INTERNATIONAL SYMPOSIUM ON

Tackling Climate Change as an Underlying Disaster Risk Driver

27th 28th June 2023

CHARLES SIKES BUILDING (CSG/17)
University of Huddersfield, UK

• Book of Abstracts •

Edited by

Dr. Chamindi Malalgoda
Prof. Dilanthi Amaratunga
Prof. Richard Haigh

Research Training Network on Tackling Climate Change as an Underlying Disaster Risk Driver (CCA-DRR)

CCADRR

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Co-funded by the Erasmus+ Programme of the European Union

International Symposium on

Tackling Climate Change as an Underlying Disaster Risk Driver

BOOK OF ABSTRACTS

Edited by

Dr. Chamindi Malalgoda
Prof. Dilanthi Amaratunga
Prof. Richard Haigh

University of Huddersfield,
United Kingdom

27-28 June 2023

Dr. Chamindi Malalgoda, Professor Dilanthi Amaratunga & Professor Richard Haigh
(*edited by*)

International Symposium on Tackling Climate Change as an Underlying Disaster Risk Driver

BOOK OF ABSTRACTS

ISBN: 978-1-86218-222-6

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Preface

Climate change is expected to continue to drive disaster risk, with significant increases in the frequency, intensity, spatial extent and duration of extreme events. Sri Lanka suffers heavily due to extreme weather events. Sri Lanka was one of the top three on the list of the most affected countries in 2017 due to climate-induced disasters and in the Climate Risk Index for 2017 (the 10 most affected countries), and was ranked number 2. Despite this, disaster risk reduction (DRR) and climate change adaptation (CAA) have largely remained distinct and independent in research and policy communities with different approaches. The UN Sendai Framework for DRR 2015–2030 laid out a pathway for DRR that has been adopted by 187 countries. It emphasises "more dedicated action needs to be focused on tackling underlying disaster risk drivers, such as the consequences of climate change". The relationship between DRR and CAA, and strategies to address them is a timely and policy-relevant issue. Addressing the dual and inter-related challenges of CAA and DRR is one of the most critical necessities for the sustainable development agenda beyond 2015.

Research Training Network on Tackling Climate Change as an Underlying Disaster Risk Driver (CCA-DRR) will bring together a bi-lateral cohort of UK and Sri Lanka to build capacity that integrates CAA and DRR. It aims to advance the dialogue between the CAA and DRR communities by investigating differences, overlaps and potential synergies between the two realms, and thereby to develop much needed capacities in the field, which will help support development strategies in Sri Lanka at a time when occurrences of disasters due to climate change are increasing in frequency and intensification. It focusses on building and sustaining research capacity in "tackling climate change as an underlying disaster risk driver (CCA-DRR)".

Research capacity development, on the CCA-DRR is one of the most critical challenges facing Higher Education Institutes in Sri Lanka, and the proposed staff exchange programme will therefore address some of the most pressing issues for researchers and universities, in the context of building and sustaining research capacity. Eventually, it is expected that these gaps in the knowledge will be filled, providing better and timely recovery for disaster-affected communities. To help build resilience to climate and disaster risks, countries must be supported to identify and leverage relevant technical, financial, and organizational capacities in all sectors of society.

In this context, this international symposium is organised as part of the Research Training Network on Tackling Climate Change as an Underlying Disaster Risk Driver (CCA-DRR). CCA-DRR is a European Commission funded Erasmus+ International Credit Mobility (ICM) project which supports student and staff mobility to and from countries outside Europe. Accordingly, this research training programme and Symposium is designed as a research capacity-building and awareness programme targeting the climate change and disaster management researchers in 8 higher education institutions in Sri Lanka. It is with great pleasure that we welcome delegates to this 12-day research training event and the International Symposium on Tackling Climate Change as an Underlying Disaster Risk Driver.

The International Symposium has 37 research presentations structured across 5 key themes and 2-panel discussions. The key themes include:

- Theme 1: Climate change action for resilience in agricultural and food systems
- Theme 2: Climate change adaptation for coastal ecosystems and flood management
- Theme 3: Business continuity, policy and governance
- Theme 4: Climate change adaptation in the built environment
- Theme 5: Climate change risk management

The Symposium programme was designed with the expectation of developing a roadmap that reviews the current state of CAA and DRR and sets out the work required and major challenges and opportunities to advance the dialogue between the CAA and DRR communities. We have no doubt that the deliberations during the international symposium will provide high-level input towards the research roadmap that will be developed during this staff exchange programme for Sri Lanka by the visiting Sri Lankan academics.

Acknowledgements

As Chairs of the International Symposium on Tackling Climate Change as an Underlying Disaster Risk Driver, we are delighted to have the opportunity to hold this Symposium. The symposium was organised as part of a Research Training Network on Tackling Climate Change as an Underlying Disaster Risk Driver (CCA-DRR). CCA-DRR is a European Commission funded Erasmus+ International Credit Mobility (ICM) project and we would like to acknowledge the financial support of the European Commission and the Erasmus+ Programme of the European Union in facilitating this Symposium in conjunction with the CCA-DRR training event.

We also thank all participants from University of Moratuwa, University of Colombo, University of Peradeniya, University of Ruhuna, South Eastern University of Sri Lanka, University of Sri Jayewardenepura, University of Kelaniya and Sabaragamuwa University of Sri Lanka for attending the CCA-DRR training event and the project coordinators, Prof. Indrika Rajapaksha, Prof. Nishara Fernando, Prof. Ranjith Dissanayake, Prof. Champa Navaratne, Prof. Nandasiri Weerasinghe, Mohamed Thariq, Prof. S.B. Navarathne, Dr. BGN Sewwandi and Prof. Achini De Silva for all the support in organising this event.

We have received exceptional help and support from a number of people, organisations and bodies in the work for this Symposium and training event. We would particularly like to acknowledge the support of Thanya Weerasinghe from the Global Disaster Resilience Centre at the University of Huddersfield for being the focal point in the organisational aspects of the Symposium and the training event. Nicola Chiles, Meena Gill and Julie Tierney of the School of Arts and Humanities also deserves a special mention for supporting the logistical and other administrative activities around the Symposium and Chameera Randil for designing the cover page. We would also like to thank all researchers of the Global Disaster Resilience Centre for being there whenever we needed help.

Finally, we would like to thank all the participants from Sri Lanka and the UK for their active participation at the Symposium and for their positive commitments towards the CCA-DRR project activities. Most of all, we want to thank the speakers for their willingness to stimulate invaluable discussions and debate around the symposium theme.

Dr. Chamindi Malalgoda, Prof. Dilanthi Amaratunga & Prof. Richard Haigh

Chairs of the International Symposium on Tackling Climate Change as an Underlying Disaster Risk Driver, June 2023

Symposium Organisation

Organised by
Research Training Network on Tackling Climate Change as an Underlying Disaster Risk Driver (CCA-DRR)
Global Disaster Resilience Centre, University of Huddersfield, UK

In association with

University of Moratuwa, *Sri Lanka*
University of Colombo, *Sri Lanka*
University of Peradeniya, *Sri Lanka*
University of Ruhuna, *Sri Lanka*
South Eastern University of Sri Lanka, *Sri Lanka*
University of Sri Jayewardenepura, *Sri Lanka*
University of Kelaniya, *Sri Lanka*
Sabaragamuwa University of Sri Lanka, *Sri Lanka*

With the support of
ERASMUS+ (The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.)

Organising Committee

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Professor Richard Haigh, *University of Huddersfiled, UK*
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Research Training Network on Tackling Climate Change as an Underlying Disaster Risk Driver (CCA-DRR)

CCA-DRR is designed to develop research capacities amongst academic staff members of UK and Sri Lanka, in "tackling climate change as an underlying disaster risk driver"

Climate change can increase disaster risk by altering the frequency and intensity of hazard events, affecting vulnerability to hazards, and changing exposure patterns. Countries such as Sri Lanka have experienced these impacts of climate change, including an increase in extreme weather-related events such as cyclones, droughts, monsoonal rain, and subsequent flooding and landslides. Despite increasing recognition of their links, disaster risk reduction (DRR) and climate change adaptation (CCA) have largely remained distinct and independent in research and policy communities. In order to rectify this, the UN Sendai Framework for DRR 2015–2030 laid out a pathway for DRR that has been adopted by 187 countries, and emphasises "more dedicated action needs to be focused on tackling underlying disaster risk drivers, such as the consequences of climate change".

Capacity Building

This Network on CCA-DRR will bring together a bi-lateral cohort of UK and Sri Lanka scientists to build capacity that can help to better integrate CAA and DRR. The Network aims to advance the dialogue between the CAA and DRR communities by investigating differences, overlaps and potential synergies between the two realms. It will achieve this through a structured training programme that draws together international expertise and diverse disciplinary perspectives.

Impact

The Network will build the capacity of Sri Lankan Universities to produce high quality, policy and practice relevant research that can support Sri Lanka's efforts to tackle climate change and its impact on disaster risk. In this context, there will also be a self-sustainability of the partnership after the end of the project. The proposed "training activity schedule" will be designed to ensure that the project achieves its intended outcomes and that the impact on the target groups is sustained beyond the lifespan of the initial project fulfilling the concept of sustainability, which consists of principles and practices that ensure lasting, autonomous and self-perpetuating change for an extended period after this exchange project ends.

Project partners

- University of Huddersfield, UK (Lead)
- University of Moratuwa, Sri Lanka
- University of Colombo, Sri Lanka
- University of Peradeniya, Sri Lanka
- University of Ruhuna, Sri Lanka
- South Eastern University of Sri Lanka, Sri Lanka
- University of Sri Jayewardenepura, Sri Lanka
- University of Kelaniya, Sri Lanka
- Sabaragamuwa University of Sri Lanka, Sri Lanka

Project team

- Dr. Chamindi Malalgoda, University of Huddersfield, UK (Project lead University)
- Prof. Dilanthi Amaratunga, University of Huddersfield, UK (Project lead University)
- Prof. Richard Haigh, University of Huddersfield, UK (Project lead University)
- Dr. Indrika Rajapaksha, University of Moratuwa, Sri Lanka
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- Prof. Ranjith Dissanayake, University of Peradeniya, Sri Lanka
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- Dr. Mohamed Thariq, South Eastern University of Sri Lanka, Sri Lanka
- Prof. S.B. Navarathne, University of Sri Jayewardenepura, Sri Lanka
- Dr. B.G.N. Sewwandi, University of Kelaniya, Sri Lanka
- Prof. Achini De Silva, Sabaragamuwa University of Sri Lanka, Sri Lanka

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Global Disaster Resilience Centre (GDRC) - University of Huddersfield, UK

A leader in inter-disciplinary research, education and advocacy to improve the resilience of nations and communities. What would it be like to live in a world in which government authorities, businesses, communities and individuals work together to create a society that is able to withstand the effects of unforeseen events and threats? At the Global Centre for Disaster Resilience we are working with stakeholders at the global, national and local level to make this happen.

The Global Centre for Disaster Resilience is committed to excellence in research, education and advocacy to improve the resilience of nations and communities to disasters.

With growing population and infrastructures, the world's exposure to hazards is increasing. When disaster strikes, communities may need to be rebuilt physically economically and socially. At the same time, it is vital that any reconstruction activity pro-actively considers how to protect people and their environment, and reduce a community's vulnerability.

At the Global Centre for Disaster Resilience, our vision is for a society that has the capacity to resist or change in order to reduce hazard vulnerability, and to continue functioning physically, economically and socially when subjected to a hazard event.

We seek to achieve our vision by undertaking work that crosses the traditional boundaries between academic disciplines and schools of thought. We provide strategic advice and practical guidance based on rigorous, stakeholder informed research. We are also supported by a worldwide network of partners from policy, government, industry and academia.

For more information about our research, teaching and advocacy, please contact: Professor Dilanthi Amaratunga & Professor Richard Haigh, Global Centre for Disaster Resilience, University of Huddersfield, Queensgate, Huddersfield, HD1 3DH, United Kingdom.

GDRC 2022 annual report can be found here: *http://gdrc.buildresilience.org/gdrc-report-2022/*

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Linked projects

- Built Environment leArning for Climate adaptation (BEACON)
- Science and Human Factor for Resilient Society (CORE)
- Integrating Pandemic, Tsunami and Other Multi-Hazard Preparedness into Early Warning and Urban Planning (COVID – 3 Project)
- Embedding COVID-19 preparedness into local disaster risk reduction (COVID-19 Liaise)
- INCLUsive Disaster Education (INCLUDE)
- 20 Years after: Then and Now - An explorative study of the status of communities relocated in the aftermath of the 2004 Indian Ocean Tsunami in Sri Lanka

Built Environment leArning for Climate adaptatiON

BEACON aims to develop trans-disciplinary and innovative research-based learning in the built environment to tackle climate change in coastal regions

Climate change is one of the greatest environmental threats affecting all countries with almost no exception. Coastal areas are some of the most vulnerable due to, in addition to changes in temperature, precipitation and more frequent flooding, they are highly impacted by sea level rise and tidal waves, which accelerate coastal erosion. As the built environment demonstrates a high fragility and vulnerability to long-term climate impact as well as extreme hazards, strengthening the coastal built environment with an effective level of resilience is vital if they were to withstand predicted climate change impacts. Although there is an urgent need to translate awareness of climate change impacts into tangible adaptation measures, recent studies have shown that there are significant knowledge gaps in relation to both risks and the effective responses within the context of the built environment.

Levels of preparedness of construction and property industries, in terms of having viable and sustainable adaptation plans to tackle climate change, are lagging behind and unsatisfactory. There is an urgent need for further education, an enhanced knowledge base and skills upgrading in climate change adaptation to reach a resilient and sustainable built environment.

In order to address climate change and build resilience to disaster and climate change impacts, a multi-stakeholder, multi-sector and a trans-disciplinary approach is needed.

