The Southern Africa Society for Disaster Reduction (SASDiR) International Conference on Strengthening Disaster Resilience in Africa: Transdisciplinary Approaches and Sustainable Solutions

BOOK OF ABSTRACT

SASDiR

21-23 August 2024

6th Biennial International Conference in Collaboration with

University Of Mauritius

southern africa society for disaster reduction

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The Southern Africa Society for Disaster Reduction (SASDiR) International Conference on Strengthening Disaster Resilience in Africa: Transdisciplinary Approaches and Sustainable Solutions

21-23 August 2024

The Ravenala Attitude Hotel, Mauritius

SASDiR 6th Biennial International Conference

Sponsored by

esri South Africa

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Coalition for Disaster Resilient Infrastructure

ABSTRACT

The Southern Africa Society for Disaster Reduction International Conference on Strengthening Disaster Resilience in Africa: Transdisciplinary Approaches and Sustainable Solutions

21-23 August 2024
The Ravenala Attitude Hotel, Turtle Bay, Balaclava, Mauritius

Jointly organized by

Southern Africa Society for Disaster Reduction

University of Mauritius

North West University

University College London

Editing Team

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PREFACE

The SASDiR 6th Biennial SASDiR International Conference hosted by the University of Mauritius from 21 to 23 August 2024, focused on the topic 'Strengthening Resilience in Africa: Transdisciplinary Approaches and Sustainable Solutions'. The University of Mauritius is pleased to host this event in collaboration with SASDiR and the University College of London. Building resilience to impacts of climate change is of utmost importance for the African continent as well as the African Small Island Developing States. As climate change impacts go beyond boundaries, Building resilience to disasters through transdisciplinary approaches and innovative sustainable solutions, is the way forward if Africa is to meet the Sustainable Development Goals.

This conference brings together eminent scientists, practitioners and students from several countries; South Africa, Malawi, Botswana, the UK, the Republic of Seychelles and The Republic of Mauritius. Technical papers range from topic addressing building resilience to climate change from a legal perspective; addressing resilience to climate change through community engagement; empowering groups of the community to cope during disasters; use of technology to better enhance early warning and reach the most vulnerable groups of the society; adaptation to climate change in the food and water sectors; application of assessment framework tools in the built environment and in road networks; promoting new approaches to managing disasters and the role of higher education in addressing disaster risk reduction at wider level.

Parallel side events being held on: Geospatial technologies - Artificial Network, Machine Learning and Geographical Information; Promoting Sustainable Urban Drainage Systems as part of the drainage networks in a small island and the Nexus approach to resource management, have focused on the climate risks facing countries, how technology can enable better understanding and better management of the event, and how forecasting of resources can provide us with information to guide towards better resource management.

We are particular thankful to the sponsors of the event, the DR3 Belmont project, the Esri Southern Africa and the Coalition for Disaster Resilient Infrastructure (CDRI) – India, and to all those institutions that have participated in this event, either as Presenters or Resource Persons. A very special thanks to all the four Keynote Speakers for their valuable contributions to the event.

On behalf of the Local Organising Committee, I wish to express our deepest thanks to Professor Dewald van Niekerk, President of SASDiR for having giving us the opportunity to host and participate in this event.

Dean, Faculty of Engineering

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[Keynote Address 1] – Flood Management in the Face of Climate Change – Mr. N. Khedah

Land Drainage Authority, Republic of Mauritius

Climate change is exacerbating flooding events worldwide, significantly impacting communities and infrastructure. The increasing frequency and intensity of these events highlight the urgent need for effective flood management strategies. These events cause immediate damage and have long-lasting socio-economic and environmental effects. One of the major impacts of climate change is the rise in global flooding issues, necessitating innovative and sustainable solutions to protect vulnerable areas.

In response to these challenges, the Land Drainage Authority (LDA) has implemented a comprehensive Land Drainage Master Plan. This plan leverages advanced technologies, including a high-resolution Digital Elevation Model (DEM), which has allowed to accurately identify and map prone areas and vulnerability index. The precise identification of these areas allows for targeted interventions, ensuring that resources are allocated efficiently to mitigate flood risks.

A key aspect of the LDA's strategy is the transition from traditional drainage systems to innovative Sustainable Urban Drainage Systems (SUDS). These green solutions are designed to manage stormwater runoff more effectively, promoting natural water infiltration and reducing the burden on conventional drainage infrastructure.

In view to ensuring that new developments do not exacerbate existing drainage issues, the LDA has introduced drainage impact assessments. These assessments adopt a holistic, catchment-based approach, evaluating the potential impacts of developments on entire catchment areas. By considering the cumulative effects of multiple projects, the LDA aims to implement comprehensive and sustainable drainage solutions that address the root causes of flooding.

High-intensity, short-duration rainfall events are a common feature in Mauritius, often leading to rapid inundation and significant flood damage. To combat this, the LDA is promoting the consolidation of drainage systems through the construction of detention ponds, retention basins, and cut-off drains These structures serve to temporarily store excess stormwater, gradually releasing it into the drainage network to prevent overloading and reduce peak flow rates.

The combined efforts integrating advanced technology, innovative drainage solutions, and a comprehensive planning approach, have significantly enhanced the resilience of communities across the Island. These initiatives are not solely aimed at protecting lives and properties but also contribute to the sustainable development.

