advisor on Disaster Management and Water Resources Management at Japan International Cooperation Agency. He has been engaged in the projects and research works of DRR, climate change adaptation, and water. He led formulation of the Japanese assistance policies of climate change adaptation and community-based disaster management.

He worked at the World Bank as Senior Disaster Risk Management Specialist and Senior Water Specialist. He worked at various positions at the Ministry of Land, Infrastructure, and Transport, Japan for 17 years. He formulated and supervised national projects of flood risk management and highways in Iwami District as Director of Hamada River and Road Office, and was responsible for research and technology development as Senior Deputy Director for River Technology and Information. He worked as Urban Development Specialist at the Asian Development Bank. He holds a PhD in international studies and MSc in Urban Engineering from the University of Tokyo.

Project team

Riyanti Djalante

*Academic Programme Officer, The United Nations University,
Institute for the Advances Study of Sustainability (IAS).*



She coordinates the Research and Policy Development stream on Global Change and Resilience, which conduct researches to address climate change, build community resilience, and reduce disaster risks. She is the Lead Author of IPCC Assessment Report 6 Working Group II, IPCC Special Report on impacts of 1.5 degree warming, and the Global Environmental Outlook 6 of the UN Environment. She is the scientific editor of the Journal of Sustainability Science and Progress in Disaster Science Journal. Her current appointments include a member of the Scientific Committee of the IRDR, research fellow of the Earth System Governance Network (ESG), Social Science Fellow of the International Council for Science (ICS). She is the UNU focal point to the UNISDR.

Previously, she worked as a Research Associate at the UNU Institute of Environment and Human Security in Germany. She also worked for the government in Indonesia accumulatively for ten years.

Takeshi Komino

General Secretary of CWS Japan



Takeshi Komino serves as Secretary General and a member of Executive Committee for Asian Disaster Reduction and Response Network (ADRRN), and Regional Steering Group member of World Humanitarian Summit (WHS). In addition, he is co-chairperson of Japan Platform (JPF), joint secretariat of Japan CSO Coalition for DRR (JCC-DRR), chairperson of Japan Quality and Accountability Network (JQAN). He graduated from Doshisha University, and holds Development Studies M.A. from Brandeis University.

Project team

Vibhas Sukhwani

PhD Student, Graduate School of Media and Governance, Keio University, Japan



He is a recipient of prestigious Japanese Government Monbukagakusho (MEXT) Scholarship. In Keio University, he has been engaged in several research projects related to disaster risk reduction and community resilience. He is also a member of India Japan Laboratory that has recently been established in Keio University to undertake cutting edge bilateral / multilateral research on different issues related to India, Japan and beyond. He has published several journal papers and has also presented his research at numerous International conferences around the world. His current areas of research interest are urban-rural linkages, water security, resilience studies, socio-ecological systems and smart developments.

Previously, he has worked as a Research Associate at Visvesvaraya National Institute of Technology (VNIT), India under a project funded by START International Inc., USA. With Civil Engineering background, he has completed Master's in Urban Planning from (VNIT), India.

Bismark Adu Gyamfi

PhD Student, Graduate School of Media and Governance, Keio University, Japan



He is currently pursuing a PhD study in Keio University Graduate School of Media and Governance, Japan. His research interest includes Resilience Ecology, Landuse and Urban Planning, Smart City and Mobilities. He graduated from Keio University with Master's in Media and Governance and has a background in Urban Planning. He has been involved in a number of JICA assisted projects in urban and land use planning in mostly Africa and Southeast Asia.