Project partners:

University of Huddersfield, UK (Lead) *(Dr. Chamindi Malalgoda, Prof. Dilanthi Amaratunga, Prof. Richard Haigh, Ms. Shavindree Nissanka)*

Lund University, Sweden *(Prof. Mo Hamza)*

University of Cantabria, Spain *(Ignacio Aguirre Ayerbe, María Merino González - Pardo)*

University of Malta, Malta *(Prof. Ruben Paul Borg)*

University of Colombo, Sri Lanka *(Dr. Nishara Fernando)*

University of Moratuwa, Sri Lanka *(Dr. Chandana Siriwardana)*

Objectives

- Identify climate change impact on the built environment in coastal regions
- Develop a coherent framework for integrating the requirements of the Paris Agreement with the Sustainable Development Goals (SDGs) and the Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR) in the context of the impact of climate change on the built environment in coastal regions
- Recognise the opportunities for climate adaptation in the coastal built environment in line with the coherent framework
- Understand skills gaps in climate adaptation in the built environment to tackle climate change in coastal regions
- Develop a trans-disciplinary and innovative research-based learning to improve competencies in climate change adaptation in the built environment in coastal regions

Project Outputs

- A review of the climate change impact on the coastal built environment
- A synthesis report on opportunities and constraints for integrating Paris Agreement with the Sustainable Development Goals (SDGs) and the Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR) in the context of built environment in coastal regions
- A comprehensive framework for climate change adaptation in design, construction and retrofitting aligning with SDGs and SFDRR
- Review of the role of the built environment stakeholders in climate change adaptation in the built environment and associated skill gaps and mismatches
- Guidance notes with case studies and good practices on implementing local adaptation strategies in the built environment in coastal regions
- A trans-disciplinary and innovative research-based learning platform in the built environment to tackle climate change in coastal regions and the proposed competency framework
- Development of curricular of the proposed learning platform

Contact:

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CORE

sCience and human factOr for Resilient sociEty

Research Problem

CORE contributes to Horizon 2020's focus on secure societies where citizens are facing increasingly threatening situations. It is built on the activities and results of previous and on-going projects and is driven by end-users within the consortium and their wider stakeholder networks. CORE will develop a harmonized vision of crisis management awareness and overcoming, through a transdisciplinary collaboration involving the environmental science and social science communities. In this way, human factors, social, societal, and organizational aspects can be supported by the scientific results obtained in research on environmental and anthropogenic risks.

How does the research address the problem?

CORE will identify and use best practice and knowledge/learning from certain countries with high levels of risk but where risk awareness is high and will provide optimized actions and solutions to help restructure and rebuild socio-economic structures after a disaster that is essential for the European society. CORE is a multidisciplinary consortium across, and outside Europe established to understand how to define common metrics with respect to the different natural and man-made disaster scenarios, and how to measure, control and mitigate the impact on the populations. Special attention will be given to vulnerable groups: disabled, elderly, poor, as well as women and children. CORE will lead to more efficient policies, governance structures and broad awareness and collaboration among citizens and rescue agencies. Best practices will be identified and reported to policymakers, end-users and disseminated to all stakeholders and NGOs. CORE will devote great attention to education in schools and the training activities are also intended to be an "awareness campaign" for young people about the vulnerability of the weak categories that cannot rely on advanced means of communication and of their importance. The young generation, used to the most advanced technologies, might become a sort of "prevention sentinels".

The overall ambition of the CORE project will be to develop a harmonized vision of DRR, crisis management awareness and capability. There is indeed a need to strengthen disaster resilience at the level of municipalities, Member States and EU agencies, which must consider the diversity of European society, and the variability of human factors.

Who is involved in the research

- University of Salerno, Italy
- Institute for Sustainable Society and Innovation, Italy
- Eidgenössische Technische Hochschule Zürich, Switzerland
- International Institute for Applied Systems Analysis, Austria
- University of Huddersfield, UK
- Hanken School of Economics, Finland
- Saher (Europe) OU, Estonia
- Public Safety Communication Europe Forum, Belgium
- Institut de Science et Ethique, France
- College of Law and Business, Israel
- Mto Safety AB, Sweden
- Sixense Engineering, France
- Euro-Mediterranean Seismological Centre, France
- National Authority for Fire & Rescue, Israel
- Italian National Fire Corp, Italy
- Italian Red Cross- Branch of Vincenza, Italy
- Joint Office for Environmental sustainability, Italy
- University of Applied sciences for public service in Bavaria, Germany
- Austrian Red Cross, Austria

Planned Activities

The overall objective of the CORE will be to develop a harmonized vision of crisis management awareness and capability.

The main outputs of the project are mentioned as below.

1. Comparative analysis of natural and manmade disaster case studies.

The project will analyze specific risk of natural and anthropogenic origin including cascade effects. In particular, the project will analyze different disaster scenarios including:

Earthquake

The inclusion of an earthquake scenario is particularly interesting due to the lack of reliable predictability and earthquakes are a prime example of a low probability but high impact disaster. Preparedness is a crucial point to population resilience.

Tsunami

Tsunamis are low probability events but with very high impact. There has been an increase in the occurrence of tsunamis in the recent past. We have included a case study from Japan, 2011 great Tsunami, from which much can be learned with Japan's high levels of risk awareness and associated early warning mechanisms.

Flash Flood

IPCC defines floods as: "the overflowing of the normal confines of a stream or other body of water or the accumulation of water over areas that are not normally submerged. Floods include river (fluvial) floods, flash floods, urban floods, pluvial floods, sewer floods, coastal floods, and glacial lake outburst floods13".

Terrorist attack

Terrorism can be defined as violent, criminal acts committed by individuals and/or groups who are inspired by, or associated with, designated foreign or domestic terrorist organizations or nations (state-sponsored).

Industrial accident

Industrial accidents may occur when industrial facilities malfunction during standard operation. They can impact the surrounding environment, also affecting the population and facilities.

2. Report with community resilience strategy.

This output will consist of a comparison of plans and procedures associated with past disaster events of different countries (Italy, Germany, Israel, Japan) to understand people response and identify possible protocols pitfalls. An inclusive approach will be used, taking particular care of typical vulnerable categories. Using the previously identified case studies from previous natural and manmade disasters, to conduct a thorough and in-depth analysis to extract lessons learnt from the perspective of community resilience.

To enable an effective response from affected populations to improve functional organisation in most fragile and vulnerable environments, and to increase the resilience of health services, social services, education, and governance, in line with target (d) of the Sendai Framework on critical infrastructure and disruption of basic services, a community resilience strategy will be developed. resilience strategy. Accordingly, a resilience building-up approach will be developed, a disaster will be simulated, and all phases of the disaster cycle will be considered.

3. Safety culture measurement toolkit

This output is aimed at designing and testing, with an in the field survey, a toolkit to measure how positive or negative safety culture is in the selected (CORE) disaster scenarios. The following groups will be investigated: professional rescuers, rescue managers, volunteering rescuer, public institutions indirectly involved in disasters' management and citizens, the latter will be furtherly categorized according to social vulnerability classifications resulting from previous outputs.

The survey toolkit will cover all factors and aspects informing the safety culture and, also involving practitioners indirectly involved in risk awareness and management, will support the understanding of the safety culture and behaviour related to the impact of management and decisions taken by government on sociopsychology of individuals. Once the toolkit is designed, testing activities will be conducted in demo sites, resulting in a survey whose gathered data will be analysed according to the methodology set in the toolkit, providing an insight of differences in safety culture with respect to different disaster scenarios, among the demo sites/regions, among addressed roles and groups, among the vulnerable categories identified by the project.

4. Tools to fight misinformation in social media on earthquakes

The objective of this work package is to develop and validate the methodological framework to deal with various kinds of relevant for disaster risk reduction information on social media also including disinformation, misinformation, fake news, and videos etc. about disaster risk reduction relevant issues in social media. The methodological framework will target public as users and actors and should be developed in a co-creation approach. The methodological framework will be validated by several communities for educational purposes on the problematic of misinformation, requirements on tools to deal with misinformation and readiness to apply these tools for critical evaluation of misinforming content in social media.

5. CORE legacy

The aim of this output is to develop best practice recommendations for policy makers and municipalities to improve risk perception, contingency planning, disaster preparedness and overall community resilience. These recommendations will be defined according to ethical principles considering the different dimensions of application such as societal, economic, cultural, environmental, and political. In addition to dissemination, the aim is to ensure that the legacy of the project is maintained through consolidated contributions to the project's short, medium, and long-term objectives.

The overall ambition of the CORE project will be to develop a harmonized vision of DRR, crisis management awareness and capability. There is indeed a need to strengthen disaster resilience at the level of municipalities, Member States and EU agencies, which must consider the diversity of European society, and the variability of human factors. This can only be achieved through transdisciplinary collaboration involving the environmental science and social science communities. In this way, human factors, social, societal, and organisational aspects can be supported by the scientific results obtained in research on environmental and anthropogenic risks.

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Funded by

European Commission

Horizon 2020
European Union funding for Research & Innovation

20 YEARS AFTER: THEN AND NOW

AN EXPLORATIVE STUDY OF THE STATUS OF COMMUNITIES RELOCATED IN THE AFTERMATH OF THE 2004 INDIAN OCEAN TSUNAMI IN SRI LANKA

BACKGROUND

The 26th of December 2024 marks the 20th anniversary of the Indian Ocean Tsunami, which killed at least 225,000 people across a dozen countries. Many more people were displaced due to the massive damage sustained on buildings and infrastructure, and a need to relocate people away from tsunami prone areas. Since 2004, relocated communities in Sri Lanka have lived their lives in relocation sites and have encountered and coped with many socio-economic, political and psychological challenges. Studies revealed that some have managed to flourish in the new settlements by employing various adaptation and enhancement measures, while some have failed to survive, prompting them to leave the relocation settlements in search of a better life. Nevertheless, longitudinal studies regarding the relocated communities are limited. As a result, there exists a significant gap in our understanding of the status of the relocated and regarding the manner in which their lives have progressed. This 20th anniversary is an important opportunity to delve into the lives of relocated communities and learn from their experiences to inform future relocation policy and practice.

OBJECTIVES

(a) To explore the status of community formation and social cohesion amongst the relocated communities
(b) To understand the status of livelihoods and social infrastructure restoration initiatives
(c) To comprehend the gender related impacts of post-tsunami relocation
(d) To examine the impact exerted by the relocation process on vulnerable groups such as children, disabled and elderly
(e) To ascertain the status of Tsunami Early Warning Mechanisms and preparedness in Sri Lanka
(f) To understand the long-term impacts of post-Indian Ocean Tsunami reconstruction
(g) To comprehend the issues and challenges that have emerged from the relocation process a long time after relocation
(h) To understand the coping and adaptation strategies employed by the relocated communities to overcome the challenges

PROJECT TEAM

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Department of Sociology, University of Colombo, Sri Lanka (Sri Lanka project lead)
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Federation of Sri Lankan Local Government Authorities (FSLGA)
Ms Hemanthi Goonesekera *(hemanthi@fslga.lk)*

Institute of Technology Bandung, Indonesia
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Intergovernmental Oceanographic Commission of UNESCO IOTWMS
Dr Harkunti Rahayu *(harkunti@pl.itb.ac.id)*

STUDY POPULATION

The study aims to collect data from four groups who have been closely involved in the relocation process:

1. Original tsunami settlers
2. Original settlers who moved back to the coast
3. New settlers
4. Host communities

PLANNED OUTPUTS

- 2 high quality journal papers
- 2 presentations at internationally recognized conferences
- Policy brief / position paper
- Dissemination round table with government officials and policy makers, NGO and INGO sector, and relevant UN agencies

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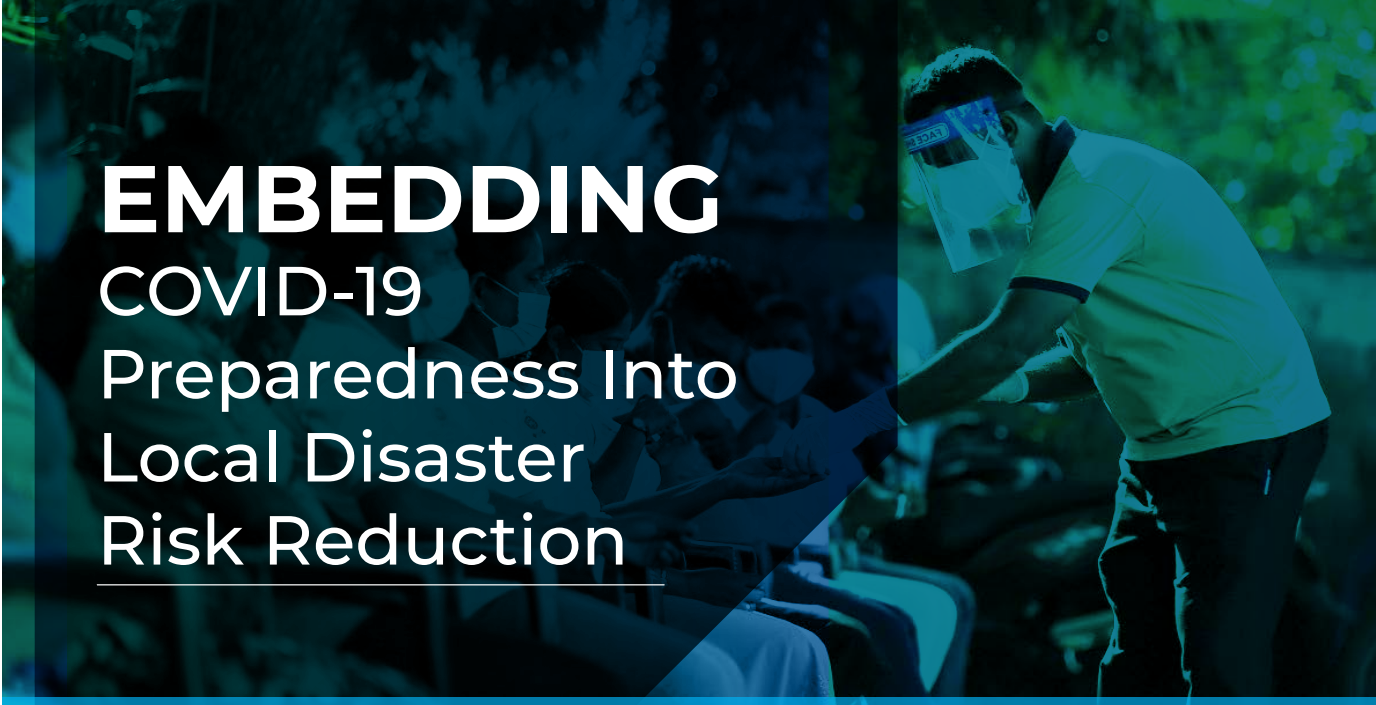

EMBEDDING COVID-19 Preparedness Into Local Disaster Risk Reduction

What is the nature of the research problem?