SESSION 1: TS 1-A

[TS 1-A] - Enhancing Disaster Risk Reduction through Urbanization and Development Planning in the Global South: A Systematic Literature Review - Dr. Fortune Mangara

North West University, Republic of South Africa

Rationale of the Research: Urbanization in the global south has brought unprecedented challenges in disaster risk reduction (DRR). Historical urban planning, often rooted in colonial times, has made cities susceptible to various disasters. This paper addresses the urgent need to mitigate these risks by proposing a comprehensive approach that combines urbanisation and development planning strategies. With the emergence of new cities in the region, it is crucial to identify and map disaster-prone areas to minimise the impact on vulnerable populations.
Method of Investigation: This paper employs a systematic literature review methodology to synthesise existing research and knowledge on disaster risk reduction, urbanisation, and development planning. Various sources, including academic articles, reports, and case studies, were systematically reviewed to identify key insights and trends in integrating DRR into urbanisation and development planning.
Main Findings: The analysis of findings from the systematic literature review highlights several critical aspects. First, historical urban planning decisions have often disregarded natural disaster vulnerabilities, exacerbating risks. Second, emerging new cities present a unique opportunity to implement innovative DRR measures from the outset, such as identifying safe building zones and implementing sustainable infrastructure. Third, involving local communities in the planning process enhances the effectiveness of DRR strategies, as they possess valuable indigenous knowledge about local hazards and vulnerabilities.
Conclusions and Recommendation: This paper argues that enhancing disaster risk reduction through urbanisation and development planning is imperative for the global south's sustainable development. By integrating DRR considerations into city planning, it is possible to create safer, more resilient urban environments. The findings emphasise the significance of proactive measures, such as risk mapping, engaging local communities, and incorporating sustainable infrastructure designs. Consequently, this paper suggests that policymakers, urban planners, and stakeholders collaborate to prioritise disaster risk reduction as an integral component of urbanisation and development planning, thus fostering resilient cities capable of withstanding future challenges.

Keywords: *Disaster risk reduction, urbanisation, development planning, global south, systematic literature review.*

SESSION 1: TS 1-B

[TS 1-B] - Disaster Management and Urban Planning: Building Resilient Cities - Dr. Yashwaree Baguant-Moonshiram

University of Mauritius, Republic of Mauritius

Urbanisation brings many benefits, such as diversity, market efficiency, jobs, education, and health improvement. It is these benefits that attract a continuous flow of people from rural to urban areas. However, due to the rapid pace of urbanisation, natural ecosystems are increasingly replaced by cities. By 2050, it is calculated that "cities will be home to two-thirds of the world's total population, and every one of the world's inhabited continents will have more people living in cities than in rural areas." However, cities and towns are seriously affected by a number of key issues related to sustainability and urban planning. These issues include: environmental degradation, social disruption, underemployment, inadequate housing infrastructure, overcrowding, and services. These factors are making cities in the world more increasingly vulnerable to disasters.

Disaster management, traditionally focused on response and recovery, needs a strong partnership with urban planning to create proactive and preventative measures. This fosters disaster risk reduction (DRR) and builds urban resilience. By integrating DRR principles into urban planning practices, cities can proactively mitigate risks, enhance preparedness, and facilitate a smoother recovery process. By incorporating DRR principles into land-use plans and building codes, cities can steer development away from high-risk zones. Zoning regulations can restrict construction in disaster prone areas. Urban planning can also contribute by ensuring essential infrastructure, like communication networks and emergency shelters, are strategically located and accessible as effective disaster management requires preparedness.

Due to the above reasons, a study was carried out to assess the resiliency of cities in the Mauritian context and the role of urban planning in disaster management. A review of the existing literature and the different case studies was carried out in order to carry out this assessment. The main issues and problems were identified and recommendations were made. This research proposes recommendations in which urban planning can be used as a tool for disaster management in Mauritius, a SIDS country. It explores the critical and growing role of urban planning in disaster risk reduction (DRR) and building resilient cities in the Mauritian context.

SESSION 2: TS 2-A

[TS 2-A] - A Participatory-Driven Taxonomy of Social Media Indicators to Advance AI-based Systems for Disaster Response - Dr. Priscila Carvalho

University College London, United Kingdom (UK)

Effective disaster management hinges on prompt, informed decisions, where social media has emerged as a real-time information source. However, its inherent noise makes manual information extraction challenging. Addressing this, our paper advocates for the use of supervised machine learning models in text classification, customized to specific locational needs. Diverging from generic AI models, we adopt a participatory approach to develop a taxonomy rooted in humanitarian documents and stakeholder engagement in Ghana and Mauritius. Our initial taxonomy has 39 social media indicators across four categories - urgent needs, impact assessment, situational awareness, and vulnerable populations. The survey responses yielded a prioritized indicator list for both countries, revealing substantial overlap in the 'impact assessment' category and notable variations elsewhere. This suggests a demand for region-specific machine learning models. We discuss a framework to train machine learning text classifiers for precise, relevant predictions aligned with the unique information requirements and priorities of each specific location. By integrating localized insights and specificities, our approach illustrates how tailored machine learning models could make them more effective, context-aware and responsive to the varied and dynamic nature of disasters happening in different places.

SESSION 2: TS 2-B

[TS 2-B] - Organisational vulnerability: Exploring the pathways - Dr. Paul Chipangura

North West University, Republic of South Africa

Purpose –This study aimed to address the underexplored domain of organisational vulnerability, with a specific focus on understanding how vulnerability is understood in organisations and the underlying pathways leading to vulnerability.

Design/methodology/approach – This study utilised a narrative literature review methodology, using Google Scholar as the primary source, to analyse the concepts of organisational vulnerability in the context of disaster risk studies. The review focused on relevant documents published between the years 2000 and 2022.

Findings – The analysis highlights the multifaceted nature of organisational vulnerability, which arises from both inherent weaknesses within the organisation and external risks that expose it to potential hazards. The inherent weaknesses are rooted in internal vulnerability pathways such as organisational culture, managerial ignorance, human resources, and communication weaknesses that compromise the organisation's resilience. The external dimension of vulnerability is found in cascading vulnerability pathways e.g. critical infrastructure, supply chains, and customer relationships.

Originality/value – As the frequency and severity of disasters continue to increase, organisations of all sizes face heightened vulnerability to unforeseen disruptions and potential destruction. Acknowledging and comprehending organisational vulnerability is a crucial initial step towards enhancing risk management effectiveness, fostering resilience, and promoting sustainable success in an interconnected global environment and an evolving disaster landscape.

KEYNOTE ADDRESS 2

[Keynote Address 2] – Recent Studies on Coastal Disaster Mitigation – Prof. Shibayama Tomoya

Institute Professor, Cho University & Professor Emeritus at Waseda University and Yokohama National University

Coastal disasters such as tsunamis, storm surges, and high wind waves are natural disasters that can occur in any coastal area worldwide. They happen when several natural conditions, such as earthquakes, typhoons, local topography, and social conditions, such as prior disaster experiences and preparedness, are combined as unfavorable circumstances for the coastal residents. They can occur at various time intervals, from tsunamis, which occur once every hundred or thousand years, to storm surges and high wind waves, which occur somewhere in the world every year due to typhoon strikes. They can be as extensive as the 2011 Tohoku earthquake tsunami or the 2004 Indian Ocean tsunami, which extended hundreds of kilometres along the coast, or as small-scale as the 2024 Noto Peninsula tsunami in the central part of Japan, where the tsunami inundated land in a narrow area of tens of kilometres. The purpose of surveying coastal disasters worldwide is to analyse them and then recommend strategies for disaster mitigation from a local perspective, adapted to the actual conditions in each region. As Japan has historically experienced many coastal disasters over the years since the beginning of history, it is also essential to organise this experience and contribute to disaster reduction worldwide. In practice, the first step is to conduct post-disaster field surveys and collect the data numerically and descriptively. In order to incorporate new findings into disaster mitigation methods, hydraulic model experiments are used to observe phenomena in more detail and to understand the physical processes. The results are then incorporated into a numerical prediction model to reconstruct a more concrete image of the disaster. By sharing these results with the local residents, it will finally be possible to construct rational disaster prevention structures and create evacuation plans tailored to the actual conditions of the region.

SESSION 3: TS 3-A

[TS 3-A] - Developing a Matrix to Measure the Vulnerability of Buildings to Flooding - Dr. Asish Seeboo

University of Mauritius, Republic of Mauritius

This investigation focuses on developing a matrix to gauge the vulnerability of residential buildings within the small island developing state member country of Mauritius. An observational study was carried out on 97 residences around the island to assess their current vulnerability to flooding. The potential sources of flooding were identified as (i) topography of the terrain, (ii) soil percolation, (iii) structure's floor level relative to adjacent terrain topography, (iv) effectiveness of drainage infrastructure within the plot area, and (v) the effectiveness of drainage infrastructure within the neighbourhood. A team of experts comprising major stakeholders (experts and academics with proven track records) was set up to determine the weightage associated with each flooding source using the Delphi technique. The Flood Vulnerability Score (FVS) was devised using a Likert scale of 1 to 5 defined as follows: (i) Low Vulnerability [$1 \leq FVS < 2$], (ii) Intermediate Vulnerability [$2 \leq FVS < 4$], and (iii) High Vulnerability [$4 \leq FVS < 5$].

SESSION 3: TS 3-B

[TS 3-B] – Application of the PIARC's International Climate Change Adaptation Framework for Road Infrastructure to Assess the Vulnerability of the Road Infrastructure in a SIDS - Mauritius - Dr. Roodheer Beeharry