The ongoing COVID-19 outbreak is an unprecedented event in modern human history. While the World Health Organisation has declared COVID-19 a pandemic, its underlying factors, vulnerabilities and impacts go far beyond the health sector, hitting the world's most vulnerable the hardest, including women, children and youth, older persons, migrant workers, displaced people and refugees, and persons living with disabilities, among others. It is an example of systemic risk: when a hazard leads not only to negative effects in parts of the system but also threatens the failure of the entire system.

The national approach evident in the pandemic response is not sufficient to meet the challenges that lie ahead. It is particularly important to better align prevention and response efforts of health ministries and disaster management authorities, from national to local. COVID-19 has underlined that response mechanisms require a lot of strengthening. Most countries do not have operational experience in handling a combination of natural and biological hazard preparedness planning.

Our project will provide insights on several critical problems that need to be better understood in order to improve epidemic and pandemic preparedness. There needs to be a better understanding on how risk works, especially how risk cascades with unexpected consequences, and how to build capacities to manage this. How can we prepare for early and better recovery, that prevents the emergence of new risk with early and rapid actions from the DRR-relate organisations? Our rationale is that pandemic preparedness has to be holistic and build national to local resilience that integrates public health and disaster risk management.

How will the research problem be addressed?

Risk has become systemic. Our approach cannot be divided into categories that are then assigned to health authorities, disaster management agencies or early warning centres. A better understanding of these issues will lay the foundation for better approaches for epidemic and pandemic preparedness. The specific objectives of our project are to:

1. Explore the extent to which COVID-19 preparedness planning is currently embedded at national level DRR planning as a biological hazard
2. Identify how public health aspects be better integrated into DRR and resilience planning, in combatting the dual challenges of other disasters and COVID-19
3. Identify mechanisms on how public health aspects (including COVID preparedness planning) can be "localised" with other hazards
4. Develop guidelines to consider COVID-19 risks from many angles and work in a collaborative way, linking national to local stakeholders in order to fight systemic risks, which is joined up and cascading

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EMBEDDING COVID-19 Preparedness Into Local Disaster Risk Reduction

What are the planned outputs and outcomes?

1. A state of the art report on the extent to which COVID-19 preparedness planning is currently embedded and integrated at the national level DRR planning as a biological hazard
2. A synthesis report on how can public health aspects be integrated with DRR and resilience planning, in combatting the dual challenges
3. A multi stakeholder transition pathway for integrated and localised public health aspects
4. Policy paper (detailing out the guidelines) on systemic risks with cascading impacts
5. Several jointly authored, peer reviewed journal papers published in high impact SCOPUS indexed journals
6. Minimum two conference presentations.
7. Two training workshops with stakeholders (graduate students and local government units)
8. One capacity development mission

Short-term impacts of our research will increase awareness of the role of the public health system in DRR preparedness planning. A literature review of Covid-19 will give an overview of the position of CoVID-19 preparedness planning in DRR framework in Indonesia. The project directly supports National Disaster Management Agency (BNPB), and the Government of West Sumatra (and its Disaster Management Agency of West Sumatra; Social Office of West Sumatra; Health Office of West Sumatra; Public Works and Spatial Planning Office of West Sumatra. In situations where disaster managers are dealing with crises on multiple fronts, responding to one disaster may exacerbate the impact of another. There need to be redesigning its approach to disseminating early warnings at the community level to ensure physical distancing and greater use of mass communication tools including public address systems and social media. These are some of the long-term impacts that this project will generate.

Who is involved in the research?

The 24-month project will be managed with equal responsibility by scientists from Indonesia and the UK who will ensure that the project delivers its planned outputs and outcomes. The team is led by Professor Dilanthi Amaratunga, Professor Richard Haigh, (University of Huddersfield, UK) and Dr Taufika Ophiyandri (Andalas University, Padang, Indonesia)

The scientists will work closely with relevant government and regional agencies, including the National Disaster Management Agency (BNPB), the Government of West Sumatra and the UNDRR.

The research is supported by the Newton Fund (the UK £735 million fund which, through science and innovation partnerships, promotes the economic development and social welfare of partnering countries, aims to strengthen science and innovation capacity and unlock further funding through which the UK and partner countries will build strong, sustainable and systemic relationships), and RISTEK-BRIN (Ministry of Research Technology – National Research Innovation Agency of Republic of Indonesia).

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This work was supported by Newton Institutional Links grant, grant ID 622261152, under the Newton Fund partnership. The Grant is funded by the UK Department for Business, Energy and Industrial Strategy and RISTEK-BRIN and delivered by the British Council.

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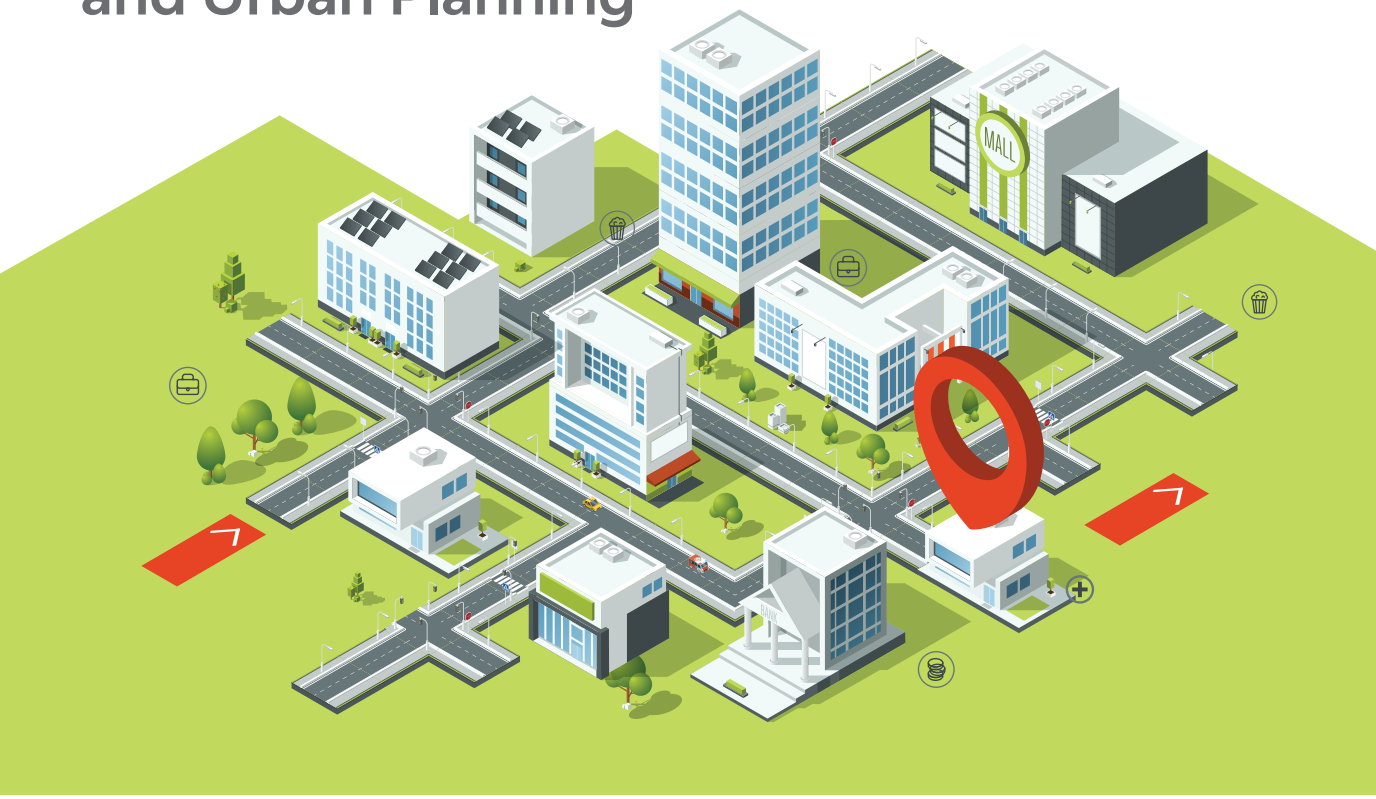
Integrating Pandemic, Tsunami and Other Multi-Hazard Preparedness into Early Warning and Urban Planning



What is the nature of the research problem?

The global spread of COVID-19 has overwhelmed health systems, but also caused widespread social and economic disruption. By putting societies and economies on hold, many countries have curtailed the ability of the virus to spread. These defensive measures have helped to limit the short-term impacts, but also resulted in a shift of priorities, alterations in work processes and venues, physical distancing, self-isolation and quarantine measures, as well as temporary lockdowns. These tend to disproportionately affect disadvantaged groups, including people in poverty and migrants, who most often live in overcrowded and under resourced settings, and depend on daily labour for subsistence.

These COVID-19 measures have also exposed gaps in many countries' disaster risk reduction strategies, which often fail to address pandemics despite them being an explicit goal of the Sendai Framework for Disaster Risk Reduction 2015-30 (SFDRR), the global agreement to reduce and prevent disaster risks. This type of threat does not respect administrative boundaries and exposes the interconnectedness of economic and social activity. What has been the disruption to different sectors of the economy? How can different sectors of the economy be better prepared for future pandemic threats? What are the implications for planning urban spaces? How can urban spaces be better developed to help society cope with the "new normal"? What are the implications of these changes for disaster risk reduction?

How will the research problem be addressed?

This project will address two specific challenges: 1) the integration of COVID-19, pandemic and biological hazard preparedness as part of multi-hazard early warning; and, 2) mainstreaming tsunami, biological and multi-hazard preparedness into urban planning for coastal regions.

We will address these challenges through the following four objectives:

1. Understand the current status and best practices of COVID / biological hazard preparedness as part of tsunami and multi-hazard early warning in coastal areas of the Indian Ocean region.
2. Explore ways to mainstream tsunami, biological and multi-hazard preparedness into urban planning for tsunami prone areas.
3. Examine the economic impacts of COVID-19 across different parts of the economy and explore ways to enhance economic preparedness and mitigate impacts.
4. Develop a vision on disaster risk reduction in future urban spaces.

What are the planned outputs and outcomes?

This project will target the nineteen of twenty-eight Indian Ocean countries that are part of the IOC UNESCO IOTWMS (Indian Ocean Tsunami Warning and Mitigation System) and are categorised as Least Developed (8), Lower Middle (5) or Upper Middle Income (6) countries on the Development Assistance Committee list. Several outputs will also specifically target national and local actors in Sri Lanka and Indonesia. Collectively, the project will provide insights into how the current COVID-19 pandemic has challenged emergency arrangements within Indian Ocean countries, but also explore some of the challenges and opportunities for how countries must evolve and adapt to the 'new normal'. Key outputs include:

- A capacity survey of the current status and best practices of COVID / biological hazard preparedness as part of tsunami and multi-hazard early warning in coastal areas of the Indian Ocean region
- A report of national and local practices for preparedness planning associated with integrated, systemic risks (natural and biological hazards) and actions during the COVID-19 pandemic
- Regional guidelines on how to mainstream tsunami, biological and multi-hazard preparedness into urban planning for tsunami prone areas, to be published through Working Group 1 of the IOC UNESCO IOTWMS, providing reach to all member states in the Indian Ocean region
- A policy brief that will inform a planned government White Paper by the State Ministry of Urban Development, Sri Lanka on mainstreaming disaster risk reduction in costal urban cities
- A position paper on economic preparedness in Sri Lanka, published jointly with the Chamber of Commerce, Sri Lanka
- A vision paper will explore the preferred future and benefits of the future for disaster risk in urban spaces, but also show the dependencies between different factors that shape the future, to be published jointly with the State Ministry of Urban Development in Sri Lanka
- Contributions to theory will be published through four jointly authored journal papers

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The Ceylon Chamber of Commerce, Sri Lanka

Bandung Institute of Technology, Indonesia

adpc
The Asian Disaster Preparedness Centre, Thailand

Green Building Council of Sri Lanka

United Nations Educational, Scientific and Cultural Organization
Intergovernmental Oceanographic Commission
Intergovernmental Oceanographic Commission of UNESCO IOTWMS (Indian Ocean Tsunami Early Warning and Mitigation system)

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Integrating Pandemic, Tsunami and Other Multi-Hazard Preparedness into Early Warning and Urban Planning

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INCLUsive Disaster Education

The COVID-19 pandemic, which is a type of biological disaster, defines the global health crisis of our time and has been described as the greatest challenge for the world since World War II. Adding to this, people across the world are also increasingly exposed to a wide range of natural hazards, the effects of which destroy development efforts.

Due to the complexities involved in tackling disaster risk, there has been increasing recognition of the need to embrace lifelong learning. This has been identified as a way of ensuring the continuous education of the various stakeholders who are responsible for managing disaster risk. In an effort to support lifelong learning, a number of online and distance learning opportunities have emerged in the field of DRR (Disaster Risk Reduction).

Despite some countries launching remote DRR education activities, they have faced a range of challenges and these have been magnified by the COVID-19 pandemic outbreak. The rise of remote teaching and the use of digital platforms has presented challenges to inclusivity and social equity, with a digital divide lowering the academic outcomes of low-income, underserved students and areas. Engagement outside the classroom has also become a challenge and this is a particular concern for practical fields such as DRR.