Université des Mascareignes, Republic of Mauritius

Mauritius, as a small island developing state, is highly vulnerable to the adverse impacts of climate change. Physical infrastructure is being increasingly exposed to extreme events in SIDS with sizeable impacts on climate-sensitive sectors such as agriculture, fisheries, transport, energy, and tourism which, to a large extent, are dependant on road facilities. These sectors are key to SIDS' Gross Domestic Product (GDP) and strain public finances by increasing expenses and the cost of borrowing after weather events strike. Road networks also accommodate other important infrastructure facilities such as power transmission, telecommunication, water distribution and wastewater networks. Road assets are particularly vulnerable to climate stressors such as higher temperatures, increased precipitation, or flooding. Such physical risks threaten to damage essential transport infrastructure and disrupt supply chains. The objective of this climate change vulnerability assessment is to examine the resilience of the road network in Mauritius to the effects of climate change and growing extreme weather events. The methodology for the evaluation exercise employs the Climate Change Vulnerability Assessment Framework devised by the World Road Association and which consist of 4 stages and 17 steps. The latter document guides the collection of both primary and secondary data from relevant stakeholders, and also through review of existing literature on the subject, in view of the assessment process. Firstly, the criticality of the various elements of the road asset that may be affected are evaluated followed by the assessment of the system according to three criteria: sensitivity, exposure and the adaptive capacity. Based on the criticality aspects of road facilities in Mauritius and the above-mentioned three criteria, the specific vulnerability issues of road assets were identified. It was found that road assets in the island were relatively highly vulnerable to climate change due to major drawbacks in pavement engineering practices and lack of proper Road Asset Management implementation. Based on the pinpointed vulnerability aspects recommendations were formulated in view of promoting the resilience of road infrastructure to extreme weather events in the island.

SESSION 3: TS 3-C

[TS 3-C] - Improved messaging for early warning and resilience at municipal level in the Eastern Cape Province, South Africa – Prof. Dewald van Niekerk

Unit for Environmental Sciences and Management, African Centre for Disaster Studies, North-West University, South Africa

Community messaging plays a crucial role in effective early warning systems (EWS), helping to mitigate the impacts of both natural and human-induced hazards. It enhances the timeliness and accuracy of information dissemination, ensuring that at-risk populations receive critical alerts promptly and comprehensively. Effective community messaging acts as the link between technical early warning information and actionable community response. It ensures that warnings are communicated clearly, understandably, and in ways that are relevant to the local community, taking into account linguistic, cultural, and socio-economic factors. The likelihood of appropriate and timely responses is significantly increased by tailoring messages to specific community needs and contexts. This, in turn, can reduce loss of life, injuries, and property damage. Engaging communities in the development and dissemination of early warning messages is equally important. Involving community members in creating and testing messaging strategies fosters a sense of ownership and trust in the EWS. This inclusivity ensures that messages are not only received but also heeded and acted upon. Furthermore, the use of multiple communication channels, such as social media, local radio, and community networks, enhances the reach and reliability of warnings. This paper explores various aspects of early warning systems and community messaging, including its role in risk communication, community engagement, and the overall effectiveness of EWS within a selected community in the Eastern Cape Province of South Africa. It also addresses the challenges associated with community messaging, including ignorance, misinformation, message fatigue, and the digital divide. Solutions such as appropriate technology, focussed messaging, continuous education, leveraging trusted local leaders, and integrating traditional knowledge systems are discussed to overcome these barriers.

SESSION 4: TS 4-A

[TS 4-A] - Student Progres Paper: Exploring Perspectives on community participation in disaster risk reduction in selected southern African Countries - Ms. Kristel Fourie

North-West University, African Centre for Disaster Studies, Republic of South Africa

The literature is unequivocal about the importance of community participation in disaster risk reduction (DRR). Community participation is a key principle in disaster risk reduction and resilience building (Haynes et al. 2020). DRR requires empowerment and inclusive, accessible, and non-discriminatory participation particularly by those disproportionately affected by disasters (Valibeigi et al. 2019). However, in practice, community participation is often merely symbolic or non-existent (Pietropaolo, 2015). In the field of DRR, the focus on actions at a grassroots level, takes its lead from development thinking. This is so despite participation in development work being a contested concept and approach and one of the greater challenges with the concept of participation is that it is not entirely clear what constitutes effective, successful, or true participation in activities (Cornwall, 2006; Rowe and Frewer, 2005; Rifkin, 1986; Schmidt and Rifkin, 1996; Kilasi, 2019).

Some key criteria for participation to occur include, trust and extensive dialogue between stakeholders; bottom-up approach rather than top-down dictation and ownership of activities and outcomes (Agunga, 1989; Baxter et al., 2022; Mefalopulos, 2003; Cornwall, 2006; Makuwira, 2018). Several authors have argued that participation occurs on a continuum and therefore the different ways in which citizens participate should be considered carefully (see Arnstein, 1969; Agunga, 1989; Cornwall, 2008).
Africa the reduction of disaster risk is not driven by the communities affected by disaster events but rather follows a top-down approach by government (Van Niekerk and Coetzee, 2012). Considering Africa's colonial history, initiatives in for example, development have been done with the apparent intention of participation although it is the 'experts' who have the final decision-making power and that usually determine the rules of community participation (Mulenga, 1999; Cooke and Kothari, 2001). The conditionality that comes with funding is not only a concern with international funding organisations but also with government funding that then dictate what project stakeholders must do. Makuwira (2017) argues that Africa's dependency on development aid has in many ways just replaced the colonial rule that African countries had faced in the past. The concern with decision-making power thus extends to the conditionality in development assistance. Thus, it is argued that the existing knowledge on community participation in general, and community participation in DRR specifically has mostly been dominated by Western paradigms (Gaillard, 2019). In contrast, communities' definition of their specific needs, problems and solutions are very different from those usually put forward by service planners and providers (Twigg et al., 2001; Burns et al. 2004).