The complexity of these challenges limits our ability to apply generic solutions for DRR education and there is a need for it to be contextualized. Effective teaching and learning strategies are important to increase the effectiveness of DRR activities and increase the inclusivity of disaster education.

INCLUDE aims to reimagine online distance learning education so that it better supports the diverse DRR community.

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include

The planned objectives of INCLUDE:

- Understand online, distance learning strategies currently used in DRR education and their effectiveness, by taking into consideration gender equality and sensitivity, and also in addressing differences in relation to the access and use by underrepresented groups
- Develop a framework to reimagine online distance learning education so that it better supports the diverse DRR community, also in addressing both natural and biological hazards and their integration
- Design an innovative University-Industry digital learning platform to provide high quality, inclusive digital education to the DRR community
- Explore the opportunities for the use of disruptive technologies in online distance learning education in DRR
- Propose a digital competence framework for educators in building capacity to implement online and distance teaching and learning in DRR

Project outputs

- A survey of online, distance learning strategies used in DRR education and their effectiveness to identify their success factors and associated issues and problems
- A framework to reimagine online distance learning education that can support the diverse DRR community
- An inclusive University-Industry digital learning platform to provide high quality inclusive digital education to DRR community
- Case studies with the use of disruptive technologies for disaster risk reduction
- Online research repository with open educational resources
- Digital competence framework for DRR educators to develop digital pedagogical competences

Project partners:

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Book of Abstracts

Theme 1:

Business continuity, policy and governance

An Integrated Climate and Disaster Risk-sensitive Business Continuity Framework for Handloom MSMEs in the Eastern Province of Sri Lanka

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Abstract

The importance of climate and disaster risk integrated business continuity processes for Micro, Small and Medium Enterprises (MSMEs) has been realized as a result of long period lockdowns due to COVID19 pandemic in 2020 and the economic crisis since 2022 in Sri Lanka. An exploratory study was carried out in seven steps with multi-stakeholders for evaluating the level of climate and disaster risk integration in the handloom MSMEs, the availability of disaster risk-sensitive business continuity plans, and the impact on the handloom MSMEs in the absence of such risk-sensitive approaches. This assessment included a distinct case study and cross-case analysis of five handloom MSMEs and eight focus group discussions with selected handloom entrepreneurs at different scales, key supply chain actors such as yarn suppliers, and key state departments such as department of industries, divisional/district secretariates, and district disaster management centres. A risk matrix was formulated using a risk score [= *f (Likelihood of the hazard x Impact)*] and the ranking of the identified climate and disaster risks.

The top ranked disaster and climate change risks for the handloom MSMEs in this context are flood, heavy wind/cyclone, heat wave, and tsunami. A number of key risk management strategies for the handloom MSMEs were identified from this study along with the details of required support and resources. The key findings for integrating disaster risks and climate change measures in the development of a risk-sensitive MSMEs were categorised in three risk management strategies: Risk Prevention, Risk Mitigation, and Risk Transfer. Further, a Business Contingency Plan that include activities to prepare in the event of disasters and a Business Recovery Plan that include activities to recover better quickly from the impact of disasters on the handloom MSMEs were incorporated in the risk-sensitive business continuity framework. An integrated climate and disaster risk-sensitive business continuity framework for handloom based MSMEs in the eastern province of Sri Lanka is presented in this paper incorporating key lessons from the COVID19 pandemic and economic crises. Further research is needed to critically analyse policy response to strengthen sustainability and innovation performance of the handloom MSME sector in Sri Lanka.

Key words: ***Climate Change, Disaster Risk, Risk-sensitive, SME, Sri Lanka***

Evaluation of Consumer's Green Behaviour towards Sustainable Consumption and Understanding the Influence of Pandemic/Crisis Situations on Green Behaviour

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Abstract

Evaluating and understanding the complex array of factors that influence consumer decision-making in the realm of sustainable practices will play a crucial role in fostering a more eco-conscious society. The study developed the Green Consumer Behaviour Index (GCBI) to provide regular quantitative measures of consumer behaviour and to promote sustainable consumption by increasing consumer awareness by providing individual reference points for comparing their own consumption patterns. Furthermore, the study evaluates the individual behavioural changes in response to the context of pandemics, crisis including economic and political situations. The GCBI was developed considering food and water consumption, purchasing behaviour, energy and transport, and household waste management with five individual performance evaluation levels. A semi-structured questionnaire was used to evaluate the 131 participants' (between 16 to 60 years old) GCBI index following the purposive sampling technique. The evaluation results showed that 42.5% participants' GCBI value was recorded under the unsatisfied category due to their fewer green practices on those evaluated categories, while 8% of the participants showed outstanding scale performance. For the other three levels in GCBI, very satisfied, satisfied, and poor levels represented by 16%, 20.5% and 13% of the total participants respectively. Pandemic condition is highly influenced on food consumption 53.4%, purchasing behaviour 50.4% and transport 49.6%. Since the current context of Sri Lanka is facing a political and economic crisis, food consumption, purchasing behaviour and transport are highly influenced due to economic crisis as 56.5%, 57.3% and 54.2% respectively. Furthermore, the political crisis is highly influenced on same categories as food consumption 52.7%, purchasing behaviour 55% and transport 45.8%. When considering the water and energy consumption, waste management, housing and fashion influence due to pandemics and crisis conditions, the results vary from no influence (0) to highly influenced (4) without exceeding 30% in each scale (in 5 point Likert scale). The developed index and the findings of the research will assist consumers, producers, policymakers, and academics in facilitating or encouraging sustainable consumption. Identifying behavioural changes during pandemics and crises is important for promoting sustainable consumption, reducing environmental impact, and creating opportunities for businesses and policymakers to develop effective strategies.

Key words: ***Green Marketing, Waste Management, Green Index, Energy Management, Food Consumption***

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Need for People Centered Policy Guidelines for Sustainable Relocation of People Displaced due to Climate Change: Case of Sri Lanka

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Abstract

Communities around the world have already begun to experience the impacts of climate change, including increased mean temperatures, sea level rise, and more extreme and damaging weather events (IPCC, 2022). These changes are impacting the habitability of places and the ability to sustain livelihoods, consequently resulting in people becoming more likely to move (migrate or relocate) to protect their lives and to improve their living conditions. For instance, the Global Report on Internal Displacement 2023 revealed that approximately 33 million people worldwide have been internally displaced. Families displaced due to climate change are unable to return to their previous homelands and must seek shelter elsewhere. Recent studies on displacement and relocation indicate that most relocation efforts (particularly in developing countries) have failed due to a combination of reasons (Fernando & Jayasinghe, 2023; Senanayake et al., 2022; Tengku & Wardani, 2023; Fernando et al., 2019; McNamara et al., 2018; Baudoin et al., 2016; Fernando, 2016; Fernando & Punchihewa, 2013; Fernando, 2010) including non-existence of appropriate and adequate policies, lack of funds to completely implement policies, failure to adopt community-centered relocation policy guidelines, lack of necessary capacities and skills of planners and implementers, failure to consider relocation as a process (Samaraweera, 2023; Sheik & Arakal, 2022; Price, 2020). Relocation can be identified as an essential climate change adaptation strategy on one hand and a disaster risk reduction strategy, on the other. It is against the above background that this presentation proposes people centered policy guidelines when relocating people displaced due to climate change by considering four stages of relocation process (before, soon after, sometime after and longtime after) using both secondary and primary data (interviews conducted with government, non-government officers and researchers). These guidelines can be adhered to minimize relocation failures in Sri Lanka.

Key words: ***Climate Change, Disaster Risk Reduction, Displacement, Relocation Failures, People Centred Policies***

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Locating Disaster Justice within the Sendai Framework for Disaster Risk Reduction: Towards Inclusive and Equitable Disaster Risk Governance

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Abstract

Disasters in the contemporary world are frequent phenomena that alter the living fabrics of people. The Sendai Framework for Disaster Risk Reduction recognizes various societal and environmental aspects such as climate change, results of inequality and unplanned rapid urbanisation as vital disaster risk drives. The 'disaster justice' concept is an evolving concept which considers how disasters enhance already existing vulnerabilities in a society and claim solid governing structures to manage these impacts. Disaster justice has further been perceived to overlap with other related types of justice known as social justice, climate justice and environmental justice (Douglass & Miller, 2018). On the other hand, the Sendai Framework for Disaster Risk Reduction emphasises the importance of disaster risk governance as one of its four core priorities. In this context, this study holds the objective of investigating the elements of Disaster Risk Governance that compliment disaster justice in the context of the Sendai Framework for Disaster Risk Reduction. This is a secondary data-based study that was conducted in two stages. First, a literature review was conducted to investigate the elements of disaster justice. Next, a desk review was conducted in order to map the coherence between the Sendai Framework for Disaster Risk Reduction and the elements of disaster justice. The main elements of disaster justice were recognised as accountability in resource distribution, representation of different voices, and recognition of different knowledge forms as per the framework presented by Shreshta et al. (2019). The findings conclude that coherence between the Sendai Framework for Disaster Risk Reduction and disaster justice lies in the several recognised thematic orientations that advocate the need for inclusive and equitable Disaster Risk Governance. The eradication of poverty, a people centred approach, climate change, regional cooperation, stakeholders, overall engagement of vulnerable groups and sectors, laws and regulations, and finance and technology are the said main thematic orientations that link the Sendai Framework for Disaster Risk Reduction and disaster justice. The research further emphasises the need for development of a framework to enhance disaster justice in the sphere of disaster risk governance.

Key words: ***Disaster Justice, Disaster Risk Governance, Disaster Risk Reduction, Sendai Framework for Disaster Risk Reduction***

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Framework for Developing Climate Adaptation Options for Listed Companies Operating in the Tea Industry of Sri Lanka

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Abstract

Companies operating in climate-sensitive industries, such as agriculture, play a crucial role in adapting to climate change due to their resources and technical capacity, which sets them apart from small-scale businesses. The United Nations 2030 Agenda also highlights the importance of companies assuming a proactive role in climate action through SDG 13. However, many companies tend to have a reactive approach to climate change, driven by short-termism and a low tolerance for uncertainty. Climate risks are often treated as a residual issue in the corporate risk management process, with limited proactive engagement from management. Nevertheless, companies must inevitably confront the consequences of climate change and develop strategies to cope with them. In managing company operations, corporate management faces the challenge of balancing the demands of multiple stakeholders while also adapting to the dynamic PESTEL environment, often losing sight of the long-term implications of climate change. This is particularly relevant in countries like Sri Lanka, currently struggling with an economic crisis. However, there is a lack of studies examining corporate engagement with climate adaptation in Sri Lanka. Therefore, research is necessary to facilitate proactive climate change adaptation within companies operating in Sri Lanka, especially in the climate-sensitive agricultural sector. Among the agricultural industries, the tea industry holds particular significance for Sri Lanka as it is the sole provider of 'Ceylon tea' and ranks as the third highest-valued tea exporter in the global tea supply. Currently, climate change remains an unresolved sustainability issue for Sri Lanka's tea industry. Hence, this study suggests the need for establishing a framework for the development of adaptation options tailored to listed companies operating in the tea industry; an economically vital sector for Sri Lanka that is highly vulnerable to climate change.

Keywords: ***Corporate Climate Change Adaptation, Sri Lanka, Strategic Management, Tea Industry***

Theme 2:

Climate change adaptation for coastal ecosystems and flood management

Integrating LEED Neighbourhood Development to Sri Lankan Coastal Cities as a Strategical Approach to Tsunami Risk Reduction

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Abstract

With contemporary city planning policies and development strategies, natural hazard events have become a significant concern due to their severity and the likelihood of occurrence. Most specifically, in the coastal regions, sea-level rises, floods and storm surges have threatened several communities, assets, and infrastructure with a tendency to increase the global trends of climate change and the vulnerability of the Anthropocene. This has emerged as the necessity of disaster resilience in coastal cities, aligned with sustainable city planning policies and frameworks. Consequently, this study focuses on integrating Leadership in Energy and Environmental Design (LEED) Neighbourhood Development with principles of smart growth, urbanism, and green building in Sri Lankan coastal cities at risk of tsunamis. The study reveals the inherent overlays between local tsunami-resilient design principles and LEED Neighbourhood Development. Further, synergetic opportunities with potential improvements and design recommendations discuss better integrating tsunami-resilient design into the LEED Neighbourhood development criteria.

Keywords: ***LEED, Neighbourhood Development, Tsunami, Coastal Cities, Sri Lanka***

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Investigating Severe Coastal Erosion of the South Eastern Coast of Sri Lanka

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Abstract

Sri Lanka has a coastline of 1,620 km, with abundant natural resources supporting millions of livelihoods. Lagoons, rivers, bays, sand dunes, mangroves, estuaries, rocky shores, saltmarshes, tidal flats, beaches, spits, estuaries, coral reefs and seagrasses are important habitats found along Sri Lanka's coastline (Ratnayake and Perera, 2022). The conserving and managing coastal zone of Sri Lanka is one of a key target to achieve the sustainable development of the country (Balasuriya, 2018). The study focuses on the coastal belt from Oluvil to Panama area which consists of treasure of flora and fauna, heavy minerals, sands, creatures, and sites with special significance. Since the beach erosion and sedimentation is a natural cyclic process, marine infrastructure development poses serious threats to the coastal process, biodiversity and to the environment. Several acres of the beach and coconut cultivation have so far been lost in the Oluvil area due to the severe beach erosion and the beaches of Komari have receded at least 30 feet from the shoreline. Further, Arugam Bay is famous for its surfing beaches with six well-known spots as well as more than 12 surfing waves within a 50 km stretch. Unfortunately, out of those 12 waves, only two are functioning and the reasons for which should be detected with the long-term monitoring of the coastal processes. Fishing boats and equipment belonging to fishermen have been damaged, paralysing the fishing industry in the area. Fishing industry is also vulnerable due to the sea water intrusion. With the application of Geoinformatics technology, wind and wave data, beach shift and the morphological changes of the beach can be detected in order to conserve the beach and coastal tourism process in the study area.

Keywords: ***Sustainable Development, Coastal Belt, Biodiversity, Arugam Bay, Geoinformatics***

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Geoinformatics-based Approach to Detect Beach Loss in the Arugam Bay, Pottuvil Area, Sri Lanka

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Abstract

Coastal morphodynamics and shift of the beach relative to the seasonal winds can be observed in the Arugam Bay beach in Pottuvil area, famous for coastal tourism and surfing which significantly supports to the regional and national economy of Sri Lanka. Therefore, this study targets to find out the influencing factors for the beach dynamic in the study area. For this study, Landsat satellite images from 2003, 2013 and 2023 will be downloaded from the earth explorer website and analysed with the view to find out the spatio-temporal changes of the beach and the bay (Arugam Bay). Google earth pro images will also be used to compare the changes since they provide high resolution imageries and the Remote Sensing (RS) and Geographic Information System (GIS) technology are to be used for the data processing with the aid of DSAS. The downloaded Landsat images will be preprocessed having removed the radiometric and geometric errors then, the base map will be created using the 2003 image on which 2013 and 2023 changes will be compared and shift will be detected. Based on the result of the study, the paper would suggest the factors influencing for the coastal morphological changes, shift of the beach and bay which will be considered for the integrated coastal zone management to conserve the beach and to enhance the coastal tourism in order to promote the livelihood and socio-economic condition of the community and the nation as a whole.

Keywords: ***Coastal, Seasonal Wind, Arugam Bay, RS, GIS, Beach Loss***

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Spatiotemporal Rainfall Data Analysis Using GIS

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Abstract

Geographical information systems (GIS) play a major role in analysing and visualizing spatiotemporal meteorological data effectively. The aim of the study is to analyse and visualize the daily rainfall data from 1997 to 2022 using GIS. The rainfall data were collected from the meteorological department in Colombo, Sri Lanka. Rainfall point data e interpolated and derived the spatial annual rainfall distribution map for Sri Lanka. The annual rainfall district polygon map was derived. Batticaloa, Jaffna, Kilinochchi, Matale, Mullaitivu and Trincomalee showed more than 50 % of the coefficient of variance with the last 26 years of rainfall data. To find the rainfall trend for Sri Lanka and each district, Mann Kendall non-parametric statistical test was performed. For the whole Sri Lanka, it shows a positive trend of rainfall, and the Hambanthota district shows a negative trend of rainfall for the last 26 years. When considering the main climatic zones in Sri Lanka, the wet zone shows a 25.38 mm/year increment of rainfall, the dry zone shows a 14.45 mm/year increment, the intermediate zone 17.48 mm/year increment and for arid zone 5.2 mm/year decrement according to the Sen's slope. Rainfall trend maps were derived for climatic zones in Sri Lanka. It is important to analyse rainfall data and disseminate them to responsible parties to make necessary steps to build capacity of the vulnerable people, especially in natural disasters like floods, droughts, and landslides. Agriculture, tourism, and fisheries sectors are also the most vulnerable sectors to changing patterns of rainfall. Hence, frequent studies of rainfall spatiotemporal analysis are important to reduce the vulnerability of such events in the country.

Keywords: ***Daily Rainfall, Trend Analysis, GIS, Mann Kendall, Sen's Slope***

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Flood Hazard Assessment in Major River Basins in Sri Lanka Under the Impact of Climate Change

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Abstract

Climate change is increasingly recognized as a significant underlying driver of disaster risk, with its profound impacts being felt worldwide. The frequency of occurrence and severity of floods around the world has increased to unprecedented levels due to changing weather patterns induced by climate change which is largely driven by anthropogenic activities (Rai et al., 2017). This abstract examines the case of Sri Lanka, an island nation vulnerable to various climate-related hazards, and explores the critical role of tackling climate change as an underlying disaster risk driver basically focusing on flood hazard. The approach demands a holistic and multi-sectoral approach, integrating climate change adaptation, disaster risk reduction, and sustainable development efforts. A pilot study was undertaken especially targeting low-lying areas located near the coastal regions of Kalu, Kelani, and Maha River basins which have evidence of experiencing frequent floods during extreme rainfall events during the southwest monsoon season (May to September). In this study, historical rainfall data were obtained from the Irrigation Department and the Department of Meteorology for the period from 1985 to 2020. The International Centre for Theoretical Physics (ICTP) Regional Climate Model version 4.7 (RegCM4-7) was selected from CORDEX (Dissanayaka & Rajapakse, 2019), and the data were downloaded for three scenarios: Historical, Representative Concentration Pathway 2.6 (RCP 2.6), and RCP 8.5. Elevation, slope, Topographic Wetness Index (TWI), Normalized Difference Vegetation Index (NDVI), distance from roads, distance from rivers, and drainage intensity were used as hazard indices to produce a flood hazard map of the catchment (Gacu et al., 2022) by adopting an integrated Geographic Information System (GIS) and Analytical Hierarchical Process (AHP)-based approach. The analysis revealed that regions with higher elevations experienced even more intense rainfall events in relation to the 50-year return period leading to worsening of flooding with meaningful insights into flood hazard . This can be combined with demographic data to assess the level of vulnerability (Hazarika et al., 2018) to identify flood risk and by aligning its efforts with the Sendai Framework, climate change can be effectively tackle as an underlying disaster risk driver to build a sustainable and resilient future.

Keywords: ***Climate Change, Disaster Risk Driver, Disaster Risk Reduction, Flood Vulnerability***

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Community Participation in Flood Early Warning – What Can It Do?

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Abstract

Community participation is emphasised as a key part of effective natural hazard early warning. Community participation is suggested to have benefits such as improved response and enhanced communication and dissemination of the warning (Baudoin et al., 2016; Marcherera & Chimbari, 2016; Twigg, 2003). Previous research has examined how early warning systems can be designed to be more participatory, but there has been limited research examining the outcomes of participation in practice, and how such outcomes are produced. This understanding is needed if effective participatory approaches are to be harnessed.

This study seeks to develop a theoretical framework that will detail the causal mechanisms that link community participation in early warning with its outcomes. As part of this, the study will contribute a greater understanding of what community participation in early warning is and what it involves, what the outcomes of participation in early warning are, and the enablers and barriers of the process.

Within a critical realist frame, the study will apply qualitative methods including semi-structured expert interviews, and a series of case studies of local-level community participation to explore the outcomes and causal mechanisms at play. Data will be drawn from the United Kingdom and Sri Lanka to examine the role of context.

Initial results from a systematic literature review and UK expert interviews revealed that participation in early warning commonly takes place via volunteer groups. In the UK, participation contributed to the supply of additional localised and real-time information, the dissemination of warnings and flood risk information, and enhanced wellbeing and social connections. Relationships and communication networks within the community and with authorities were found to be key enablers.

With climate change likely to bring more severe flooding to the UK and other locations globally, it is imperative that flood warning is effective at all scales, including the local level. Through the examination of existing practices, and what outcomes have been achieved and how, this study will support the development of a deeper understanding of community participation in early warning and how it might be used to strengthen early warning at the local level.

Key words: ***Community-based, Disaster Risk Reduction, Early Warning System, Local Level***

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Strategies for Urban Planning in Tsunami Prone Areas in Sri Lanka

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Abstract

Extreme natural hazards such as sea level rise, coastal storms, and heavy rains frequently affect coastal cities. Tsunami, despite being a low-frequency hazard, remains the most damaging disaster faced by coastal communities due to its unpredictable nature and the high impact caused by a single hit. The 2004 Indian Ocean Tsunami (IOT) affected 15 countries, causing them to revise their urban planning frameworks to be more inclusive of tsunami preparedness. Sri Lanka, an island devastated by the 2004 IOT, was undeniably compelled to rebuild better from the lessons learned, with records of around 35,399 fatalities, 114,069 damaged or destroyed houses, and 480,000 human displacements. Furthermore, the Tsunami is responsible for the greatest percentage (nearly 0.2% of its population) of fatalities and economic damage in Sri Lanka's recent history. Nonetheless, Sri Lanka's urban planning guidelines lack the necessary preparedness measures for Tsunami-prone cities which emphasises the importance of sustainable and resilient urban planning. This study synthesises and evaluates the current level of integration of Tsunami preparedness strategies in Sri Lankan urban planning frameworks and related policies. A comprehensive review of urban planning policy frameworks and guidelines in Sri Lanka was conducted, and the inclusion of Tsunami preparedness measures within a set of predefined parameters was investigated. A critical analysis was then carried out, which involved comparing existing local strategies with globally practised guidelines in the same categories, allowing the gaps in Sri Lankan coastal city planning to be identified. The findings highlight shortcomings in existing strategies in the country, such as their failure to address multi-hazard threats and systemic risk, as well as insufficient community participation and limited access to timely disaster risk information. The findings are being used to inform an initial model of urban planning strategies in tsunami-prone areas that can be used before a hazard event occurs, during and immediately following a hazard event, and during disaster recovery and reconstruction in Sri Lanka.

Key words: ***Coastal Cities, Sri Lanka, Sustainable Urban Planning, Tsunami***

Theme 3:

Climate change action for resilience in agricultural and food systems

Nature Based Solutions for Building Resilient Food Systems in Sri Lanka

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Abstract

Local food systems are increasingly challenged to meet growing demand for staple as well as essential crops due to the effects of recent economic crisis fuelled by COVID-19 pandemic along with climate change and growing competition for resources. Evidences highlighted that urban and peri urban dwellers are more vulnerable compared to rural. Agricultural landscapes are diverse geographically and compositions are compatible with the agro-ecology of the locations. In general, household are strengthening with any kind of home garden which is tagged as Kandyan forest garden, home garden, backyard or mixed garden. Present study aimed to investigate the structure, functions, operation of typical home garden system of Sri Lanka and find out the nature-based solutions of home gardens for building resilient food systems in different agroecological zones. Case studies were conducted in 10 districts (Kilinochchi, Vavuniya, Anuradhapura, Kandy, Badulla, Rathnapura, Ampara, Monaragala, Hambantota and Galle) of Sri Lanka. Participatory appraisal tools were used to understand the systems and storytelling and in-depth interviews with key informants were utilized to explore the interventions of nature base solutions in building resilient food systems. Results revealed that rural food systems were remarkably resilient, through its own home garden-based supplies. Food basket composition along with species diversity varied across the districts and developed the typology of home gardens based on structure, composition, economic, social and environmental contribution. Household food security, meal diversification, income generation through saving from food bills, fire wood, medicine, etc. and sale of excess harvest, strengthen community bonds through sharing the harvest, seeds and plating materials, etc. preserving nature and safeguarding the agro-ecology were key strategic interventions in building resilient food systems. Traditional knowledge and knowhow enriched the application of nature base solutions into rural food systems where gender inclusiveness play a significant role in bridging the generations.

Key words: ***Food System, Home Gardens, Nature-based Solutions, Sri Lanka***

Food System Vulnerability to Climate Change: A Sri Lankan Perspective

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Abstract

Climate change is a key drivers of food system outcomes including food security, social welfare, and environmental capital. This research aimed to identify vulnerabilities in the food system, understand factors contributing to vulnerabilities and propose feasible adaptation options to build food system resilience to climate change. This research focused on three major food supply chains in the country: rice, upcountry and low-country vegetables.

This study adopted a mixed-method approach which included case studies, focus group discussions, key informant interviews, a web-based search of climate change impact-related media coverage over six years, and secondary data compilation.

The analysis revealed that drought was the major climate hazard impacting the rice-producing districts of Ampara, Anuradhapura and Polonnaruwa. There is a clear relationship between the intensity of the climate hazard and paddy production in these districts. Climate change has threatened the operations of small- and medium-scale rice mills as a short supply of paddy makes these mills redundant. The case studies in the Anuradhapura and Ampara districts supported these findings.

In the case of up-country vegetables, the main supply districts Nuwara Eliya and Badulla are susceptible to climate hazards such as wind, landslides, and heavy rains while the major low-country vegetable-producing district, Anuradhapura is affected by droughts. Upstream vegetable supply chains in Nuwara Eliya and Badulla districts are highly vulnerable due to wind events seriously affecting vegetable production and post-harvest handling. The case study conducted with upcountry vegetable farmers and supply chain actors confirmed these findings. Overall, climate change adaptation measures remain insufficient along the studied supply chains.

The study points to a clear link between climate hazards and crop production and supply chains implying the need to intensify climate change adaptation efforts. The poor availability of data related to food supplies and distribution is a serious limitation in identifying vulnerabilities in the food system and making recommendations to build a resilient food system.

Key words: ***Climate Change, Food Security, Food System, Supply Chain Vulnerabilities***

Linking Forest Based Food, Enterprises and Livelihood: A Case of Kithul (*Caryota urens*) Value Chain, Sri Lanka

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Abstract

Kithul industry is considered a nature-based enterprise based on *Cayota urens* palm that grows in tropical rain forests and in home gardens, especially in the wet zone, employing thousands and securing their livelihoods. This forest-based healthy food enterprise supplies treacle, jaggery, flour and vinegar and is a good source of toddy; an alcoholic beverage that is produced and consumed locally. The study eyed on exploring the value chain of forest-based enterprise, and its socio-economic contribution, status of climate resilience, and adaptation. The study relied on both quantitative and qualitative data which were collected from Rathnapura, Kandy, Badulla, Nuwara Eliya, Galle and Matara districts which were recorded as flood prone areas and famous for Kithul based productions by using interviewer administrated questionnaires and in depth-interviews. The results revealed the availability of two types of value chains; informal chains that ended up in producer regions, limited value addition and catered the need of local consumers. The formal lengthier chains were organized, catering to the needs of urban markets as well as overseas markets with proper quality standards, brands and packaging. Typically, the value chain consisted with input supplier, tree owner, tapper, collector, processor, trader, exporter and consumer. Health concern segment of both high-end local market and ethnic market places demand on healthy Kithul products made in rural villages. The primary producers used traditional knowledge and technology throughout the process. Villagers used naturally grown Kithul trees of forest areas, buffer zones or home gardens for the tapping. Production is mainly home-based using woods and coconut shells as energy sources. This wild collected sap, creating an income source, household wellbeing, along with social upgrading for the rural livelihood by providing harvest for 270 days per year and the total syrup from an average palm in its flowering recorded as 280L. At the average price of 200 LKR, the gross value per Kithul palm would be 56,000LKR. Even though these areas are more susceptible for climate change, Kithul palm has a higher potential in climate resilience due to its root system which is effective in preventing soil erosion whilst increasing water retention capacities. Further its canopy can slow down the intensity of rain as it falls to the ground thus, preventing soil erosion. Promoting Kithul palm as a plantation in flood and landslide prone areas could be a nature-based solution to specially in mitigating the damage caused by floods while ensuing economic security to rural community.