This study will take the already existing complexities of participation into account and explore what the concept of community participation means and establish which systems and frameworks of community participation are used for community participation in DRR in Southern. The study will aim to address the limited research on community participation in DRR drawing from Southern African perspectives. This is an exploratory reiterative study and the researcher is currently preparing for the first round of data collection.

SESSION 4: TS 4-B

[TS 4-B] - Identification of Barriers hindering Organizational Resilience to Climate Change induced Hydrometeorological hazards: A Case Study of Chikwawa District, Malawi - Mr. Japhet Khendlo

University Des Mascareignes, Republic of Mauritius

Malawi, like many nations worldwide, is increasingly grappling with the ramifications of climate change. Over the past two decades, the country has endured around 30 climate-related disasters, including floods, droughts, and heat waves which has resulted in the loss of 2500 lives, affecting 2.6 million people, and economic losses exceeding $1 billion. Notably, the southern region, particularly the District of Chikwawa, bears the brunt, with 40% of these disasters concentrated there. In light of the latter situation, this study seeks to evaluate organizations' capacity in Chikwawa District to adapt to the challenges posed by climate change. Primary data was collected through a questionnaire distributed among 25 organizations, involving 325 participants. Thematic analysis was employed to group the collected data in specific items and the 'Index of item Objective Congruency' and Cronbach's Alpha were used for reliability and validity of the questionnaire. Tests showed an IOC of 0.6 and Cronbach's alpha of 0.76, validating data for analysis. AHP method is applied to assess the relative importance of decision parameters. Alarmingly, 90% of the organizations surveyed had to suspend operations at some point due to climate-related disasters, while only a mere 5% engaged in collective initiatives to mitigate flood impacts across five flooding instances. Regarding external factors influencing resilience endeavors, 67% were found to lack flood mitigation measures whereby only 4% conducted risk assessments, of which only 5% implemented proactive measures. Among respondents, 90% relied solely on government initiatives for bolstering resilience measures and 70% relied on NGOs for assistance during devastating flood events. About 85% of organizations didn't act collectively regarding coordination and communication during extreme weather events. Businesses within the district were found to face multiple challenges such as lack of continuity planning, adaptive capacity, culture of learning, flexibility in approach, effective leadership, and lack of funding. The study sheds light on the urgent need for concerted action to enhance organizational resilience in the face of climate change. This study outlines a methodology to identify obstacles in promoting proactive organizational adaptation to the escalating impacts of climate change, aiming to protect lives and livelihoods in a community.

SESSION 4: TS 4-C

[TS 4-C] - Participatory Governance and Climate Resilience: Addressing Disaster Risk and Adaptation in Islands and Coastal Regions of the Global South – Catalina Spataru, Manta Nowbuth, Priscila Carvalho, Yaw Boafo, Ebenezer Amankwaa

Good governance in disaster risk reduction and resilience is fundamentally tied to the principles of participation, enabling individuals to express their views directly or via representation. This participatory approach underpins sustainability, ensuring the legitimacy and acceptance of decisions, especially in disaster risk management. Broad participation across all levels, from local communities to central agencies, incorporates diverse perspectives, enhancing the ethical and legal validity of decisions. Over the past several decades, international efforts have increasingly focused on understanding and managing disaster impacts. We advocate a theory of change that emphasizes stakeholder involvement in decision-making processes, leading to more informed choices and a higher likelihood of achieving substantive change. This approach involves co-creating and executing research that integrates both quantitative and qualitative expertise with stakeholder perspectives. It also highlights the importance of engaging appropriate stakeholders at specific stages of the decision-making or research cycle. Recognizing the interconnected global agenda for disaster resilience, we developed interactive processes to engage stakeholders in islands and coastal regions of the Global South. This initiative aimed to support the creation of a toolbox for equitable disaster risk reduction and resilience governance. Stakeholder engagement revealed various knowledge gaps in climate resilience and adaptation, emphasizing the need for methodologies that support resilience and adaptation across resource use and systems, as well as knowledge sharing among locations. In response to these insights, we developed a comprehensive toolkit for climate-related disaster risk reduction and resilience. This toolkit includes a range of methods and tools designed to address the unique challenges posed by floods, droughts, and heatwaves in islands and coastal regions. Our engagement with stakeholders in the Global South, particularly in islands and coastal areas, confirmed the urgent need for integrated tools like ours. These tools provide a more comprehensive understanding of the potential implications of governance changes for disaster risk reduction management. In this paper, we discuss the outcomes of our stakeholder engagements and how these interactions informed the development of our toolkit. By highlighting the importance of participatory governance and the integration of diverse perspectives, we demonstrate how collaborative efforts can lead to more effective and equitable disaster risk management strategies. Our findings underscore the critical role of inclusive and participatory approaches in building resilience and adapting to the impacts of climate change in vulnerable regions of the Global South.