Key words: ***Forest Food and Beverages, Food Security, Rural Livelihood, Kithul Value Chain, Sri Lanka***

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Developing a Self-Reliant Green Cabin as a Disaster Resilience Mechanism to Extend the Post-harvest Life of Vegetables

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Abstract

Climate changes greatly impact postharvest life of fruits and vegetables particularly leafy vegetables as a result of environmental vulnerabilities such as fluctuation of RH and temperature. Hence, those commodities should be stored at low temperatures and high RH (≈95%) after harvesting. As a climate resilience technique, a Self-Reliant Green Cabin (SRGC) with cooling and humidifying facility was fabricated to keep hydroponically grown plants while providing light for photosynthesis and controlling temperature and RH to minimize respiration and evapotranspiration. SRGC is composed with three compartments (1st, 2nd, and 3rd from bottom to top) where 1st compartment was bult for cooling and humidifying, 2nd compartment equipped with Light-emitting diode (LED) for storing vegetables, and 3rd compartment for creating natural air currents through the cabin. The cooling with humidifying was achieved with evaporative cooling coupled with fans and this mechanism capable to lower the temperature and elevate RH to ≈ 22-23^{0}C and RH ≈ 90-95% respectively in 2nd chamber. Four leafy vegetables (*Alternanthera sessilis, Ipomoea aquatica, Centella asiatica,* and *Hygrophila auriculata*) were subjected to this study using the SRGC. According to dry matter loss %, lightness (L* value), and yellowness (b* value) of hydroponically grown selected leafy vegetables stored in SRGC under different spectral compositions [6 hrs LED illumination with high-intensity white, low-intensity white, red-blue (RB) compared to continuous darkness], RB LED illumination was suitable light spectra for all four leafy vegetables. The best-selected RB LED light intensity for *A. sessilis, I. aquatica*, and *H. auriculata* was 60±5 lux, whereas 50±5 lux for *C. asiatica*. According to the air sample analysis, no ethylene accumulation occurred in the 2nd compartment of the SRGC when it was loaded with the hydroponically grown selected plant samples. In conclusion, the developed SRGC with RB LED illumination was proficient to maintain self-reliant condition for selected leafy vegetables by extending the post-harvest life by 5-6 days. Hence, this SRGC can be introduced as a disaster resilience mechanism to minimize post-harvest losses of leafy vegetables as well as they can cultivate in non-vulnerable areas and can transport to disaterous area/s along with SRGC to extend the post-harvest life.

Keywords: ***Leafy Vegetables, Postharvest, LED, Hydroponic, Relative Humidity***

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Unveiling the Green Trail: Harnessing RFID Technology for Sustainable Vegetable Traceability

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Abstract

Efficient traceability systems are vital for managing the agro-food supply chain and responding effectively to product recalls. This study proposes the development of a real-time application and online tracking system using Radio Frequency Identification (RFID) technology to ensure vegetable traceability and analyze post-harvest losses in the transport and handling chain. Traceability has been identified as a crucial tool for ensuring the effectiveness of practices in the global supply chain and guaranteeing the safety of agricultural crops (Regattiere, Gamberi, & Manzini, 2007). The integration of RFID technology with an appropriate information infrastructure enables end-to-end traceability at reduced labor costs, even for small and medium-scale business enterprises (Kelepouris, Pramatari, & Doukidis, 2005). This research aims to design a distant traceability technique and a real-time tracking system using RFID coding and GPS tracking technology for the selected vegetable varieties in Sri Lanka. The system will provide insights into post-harvest loss reduction in the transport and handling chain within the food industry. Implementing RFID-enabled traceability systems eliminates the need for line-of-sight and labor-intensive processes like manual product counting and scanning. This automated data capturing ability improves the overall efficiency of traceability systems and enhances supply chain management (Kamble & Gunasekaran, 2016). The proposed system's online tracking capabilities will allow farmers and ground-level food handlers to conveniently update information regarding harvest variety, quantity delivered to primary buyers, and received prices. The system will ensure transparency, prevent unethical practices, and enable real-time monitoring of post-harvest losses. It will also contribute to preventing stockpiling of crop products and illogical price fluctuations. Furthermore, this research aligns with the objectives of the proposed organic agriculture program by the Sri Lankan government, providing an effective tool to support sustainable farming practices and enhance the country's food security. In conclusion, this study proposes the development of an RFID-enabled traceability and tracking system for vegetables, aiming to minimize post-harvest losses, improve traceability, and enhance the efficiency of the supply chain in Sri Lanka's agro-food sector. The system's automation and real-time capabilities contribute to transparency, ethical practices, and the overall sustainability of the vegetable distribution system.

Key words: ***Agro-food Traceability, RFID-enabled Real-time Tracking, Post-harvest Loss Reduction, Sustainable Vegetable Supply Chain, Precision Agriculture***

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Importance of Sustainable Utilization Practices and Emerging Technologies towards Food Security

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Abstract

The global demand for food products is continuously increasing due to the rapid growth rate of the world population. Therefore, establishing food security is crucial for providing adequate nutrition to individuals, reducing hunger, and poverty. The biggest challenge would be to cater to future food needs with the available land for cultivation. In addition, the food supply chain in Sri Lanka was severely damaged by the COVID-19 pandemic. Therefore, integrating traditional and regional knowledge with modern knowledge would be one of the promising sustainable strategies to achieve food security. Ancient food processing and preservation practices maintained a healthy balance between humans and the environment. Some traditional preservation methods include preserving meat by immersing it in bee honey, drying, smoking, adding salt and sugar, pickling, and fermentation. Disseminating and encouraging people to utilization of traditional knowledge while blending it with novel technology is a timely requirement to establish food security in Sri Lanka. Sri Lanka is rich in diverse food crops; however, some crops are in the underutilized category due to a lack of awareness and restrictions in the existing supply chain in the country. Combining the regional knowledge of underutilized food crops and food processing techniques is a prime strategy for achieving food security. Facilitating home gardening is always a better solution to fight against food insecurity; however, it is not completely achievable due to the busy lifestyles and lack of knowledge related to the plantation. Thus, community gardens are a better alternative to assure food security at the regional level. This strategy would be a successive approach due to easy access to the cultivable lands, and the required manpower can be found in the region (schoolchildren, senior citizens). Furthermore, changing consumption patterns and adapting processing methods direct to more affordable and sustainable processed food options. The presented strategies will allow for establishing a supply chain that may remain stable in pandemic situations. In addition, this will help commercialize new value-added food products and establish long-term food security in the country.

Key words: ***Community Gardening, Food Security, Regional Knowledge, Traditional Knowledge, Underutilized Food Crops***

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Impact of Climate Change on World Food Security

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Abstract

Global food security is at risk from climate change, which alters agricultural systems and makes it harder to supply the dietary needs of an expanding population. Crop yields and animal productivity are directly impacted by the changing climate, which are defined by increasing temperatures, changed patterns of rainfall and frequent incidences of extreme weather events. Reduced agricultural productivity and disturbed food production cycles cause food scarcity and price variations. Additionally, the quality and quantity of natural resources needed for agriculture such as water and soil are impacted by climate change. Changes in precipitation patterns and higher evaporation rates cause water shortages and drought, reducing irrigation systems' dependability. The productivity of agriculture is further hampered by soil erosion and degradation brought by climate change. Beyond the agriculture industry, the effects of climate change on food security are widespread. It impacts the systems of food chain as storing, transporting and distributing food, leading to greater post-harvest losses and restricted market access. Furthermore, climatic catastrophes like heat waves, storms and floods cause damage to vital infrastructure and the food supply system. A diversified strategy is needed to address the threats to food security posed by climate change. This entails putting sustainable agricultural practices such as agroforestry, conservation agriculture and precision farming into practice to increase resistance to climate change. Investing in climate-smart infrastructure and technologies such as crop types that can withstand drought, effective irrigation systems and weather monitoring systems can also help lessen climate change's effects on food production. Coordination of responses to difficulties in food security brought on by climate change can be facilitated by strengthening regional and international cooperation, knowledge-sharing platforms and early warning systems. In conclusion, the disruption of agricultural systems and the escalation of current issues caused by climate change constitutes a serious threat to global food security. To mitigate these effects, a comprehensive strategy incorporating climate-smart technologies, sustainable farming methods and assistance for disadvantaged farmers. To maintain a sustainable and resilient food system in the face of a changing climate, it is imperative to address the impact of climate change on food security.

Keyword: ***Climate Change, Food Security, Irrigation Systems, Post-harvest Losses, Precision Farming***

Exploring Climate-Resilient Sri Lankan Maize Landraces based on Kernel Nutritional Composition for Food Security Enhancement

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Abstract

Maize (*Zea mays* L.) is one of the most commonly grown cereal crops and characterized by higher efficiency in water, nutrient and biomass production. This phenomenon is evident due to its enhanced C4 photosynthetic mechanisms as this maize can withstand harsh environmental conditions. Therefore, studying the native maize germplasm is crucial for identifying resource-efficient genotypes as well as improved nutritional values for the crops for future agricultural systems. Recent findings indicate that the Sri Lankan maize germplasm outperforms the commercial elite varieties in terms of photosynthesis, biomass, water use efficiency and resistance to pests and diseases and withstanding harsh environmental conditions. However, data on the nutrient composition of these maize germplasm are lacking and elucidation in this area would be useful for the future food and feed industry and security. Therefore, this study aimed to examine the local maize landraces based on nutrient composition through the assessment of nutritional parameters and the rank summation index was used to identify the best performing germplasm for crop development programs. The maize seeds from 42 landraces were compared to the Bhadra (control) cultivars. The proximate chemical composition was analyzed using near-infrared spectroscopy (NIR) and the carbohydrate content and energy value were determined using the calculation method. Data was analyzed using SPSS software and the Rank Summation Index (RSI) to identify and select the best performing landraces. The results showed that significant differences ($p<0.05$) were found to be between the nutritional compositions such as ash, fiber, fat, protein, carbohydrate and energy among the landraces tested. Accordingly, the maize landraces SEU 22, SEU 31 and SEU 2 were found to be superior in nutrient composition compared to with that of Bhadra and had the lowest RSI of 85, 88 and 89, respectively. The hierarchical cluster analysis showed that these varieties were in the same group with minimal distance. Therefore, these maize landraces were highly recommended for future breeding programs to produce nutrient-enriched maize kernels for sustainable food security in the climate-changing scenario.

Key Words: ***Climate Change, Food Security, Maize Landrace, Proximate Composition***

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Red Chili Hybrid Seed Production by Small Farmers in Sri Lanka - A University Enterprise Collaboration (UEC) for Technology Innovation in Climate Change Adaptation

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Abstract

Sri Lanka strives to reserve the foreign exchange to face emerging economic crisis through a rapid food drive to elevate the GDP contribution of Agriculture which has fallen from 75 percent in 1977 to 7.5 percent in 2022. The need for food import is a prime need to save foreign exchange and to reduce the Import-Export gap of US$ 8,139 Million in July 2022. The current paper presents a University Enterprise Collaboration program initiated in dry chilli production to retain US$ 90 Mn, to import 60,000 tons of red chilli, to produce 15,000 kg of chilli hybrid seeds using the new variety (MICH-HY1), with a yield potential of 32 mt/ha (5 -6 times more compared to conventional varieties).

Agriculture System Modernization Project (ASMP) with World Bank assistance, the Department of Agriculture, University of Ruhuna, and Dialog Axiata program have jointly created an innovation platform with farmer start-up companies to meet this target. The program provided technical assistance for 186 farmers to create startup agro-business enterprises in Welimada, Bandarawela, Nuwaraeliya, and Badulla Districts, by providing 50-60 percent of financial support to build automated protected agricultural systems for Climate-smart agriculture; technical expertise were provided to use a mobile app to save water nutrients and chemical inputs. The project results in the year 2022 and the expected progress for the next two years is demonstrated in Table 1.

Table 1: Expected outcome

	2022	**2023**	**2024**
Seed Production per annum (kg)	684	1,860	2,046
Value of the seed production (Rs Mn)	68	205	248
New employment opportunities	228	558	558
Potential cultivated land increase (ha)	1,300	3,534	3,887
Expected Fresh Chilli Production (tonnes)	38,988	106,020	116,622
Expected Dried Chilli Production (tonnes)	9,747	26,505	29,156
Foreign Exchange Savings through import substitution (US$ Mn)	22	67	81

Source: ASMP

Foreign exchange saving through import substitution, productivity improvement by adapting technologies for Climate Smart Agriculture, technology transformation through University-Industry collaboration for rural poverty alleviation, and women empowerment for good quality seed production which promotes local hybrid seed production by strengthening farmer entrepreneurs with technical innovations are the good lessons learned from the current program.

Key words: ***Chilli Seed Production, Climate Smart Agriculture, Hybridization, University-Industry Collaboration***

Disaster Early Warning System for Vulnerable Paddy Farming Communities from Upstream to Downstream: A Case study of Sri Lanka.