SESSION 5 - TS 5-A

[TS 5-A] - Strategies for sustainable flexible pavement solutions and resilience in small island developing states- local possibilities - Mrs. Reshma Rughooputh

University of Mauritius, Republic of Mauritius

With urbanisation and economic development, road construction has been at the core of the island's priorities. Hence, transportation planning and providing for efficient and effective transportation are indeed at the forefront. However, the use of conventional road materials of flexible (bituminous) pavements contribute to greenhouse gas emissions and heat island effect. These are not in line with sustainable development goal, SDG 13, which is to "take urgent action to combat climate change and its impacts". Although locally, some initiatives are around using recycled asphalt pavement (RAP) are known, there exists no guidelines and strategies well documented to present the solutions geared towards sustainable flexible solutions. This paper presents an overview of the possibilities that can bridge the gap between conventional construction and sustainable construction, primarily through the use of waste materials and looking at how to decrease the emissions during the production and laying of the bituminous mix. The results are compiled from past studies that have been conducted and in line to promote circularity and thus, the circular economy. These well justify the importance and role of the government to emphasise on clear strategies, policies and incentives towards waste recycling in road construction and hence production of green asphalt. Enhanced institutional collaboration is required together with government and the construction industry to promote research and development (R&D) in the long term; while not delaying on already existing, short and medium strategies and technologies available. While some of these also include competition and pricing/ cost elements for the manufacturer, the SDG 13 and reducing the effects of climate change must be outrightly adopted.

SESSION 5: TS 5-B

[TS 5-B] - Decentralization of disaster risk financing to Local Councils in Malawi – Opportunities, Threats and Challenges - Mr. Maynard Nyirenda

Sustainable Development Initiative (SDI), Republic of Malawi

In recent years, Malawi has experienced severe disasters which have resulted in fiscal pressure and macroeconomic instability. International policy is widely supporting decentralization of disaster risk management (DRM). The central role of local government in disaster risk reduction is recognized in the Sendai Framework for Disaster Risk Reduction 2015-2030. However, the Global Assessment Report on Disaster Risk Reduction (2019) reported that around half of the local governments had their own local DRR strategy but are lacking in implementation due to financial incapability. In 1998, Malawi adopted the National Decentralization Policy. In line with the policy and the recognition that most disaster-related activities take place at the local levels, the need for devolving DRM functions is stipulated in the country's policy and legislative frameworks. However, the DRM Act (No. 27 of 2023) provides for decentralization of DRM functions and responsibilities to local councils without providing clear guidance on how the devolved mandates will be financed by local councils. This situation poses a number of questions such as; how are local councils funding decentralized DRM functions? and how can councils best finance DRM functions? Therefore, the purpose of this study is to provide answers to these and other related questions. This study seeks to examine the status of disaster risk finance at local government level in Malawi. Whereas a lot of research has been conducted on disaster risk management and decentralization, the concept of decentralized disaster risk financing is yet to receive scholarly attention. As such, this study contributes to this scholarly gap by focusing on how local governments can best finance devolved DRM functions. Assessment and review of disaster risk financing mechanisms at local government level is based on basic principles of fiscal decentralization and disaster risk financing. The study employs a mixed methods design that will focus both on secondary quantitative data and through key informant interviews. In addition, a review of relevant literature; policy and legislative documents; sectoral strategies and reports pertaining to financing DRM at local government level will be conducted.

SESSION 5: TS 5-C

[TS 5-C] - Adapting the CIERA framework for the measurement of road infrastructure resilience to climate-related events – Mr. Zaheer Doomah

University of Mauritius, Republic of Mauritius

The World is experiencing an unprecedented acceleration in climate change and many Small Island Developing States (SIDS) like Mauritius are experiencing extreme weather conditions more frequently. For centuries, the traditional drainage systems have acted as a crucial infrastructure to transport stormwater away from urban areas. However, with stronger adverse climate events and rapid urbanisation, the traditional drainage systems are facing significant challenges in coping with the excess runoff. The use of sustainable drainage systems (SDPs) has emerged as an alternative for increasing resilience due to their capacity to deal with stormwater runoff at source. However, the uptake of SDPs remain slow amongst professionals of the built environment in SIDS due to their inherent characteristics, with grey infrastructure still preferred. This study therefore aimed to identify the critical success factors (CSFs) and main barriers for the adoption of SDPs in SIDS.

A mixed method approach was adopted for the research with an exploratory sequential design used. Qualitative data was first collected in the form of semi-structured interviews from a purposive sample of nine experts working in the stormwater management field in both the public and private sector to gain an insight on the main critical success factors. Further to data saturation reached, the data collected was then used to develop a survey questionnaire that was administered to a sample of ninety five professionals in the sector in order to develop a ranking for the CSFs using the Relative Importance Index.

The study identified several CSFs with the five most highly ranked being increasing awareness on the benefits of SDPs, adopting a collaborative approach among stakeholders, providing more training on the implementation of SDPs, obtaining management and organizational support and attracting foreign investment for SDPs. The most important barriers emerging from the research were lack of appropriate guidelines on SDPs in SIDS, lack of experience and skills in SDP implementation, lack of collaboration among stakeholders, inadequate funding for SDPs and lack of research on SDP and their performance in SIDS.

This research helped to provide useful insights for both policy makers and professionals in the built environment on the main critical success factors and barriers for the wider adoption of sustainable drainage projects in SIDS to improve resilience .