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Abstract

Rice is the staple food for over half the world's population. Approximately 480 million metric tons of milled rice are produced annually. In Asia, the demand for rice is expected to increase by 70% over the next 30 years (Sumithra, 2014) In 2020, rice, and paddy production for Sri Lanka was 5.12 million tonnes. (Knoema , 2020) In Sri Lanka, natural disasters like floods and droughts often damage or destroy the harvests of rice farmers.

The importance of having an effective "early warning systems" is widely accepted as one of the key components to managing disaster risk. (iN MHEWS, 2019) The communication and dissemination component has been recognized as weak with lack of sufficient attention resulting in an unbearable gap between upstream to downstream. (SFDRR, 2015)

There are three main phases in a typical early warning system: upstream, downstream and interface (Haigh, 2020) A country-specific, multi-hazard early warning system should be established considering national and local administrative parameters. (Fakhruddin, 2014) EW coverage is not adequate in Sri Lanka. (Pradeep, 2015) several gaps and shortcomings exist in the Agri - early warning system(Jayarthne, 2022) However, the community has lacks trust in the existing EW mechanism. (Rajesh, 2020) there are no proper- records of the number of people who receive the warning. How many people responded to the EW message? And how effective? Also, a proper feedback mechanism has not been identified.

There are four themes such as Climate change scenarios and their impact on different agriculture systems, Agriculture early warning systems, Sri Lankan context, Upstream to a downstream multi-hazard early warning system to trigger early action were reviewed in the literature to find out the gaps and shortcomings in the paddy early warning systems and this study is aiming to identify the reliable transformational changes in the warning dissemination mechanism and introduce a new or modified warning mechanism for paddy farming communities to adapt early action to mitigate the impact due to disasters while enhancing paddy yield in Sri Lanka.

The objectives of this research are to find out "risk and vulnerability" ,"dissemination and reception" rate of the paddy farming communities and stakeholders who can intensify efforts to enhance the early warning mechanism and strengthen the "upstream-downstream nexus" to innovative changes and streamline the transformational improvement of the "early warning dissemination and reception" mechanism to smooth operation.

The outcome of this research will contribute to increase the paddy production of the country and considerable impact to the GDP and the new knowledge intended to create agriculture preparedness, response, and risk reduction in the paddy cultivation with appropriate disaster early warning.

Keywords: ***Upstream-downstream Early Warning, Paddy Cultivation, Disasters***

Nudging the Farmers' Migration Intention through Training of Trainers: The Case of Agricultural Advisory Officers in Sri Lanka

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Abstract

Currently, Sri Lanka has a population of around 22 million of which approximately 4 million are living in other countries and recent estimates highlight that 4 million farmers have migrated into different districts in Sri Lanka. Climate change and low financial literacy level are the two main reasons behind the high domestic and international farmer migration in Sri Lanka. The projected changes reported in *The National Adoption Plan for Climate Change Impacts in Sri Lanka, 2016-2025* suggest that the climate of Sri Lanka is undergoing three major types of changes: gradual increase in ambient air temperature, changes in distribution pattern of rainfall, increase in frequency and severity of extreme weather events. As a result, farmers are migrating into other districts and other countries. One of the other roots of high international migration from Sri Lanka has been the low level of financial literacy. Sri Lanka has a labour force of around 9 million of which 2.8 percent are employers. Lack of business entrepreneurs leads to slow business expansion and an inadequate number of employment opportunities generated for the youth in Sri Lanka. The absence of financial literacy components in all levels of education programs in Sri Lanka has produced university graduates who are seeking employment opportunities in government entities and foreign countries. In this regard, agricultural advisory officers are also not an exception in Sri Lanka. They are mostly recruited with G.C.E. (Advanced Level) qualifications or a university degree and with a political affiliation to governing political party. There is a dearth of training programs for agricultural advisory officers in Sri Lanka. Therefore, in order to mitigate the impact of climate change and reduce farmers' sizable migration rate, it is essential to design training programs for agricultural advisory officers. This research will focus on the training needs of agricultural advisory officers to improve farmers' knowledge and develop their financial literacy skills by designing and implementing a training of trainers program for them. By evaluating secondary information sources, a suitable farmers' advisory group will be selected and an opinion survey will be conducted among them before designing the training programs.

Theme 4:

Climate change adaptation in the built environment

Vulnerability Assessment of Railway Infrastructure Systems due to Natural Hazards

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Abstract

Global warming and climate change caused natural extreme events which make infrastructures vulnerable for damage. Railway infrastructure is one of them. To increase the resilience of railway infrastructure for natural disasters, it is extremely important to establish accurate and optimum decision making methods and strategies. Identification of vulnerable components of the railway infrastructure, prediction of possible consequences of damages and preparing for it is very important to minimise the loss of lives, assets, time and money. In this study, a methodology on probabilistic damage assessment is proposed, with a specific focus on fragility curves for quantitative measurement of the predicted damage focusing on railway infrastructure. The paper outlines a range of fragility models for the railway track subjected to a range of hazards including earthquakes, floods, and landslides. Specifically, the accuracy of quantification of the probability of failure is discussed with emphasis on the railway track. In context of the expanding resilience frameworks for railway infrastructure for natural hazards, several future research directions are also highlighted.

Keywords: ***Fragility Curves, Railway Resilience, Natural Hazards, Vulnerability Assessment, Railway Infrastructure, Loss Estimation, Multi-hazards***

Climatic Cartography and Wellbeing in the City: Power and Politics of Mapping in Effective Policy Discharge towards Urban Resilience in Colombo, Sri Lanka

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Abstract

Mapping creates and builds the world as much as it measures and describes it. As a representation tool in the planning and design of cities, cartography is particularly instrumental in the constructing of 'lived space' in which are assessed wellbeing and urban resilience. (Kitchin et al., 2011) As a holistic parameter of health, wellbeing encapsulates both 'feeling good' (hedonic) and 'functioning well' (eudemonic) characteristics and is often defined as a mirror opposite construct of mental and/or physical dysfunctions such as depression. (Huppert & So, 2013) This definition of wellbeing is synonymous with the definition of urban resilience as an opposite construct of disaster as an expression of social vulnerability or entrance into a state of uncertainty based both on a physical event and a social catalyst. (Quarantelli, 1998) Parameters of urban resilience such as redundancy, robustness, connectivity, inclusion, and integration directly relate with indicators of built-environment related wellbeing such as walkability derived from the prompts; 'connect', 'keep active' and 'take notice'. As the nexus between sustainability, (environmental, social, and economic), and wellbeing as the ultimate intent behind the formation of cities is well established, the combination of tangible, and psycho-social aspects of urban resilience and wellbeing in the city defines a novel connect between climate change adaptation and disaster risk reduction. (Anderson et al., 2017; Ribeiro & Pena Jardim Gonçalves, 2019) In practice, establishing the complexities of wellbeing and urban resilience in a cohesive manner requires effective policy planning and implementation which depends on a well-established 'Network of Influence'. (Munasinghe, 2012) To bridge inter-domain gaps, an effective multi-dimensional visual representative tool is required. Learning from comparable contexts such as Hong Kong, urban climatic maps (UCMaps) consisting of sound meteorological and geospatial data combined with mapping of psycho-socially approached occupancy/ behavioral data is found as the way forward for effective policy discharge towards urban resilience in the city of Colombo. (Dovey et al., 2017; Ng & Ren, 2015)

Key words: ***Climatic Cartography, Wellbeing, Urban Resilience, Climate Change Adaptation, Disaster Risk Reduction***

Coherence across Global Development Agendas in Making Smart Cities Disaster Resilient

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Abstract

Harmonising different global agendas, such as Sendai Framework for Disaster Risk Reduction (SFDRR), Sustainable Development Goals, The Paris Agreement, the New urban agenda, etc. allows for maximising their co-benefits. Supporting such synergistic implementation, the Making Cities Resilient 2030 (MCR2030) initiative is envisioned in a way that directly contributes to achieving the Sendai Framework for Disaster Risk Reduction priorities. For instance, the MCR2030 guide including its strategic objectives frequently refers to the SFDRR global target 'e' intending to substantially increase the number of countries with local disaster risk reduction strategies by 2020. Therefore, it can be argued that MCR2030 helps in achieving SFDRR priorities in central units in the urban ecosystem, i.e. cities. Cities as the key driver of a nation's growth should be able to absorb, recover and prepare during and after extreme events that affect the city's domains including the economy, infrastructure, people and living, governance, environment, etc. There is no exception for advanced city conceptualisation models like Smart Cities, as disasters affect Smart Cities as well; differently and sometimes more severely given their unique ecosystem. This study looks at how the application of MCR2030 for Smart Cities helps in achieving SFDRR priorities, in particular. To identify the synergies, initially, a systematic literature review was undertaken and thereafter the MCR2030 elements were mapped against the SFDRR elements employing the desk study analysis approach, which were later reviewed with Smart City dimensions and characteristics. The findings suggest that the smart characteristics identified through the systematic review complement the thematic areas in MCR2030 which were mapped against the SFDRR elements. This suggests that these smart characteristics contribute to expediting the resilience-making process in cities. The findings of this study are of large relevance to any type of Smart Cities in the resilience journey.

Key words: ***Making Cities Resilient 2030 (MCR2030), Sendai Framework for Disaster Risk Reduction (SFDRR), Smart Cities***

Financial Incentives as a Strategy to Promote Disaster-Resilient Housing

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Abstract

Housing sector damage is among the most intense and harmful impacts of natural hazards, which trigger significant socioeconomic deterioration in the human development agenda. Even though there have been continuous efforts to develop a disaster-resilient, housing sector losses are replicating with increased intensity and frequency. The resilient construction methodologies and technical know-how have already been discussed in broader terms. However, motivating people to invest in resilient technologies remains challenging, which requires additional inducements such as financial incentives.

Some efforts have already been taken to provide such inducements via financial incentives in different contexts. However, the effectiveness of such mechanisms is subject to questions, and how to strategically use these financial incentives to promote disaster resilience remains problematic. Therefore, this research addresses the question of using financial incentives to promote disaster-resilient housing.

A round of expert interviews was conducted with disaster resilience experts, financial regulatory authorities, housing building authorities, and local government authorities—data analysis using content analysis and thematic analysis. Finally, synthesising the study results and conclusions, a financial incentive framework for promoting disaster-resilient housing will be developed. The findings will provide insights into the concept of resilient housing, the need and current role of providing financial incentives, the challenges, prerequisites, and the methods and approaches of using financial incentives to promote resilient housing.

Keywords: ***Financial Incentives, Disaster Resilience, Housing Sector***

Role of Built Environment Stakeholders in Climate Change Adaptation

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Abstract

Recent evidence confirms a close liaison between natural and human-induced hazards and the built environment, as the built environment demonstrates a high fragility and vulnerability to hazardous situations. Accordingly, the built environment stakeholders must be well-informed and capable enough to address the climate change adaptation needs. Thus, it is essential to identify the built environment stakeholders' role in climate change adaptation measures.

The study investigates the built environment stakeholder's role under six different stakeholder categories: National and Local governments, The Private Sector, Academia and Research Organizations, Civil organisations and Professional Bodies and communities. The data has been collected by country-level contextualising studies using secondary and primary data. A case study approach has been used, and primary data has been collected through expert interviews with stakeholders representing the above categories in five different countries: United Kingdom, Spain, Malta, Sweden and Sri Lanka.

The findings summarised a set of key roles and sub-roles for each stakeholder category considering the current status and needs. The National Governments need to set a long-term vision, enabling multi-sector interventions while promoting investment and innovation in climate change adaptation. The local governments overlook local adaptation plans, while the community is responsible for decarbonising operations and practising adaptation at the local level. Civil organisations and professional bodies are the voice of the community, linking policy and practice. Academia and research are responsible for nurturing skills and new knowledge, and the Private sector must contribute by adopting climate resilience into their business portfolio and Corporate Social Responsibility.

Keywords: ***Climate Change Adaptation, Built Environment Stakeholders, Roles and Responsibilities***

Exploring the Importance of Urban Sustainability in Nigeria and the Consequences of Its Neglect

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Abstract

The rate at which various countries of the world urbanises in recent times is alarming. The 2020 report from the UN-Habitat shows that urban areas are already home to more than 55% of the world's population and the figure is expected to grow to 70% by 2050. What is perhaps the most striking aspect of this rapid urbanisation is the rate at which the number of megacities (cities with 10 million inhabitants) has been increasing globally. Recent projection demonstrates that the number of megacities will rise from 33 in 2018 to 43 in 2030. This is a scenario where urbanity takes over rurality as projected in 1955 by Davis Kingsley, a scenario that explains the rapid rate of Nigerian urbanisation. Nigeria has an overall population of about 213 million as at 2021, and shockingly projection notes that from 2014 to 2050 the Nigerian urban population will have an addition of 212 million more than triple of what it is presently. Moreover, Lagos which is one of the cities in Nigeria is already among the global megacities with over 10 million population. This is both massive and challenging mostly because this rapid urbanisation is occurring without development, it is not adequately planned, managed, and financed. Strikingly, these urban areas lack sustainable and resilient infrastructural facilities which result in increased disaster risks and vulnerability, negating the efforts geared towards the achievement of the 2030 sustainable development goals (SDGs) agenda. Indeed, there is the need for countries to act promptly, particularly in the creation of urban sustainability giving the teeming population resident in the urban centres. It becomes critical to understand the importance of urban sustainability and the consequences of its neglect. This is an understanding that can help to facilitate a quick response towards its creation. Accordingly, this research centres on exploring the importance of urban sustainability in Lagos, Nigeria, and the consequences of its neglect. The researcher conducted qualitative expert interviews and the data collected was transcribed manually and coded to generate the themes that addressed the research questions. The findings revealed several reasons why the creation of urban sustainability is important such as to protect the environment for the present and future generation, reduce urban abject poverty, increase employment opportunities, and increase public health services. The findings also reveals that the lack of urban sustainability leads to such consequences as increased environmental problems, increased urban vulnerability and increased disaster risks. Based on this, the experts strongly recommends that the Nigerian government, urban planners, and other relevant stakeholders should urgently act on creating urban sustainability in Lagos to avert the consequences that results from the lack of it.