SESSION 6: TS 6-A

[TS 6-A]- Identifying drivers of Mosquito-Borne-Diseases in Mauritius to promote public health resilience and mitigate public health disasters - Dr. Smita Goorah

University of Mauritius, Republic of Mauritius

Introduction: Mosquito-borne diseases (MBDs) can cause a major public health disaster. Climatic and environmental conditions, urbanization, changes in land-use, and the increased movement of people and goods worldwide are contributing to their increased transmission. Mauritius is at risk as it is situated in a vulnerable geographical region close to Africa where important MBDs are prevalent. Historically, Mauritius has experienced severe mortality due to malaria, chikungunya fever and dengue fever. Knowledge gaps exist in how MBDs and their potential drivers have evolved over time in the island especially in the context of the climatic conditions, increasing urbanization and marked changes in land use. It is increasingly being recognized that socioeconomic and mosquito habitat conditions increase the risk of MBDs in certain regions. Aims and Objectives: In this study, we use interdisciplinary research to identify potential drivers and vulnerability areas related to dengue fever Methods: Dengue fever cases were identified by municipal ward (MW) and village council area (VCA) and a map was generated on the software QGIS 3.12. Meteorological data consisted of rainfall data and temperature data. The Relative Development Index per VCA and MW was used as a proxy for socioeconomic factors. The population density was calculated per VCA and MW. The number of houses in close proximity to rivers were determined per VCA and MW. Statistical tests consisted of multiple regression analysis with dengue incidence per VCA and MW as the dependent variable. The independent variables per VCA and MW were the population density, the number of houses in close proximity to rivers, the RDI, the maximum rainfall and the minimum mean temperature. Results: The results suggest that the proximity of houses close to rivers has a significant positive effect on dengue incidence ($p=0.03$) implying that VCAs and MWs with more houses close to rivers had a higher dengue incidence. The RDI has a significant negative effect on dengue incidence ($p=0.01$) implying that the more developed VCAs and MWs had lower dengue incidences. The population density, mean lowest temperature and maximum rainfall have no significant effect on dengue incidence per VCA and MW ($p>0.05$).

SESSION 6: TS 6-B

[TS 6-B] - Assessing Coastal Community Coping Capacity and Vulnerability to Storm Surges Enhanced by Climate Change in Mauritius : A Case Study - Marie Anais Kimberley Therese

University of Mauritius, Republic of Mauritius

With limited landmass, low-lying terrains, and resilience on coastal resources, SIDS face an amplified vulnerability to the consequences of storm surges, a gap is addressed in that study by not only combining methodologies to assess technical and social aspects but also providing a holistic perspective, which distinguish itself from existing studies that predominantly focus on either technical or social dimensions of coastal vulnerability. A multifaceted approach evaluated vulnerability and coping capacity in Mauritius's coastal communities, employing Historical Analysis, Satellite Imagery Analysis, Coastal Vulnerability assessment, and Questionnaire Surveys. Utilising historical analysis, satellite imagery, and a coastal vulnerability index, insights into the village's history, storm impacts, and local vulnerabilities were gained. Focused on Rivière des Galets, a village in southern Mauritius with 500 residents across 60,000m², the study revealed coastal erosion rates ranging from -24.1m/yr. to 8.2m/yr. and a Coastal Vulnerability Index varying from 9.1 to 45.6. High-risk zones, lacking protective barriers and comprising sandy beaches, demand urgent attention for resilience and adaptation strategies amid increasing exposure to climate hazards. The research underscores the need to address both scientific and ethical/societal dimensions of climate adaptation, advocating for comprehensive coastal management. Despite existing protocols, a communication gap persists between authorities and locals. The study's multifaceted approach addresses physical vulnerabilities and community dynamics, offering insights for policymakers and community leaders. Recognizing the gap between policy structures and coastal residents' experiences, the research adopts a participatory, bottom-up approach through detailed surveys and interviews. By incorporating local perspectives into decision-making, it aims to inform resilient disaster management strategies, empowering communities and enhancing coastal resilience. Future works will extend this commitment by delving into understanding and improving policies for coastal resilience, fostering collaboration with the community. This holistic approach ensures that our research not only informs academic discourse but actively contributes to real world solutions fortifying coastal communities against future challenges by including numerical modelling, Community capacity and Policies Analysis & Improvement.

SESSION 6: TS 6-C

[TS 6-C] - Investigating information collection and decision-making skills amongst South African fire chiefs - Ms. Suna Meyer

North West University, ACDS, Republic of South Africa

Rationale of the research:
Emergencies are known to occur suddenly and unexpectedly and are consequently life-threatening. Due to the sudden nature of emergencies, time is of the essence and tremendous pressure is exerted on emergency responders. The most critical activity during emergencies is making decisions regarding the next steps. Decision-making in emergencies is challenging due to the high-stress levels in intense and dangerous situations. In the face of extreme time constraints, firefighters often receive information that is incomplete, contradictory, or confusing. Nonetheless, they must mentally process multiple pieces of important information about the emergency event and subsequently make correct decisions. The importance of these two skills (decision-making and information collection) in preventing unnecessary human and economic losses is encapsulated in the Knysna Fires of 2017 incident. In a forensic report on this fire, Klatzow makes the following statement "Of concern is the time, and repeated warnings were given to the authorities regarding this fire. It appears that these warnings did not result in any action (i.e. decisions) being taken. Prompt fire prevention methods such as water bombing and ground crews may very well have averted this fire catastrophe".