Key words: ***Urbanisation, Urban Sustainability, Importance, Consequences of Neglect***

Lessons Learned from Japanese Urban Planning Approaches: An Integrated Approach to Improve Urban Resilience and Climate Actions via the Adoption of Nature-Inspired Solutions (NIS)

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Abstract

Japan is known for having a rich cultural legacy and for being particularly vulnerable to a variety of natural dangers. Japan is one of the most susceptible countries in the world, according to the INFORM Global Risk Index 2019. To create solutions to reduce the danger of natural calamities, including climate activities, Japan has identified prospective areas where cultural knowledge may be employed. Using the Community Based Observer Networks (CBON), an indigenous scientific method for tracking environmental changes, in conjunction with NIS, such as slime mould behaviour patterns, to generate multi-objective urban planning strategies, is one of the effective measures. Japan has created a distinct methodology that emphasises the need of community engagement in sustainability and resilience by fusing indigenous knowledge with environmental studies. According to this perspective, the CORE (Science and Human Factor for Resilient Society) project, which is supported by the Horizon 2020 programme, investigates the state of the art within these complex characteristics to create a harmonised resilience approach for enhancing the multi-hazard risk management capabilities of European nations. To further climate action, this study aims to highlight Japan's best practises of CBON and NIS in creating multi-objective urban planning solutions. The CBON technique, which creates thorough data on environmental variables and effective uses of NIS in Japan's urban planning issues through evaluating published sources, is explored in this study. The integrated CBON and NIS techniques can be used to track how anthropogenic and ecological activities affect environmental changes, giving a base for developing deployment strategies that adapt to various urban dynamics' velocities. This gives vulnerable communities a thorough awareness of the cultural and urban surroundings, enabling them to recall events and characterise changes accurately. By bringing together community agents and experienced practitioners from throughout the world, including Japan, this method can provide more resilient and sustainable urban solutions.

Keywords: ***Climate Change, Community-based Observing Networks, Community Resilience, Nature-Inspired Solutions, Urban Planning***

Theme 5:

Climate change risk management

Potential of Machine Learning for Climate Change Risk Assessment

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Abstract

Climatic change is intensifying weather and climate extremes and is expected to exacerbate multi-sectorial risks. A number of climatic risks will be implicated, causing cumulative and interaction effects on a wide range of natural and human systems. To assist decision makers in effectively managing present and future climate change risks, a greater knowledge of risk interactions and dynamics is necessary. To address this challenge, the research community has begun to explore new methodological techniques and tools, such as the application of Machine Learning (ML) to environmental applications, harnessing the potential of the immense diversity and availability of spatio-temporal big data. This review outlined the current state of the art and the potential of ML approaches for this area of study in light of the growing interest in the use of ML methods to Climate Change Risk Assessment (CCRA). Together, scientometrics and systematic analysis were used to provide a thorough examination of publications from the years 2000 to 2022. The investigation revealed that a wide range of ML algorithms have previously been used within CCRA, with the most common being Decision Tree, Support Vector Machine, Random Forest, and Artificial Neural Network. These algorithms are frequently used in an ensemble or hybridized fashion to evaluate the majority of flood and landslide risk occurrences. Furthermore, the use of ML to deal with remote sensing data is consistent and successful across evaluated CCRA applications, allowing for target identification and categorization as well as the detection of environmental and structural aspects. In contrast to research evaluating dangers under existing conditions, literature on future climate change scenarios appears to be scarce in scientific production. The similar limitation may be observed in the evaluation of compound and cascading hazards and risks, as these ideas are just lately beginning to appear in CCRA literature but have not yet been used in conjunction with ML-based applications.

Key words: ***Big Data, Climate Change, Climate Change Risk Assessment, Extreme Events, Machine Learning***

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Impacts of Climate Change on Landslides in Badulla District, Sri Lanka

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Abstract

Climate change challenges many aspects of life and the impacts due to climate change are increasing in an alarming rate. There is a relationship between climate change induced natural disasters and one such disaster Sri Lanka faces is landslides. High rainfall intensity together with many other anthropogenic factors have increased the incidents of landslides around the world. One of the major factors inducing landslides is increase in rainfall amount and intensity of rainfall. Most of the landslides in Sri Lanka is triggered by prolonged and high intense rainfall and have led to many fatalities and significant economic loss. Badulla district is identified as one of the districts that is most prone to landslides in Sri Lanka. It is important to evaluate the impacts of climate change on landslide activation. Therefore, this study was aimed at analyzing the rainfall trend and its impact on landslides in the context of climate change in Badulla district. Secondary data from department of meteorology, disaster management center and previous studies were collected to analyze the effects of climate change on landslides in Badulla district. A landslide inventory and a map were prepared. A total of 58 landslide locations were mapped and the major triggering factor of the majority of the landslides was identified as heavy rainfall. According to the results, majority of the landslides occurred during Northeast monsoon followed by inter monsoons. Northeast monsoon rainfall showed an increasing trend over the past 10 years. Rainfall variations and landslide activation showed a positive increment over the last decade which indicates climate change is directly affecting landslide occurrences in Badulla district. However, according to the projected rainfall trend for 2040 – 2060, Badulla district shows a relatively low rainfall pattern, and the projected landslide vulnerability is moderate. The outcome of this study can be used to understand the relationship between rainfall trend and landslide frequencies, which will help in implementing adaptation measures and building resilience against climate.

Key words: ***Climate Change, Landslides, Rainfall, Badulla District, Adaptation Measures***

Analysis of Extreme Weather Events in Colombo District as a Tool for Disaster Preparedness

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Abstract

Extreme weather events cause severe damages to both environment and humans. In Sri Lanka, droughts and floods are the most significant natural hazards that occur due to the rainfall variability, damaging the agricultural, industrial, and household activities and the economy of the country. Therefore, this study aims to assess rainfall variability, severity of drought and wet periods in Colombo District and to use the findings in disaster preparedness. The daily rainfall data from four rain gauging locations (Rathmalana, Homagama, Colombo, and Angoda) for the last 33 years (1989 – 2022) was analysed using Standard Precipitation Index (SPI). The variation of SPI values indicates the occurrence of extreme wet events (SPI > 2) in September to November in 1990, 1993, 1994, 1996-97, 2005-06, 2009, 2011, 2012, 2014-16, 2018 and 2020 suggesting the influence of Southwest monsoon and second Inter-monsoon rainfall seasons. The year 2016 was identified as the most affected year by flood events in all four locations. Extreme drought events (SPI < -2) have occurred in 2000 in Rathmalana and Angoda regions while severe droughts (-2 < SPI <-1.5) in Colombo and Homagama regions. The analysis of occurrence of wet (SPI > 1) and dry months (SPI < -1) revealed that in last 33 years, the occurrence of wet months ranged between 8.3 % to 33.3 % in all four regions indicating the risk of floods in Colombo District. The highest occurrence of wet months was observed in 2017 in Rathmalana region, 2002 and 2017 in Homagama region, 2002 and 2013 in Colombo region, 1995 and 2002 in Angoda region. At least 3 months dry period has occurred in the years of 2003, 2013, 2014, and 2021 in Colombo district. Therefore, results show the importance of mitigative measures, such as inclusion of wetlands and production of flood risk maps could enhance the flood mitigation while use of rainwater harvesting systems, reduction of water loss, and reuse of water for drought mitigation could be utilized to reduce the adverse impacts of these extreme weather events on Colombo District.

Key words: ***Disaster Risk, Drought, Flood, Rainfall Variability, SPI***

Appraising Heat Stress Vulnerabilities of Elders in Tropics: Ageing-In-Place and Quality of Life

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Abstract

Climate change is an emerging threat to physical and mental health of people and planetary health. Vulnerability of people to climate change differs substantially among and within regions and South Asia is one of the hotspots of high human vulnerability to climatic hazards (IPCC, 2022).

Climate change and population ageing are synchronized global issues influencing national agendas over the next decades. Burgeoning trend in global temperature will promote heat stress in tropical Asia and heat waves are estimated to be intensified in future. Heat stress and heat related illnesses are greater in the warmer and poorer regions (Hijioka, 2014). Hence, severity of heat stress on ageing populations in warming climates is a significant societal and global public health challenge.

Sri Lanka is rapidly aging and by 2041 one in every four persons is an elder (UNFPA, 2017). Moreover, increase in prevalence of extreme heat in the tropics will exacerbate the thermal discomfort and vulnerabilities of low-income communities who live in sub-standard houses. They suffer from energy poverty to cool indoors and therefore deprived of the means to improve thermal comfort. With the frequency of current extreme heat incidences in Sri Lanka, heat stress is an emerging threat on human health and well-being. Thus, the study prioritizes an evidence-based framework to appraise, exposure, vulnerability and burden of disease due to extreme heat events.

A randomly selected cohort of young elders residing in a low-income settlement was experimentally investigated during the hottest month of April. Indoor thermal conditions of houses and skin temperature profiles of elders were collated. Infrared thermal imaging analysis revealed more than 70% of the cohort portrays a mean skin temperature of 37°C with warmed forehead. The findings explicitly prove the skin temperature levels of elders are above the acceptable range of 33 to 36.9°C. Further, the houses are overheated with a mean air temperature of 38°C. As elders spend more than 90% of time in indoors and prevalent heat stress risk adversely affect their well-being and quality of life.

This, study informs the importance of evidence-based policies and practices which integrates heat events, health and housing for low-income communities in Sri-Lanka. Further, highlights the necessity of far-reaching implications to address climate change induced extreme heat risks through systemic framework to originate localized solutions to ensure health and well-being of vulnerable population in tropical cities.

Key words: ***Heat Stress, Heat Waves, Elderly People, Low-income Communities, Tropics***

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Incorporating Citizen Perspective into Pandemic Preparedness: The Lens of Health Emergency and Disaster Risk Management (HEDRM)

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Abstract

All communities are at risk of health emergencies, largely caused by infectious diseases. The recent challenges of COVID-19 underlined the need for a whole-of-society approach to managing epidemic and pandemic-associated risks and consequences. In this context, community participation has been identified as a significant aspect of pandemic preparedness and response, which is key to pandemic risk reduction. The health emergency and disaster risk management framework (2019) is a main instrument of the WHO, which provides a common language and a comprehensive approach that can be adapted and applied by all actors in health and other sectors who are working to reduce health risks and consequences of emergencies and disasters. Also, the HEDRM framework has been constituted by the Sendai Framework for Disaster Risk Reduction 2015–2030, International Health Regulations (IHR) (2005), and Paris Agreement on Climate Change. Considering the given importance, this paper is aimed to explore the key aspects of community-based disaster risk reduction included in the HEDRM framework that can be instrumental to a community-based approach dedicated to pandemic preparedness. As informed by the current pandemic, the incorporation of the citizen perspective enables trust-building among stakeholders involved in pandemic preparedness and response at all levels. As health emergencies affect communities disproportionately, communities need to be the driving force during a pandemic. Therefore, HEDRM identified inclusive, people- and community-centred approach, and multi-sectoral and multi-disciplinary collaboration as key principles that guide policy and practice. Participation of communities in risk assessments to identify local hazards and vulnerabilities, development of preparedness plans, detection and effective response at local levels, community capacity in primary healthcare and roles of local health workers, community-based organizations, and civil society have been identified as central to effective Health EDRM. Further, civil society can actively engage in community-level surveillance, household preparedness, local stockpiling, first aid training, and emergency response. Active community involvement ensures such activities and strategies are context-specific, culturally appropriate, efficient, and cost-effective. Also, this approach can build public confidence, disseminate information among communities, and identify people at risk.

Key words: ***Pandemic Preparedness, Health Emergency and Disaster Risk Reduction Framework, Community-based Approach, COVID-19***

"Desa Seduluruan" Sister Villages of Mount Merapi: Local Preparedness for Pandemic

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Abstract

Mount Merapi is the most active of Indonesia's 130 active volcanoes rises to 9,551 feet (2,911 metres) and located on the border between the province of Central Java and the special region of Yogyakarta. The continuous eruptions have threatened the communities living beneath the mountain and lack of efficient evacuation planning had increases the risk, making communities venerable during an eruption. Local authorities have introduced the sister village concept implementing self-evacuation during a threat of volcanic eruption. The idea is to have a permanent evacuation centre at a safe location for the people who are living in high-risk zones. Primary aim of the sister villages is to enhance the capacity of the risk communities to self-evacuate during a volcanic eruption and to empower them with knowledge and guidance for maintaining their lives until the treat is neutralized. According to local authorities this attempt is one of the successful and productive approach of making communities empowered during an emergency. With that scope this study aims to evaluate the sister villages of mount Merapi and its processes and functionality within the perspective of multi-hazard and pandemic preparedness. The study was based on a filed visit to mount Merapi followed by set of semi-structured interviews with local authorities and the people who are living in both risk and host communities. Results have highlighted that under the guidance of the local authorities, local communities have developed their own strategies to safely evacuate during an eruption. The evacuation centres have the capacity not only to accommodate people but also the animals as well. This was one of the critical issues that risk communities faced before implementing the sister villages approach. Moreover, during the pandemic the shelters were partitioned, and each family got separate cubical to avoid contact and maintain social distancing. Both communities were adhering to the given guidelines and there were zero COVID cases form both risk and host communities during the pandemic period. It is not always easy to maintain the social cohesion among two communities, therefore, local authorities have launched festivals, art performance, games, and many other community engagement activities to maintain the social cohesion. Results conclude that the self-evacuation approach in Merapi region is indeed successful because of good collaboration, better community awareness, community engagement in decision making, and community-based initiatives. By strengthening the same aspects, this concept may be applicable to other disasters when making communities resilient.

Key words: ***Community Resilience, Local Preparedness, Pandemic***

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