Method of Investigation:
The respective directors of the provincial disaster management centres will be contacted via e-mail. The purpose of the research will be explained thoroughly, and permission asked to continue with the study. Consent forms together with the questionnaires will be e-mailed to the respective provincial disaster management centres to be distributed amongst fire chiefs from local municipality fire departments. Participants will have six weeks to complete the questionnaires and return to the researcher.

The Crisis Leader Efficacy in Assessing and Deciding (C-LEAD) scale will be used (Hadley, Pittinsky, Sommer & Zhu, 2010). This tool is designed to assess the efficacy of individuals to perform critical behaviours (information assessment and decision-making) under extreme crisis situations.

SESSION 7: TS 7-A

[TS 7-A] - Insuring Against Infrastructure Quality and Reliability - Dr. Virendra Proag

University of Mauritius (retired), Republic of Mauritius

It is generally believed that when disasters occur, all is lost. Others say there are no disasters, only unheeded warnings. So, if these warnings are really taken into account, it should be possible to insure ourselves against those disasters, or at least try very hard.

The quality of an infrastructure can be assessed or determined through several performance characteristics that contribute to an overall performance satisfying a customer's requirements. These characteristics will change with the age of the product or service. For normal users, reliability means that a service has a high probability of being available in the quantity, quality, and at the time required. Exposition of the economy to foreign competition imposes stricter requirements, particularly on the reliability and quality of most activities, including infrastructure services, compared to local demands or those prevailing in a closed economy. Developing countries require significant improvements in infrastructure quality if they wish to participate effectively. These improvements are essential given that more than 80 % of their exports go to developed countries. Physical infrastructure such as roads, rail, air, and marine transport, telecommunications, power, becomes a pre-requisite for productivity growth and successful international competition.

This paper explains the approaches to increase the reliability of infrastructure systems. Possessing and driving car involves many risks which are now well studied and taken care of. It is proposed to examine similar possibilities which can be applied to infrastructure systems, using examples from Mauritius to present broad guidelines that could be applied in other countries.

SESSION 7: TS 7-B

[TS 7-B] - Comparative study of SPI and SPEI meteorological drought indices as drought assessment tools in Mauritius - Mr. Vimal Mungul

University of Mauritius, Republic of Mauritius

As per the World Meteorological Organisation (2024), drought had been defined as a global hazard which formed part of the natural climatic cycle resulting in a prolonged dry period that could occur anywhere in the world. It had also been defined to have a typically slow on-set caused mainly by a lack of rainfall. As per the sixth assessment report of the Intergovernmental Panel on Climate Change (IPCC) (2021), an increase in the frequency, intensity and duration of droughts would increase risks of food security globally. The key aspect of this study aims to highlight the application of the Standardised Precipitation Index in Mauritius as requested by international organisation such as the WMO. The results of the index would be compared with the novel Standardised Evaporation Precipitation Index (SPEI) which had been designed by Vicente-Serrano et al. (2010). The SPEI took into consideration the influence of global warming by introducing temperature as a main parameter in the computational methodologies of the SPEI index. The degree of agreement between the two indices in this study will be useful to the determine the most appropriate index for meteorological drought monitoring in Mauritius and would also clarify if global warming is having any influence on drought severity and occurrences in Mauritius. In order to get prepared, this study is compulsory to get the population prepared for such natural disaster and enable authorities for its associated disaster risk reduction.

Keywords: *SPI, SPEI, Degree of agreement, Drought*

SESSION 7: TS 7-C

[TS 7-C] - How to build resilience to impacts of climate change in data centers at Orange Business - Mr. Kaveesh Matabudul

University of Mauritius, Republic of Mauritius

Purpose

To build climate resilience, all stakeholders (companies, communities, and governments) must be able to foresee risks and hazards related to climate change, withstand shocks and strains, and eventually restructure and transform growth trajectories. Although open innovation is thought to be the driving force behind organizational resilience, little is known about its function and mechanism of action in enhancing organizational resilience. This work aims to explore the use of solar panels (PV) systems as alternative source of off-grid electrification in data centers. They give ways to supply data centers not currently served by the national grid with (clean) electricity. To get the most out of solar systems for off-grid electrification, their standards must be raised.

Design/methodology/approach

Both qualitative and quantitative data were collected for the methodology using methods such secondary data compilation, focus groups, surveys, historical data, and open data. Descriptive statistics were employed as the analytic approach for the quantitative data, and graphs, scatter plots, and frequency tables were utilized to analyze the data and look for any trends or outliers. Regression and Pearson correlation coefficients are two examples of inferential statistics. To create estimates or generalizations based on data, anova test, t-test, Chi square goodness of fit, and Chi square test for independence were employed.

Finally, a questionnaire survey was conducted to extract specific information from the chosen respondents. The questionnaire had allowed to collect data from respondents, provides a standard means for writing down answers and help in processing collected data. The types of questions were mainly Dichotomous, list, category, ranking Scales and Verbal.

Gap analysis

In the local context, we don’t have specialized laboratories that can perform such experiment and simulation to find out the perfect locations that are ideal to install solar panels to extract the most power from. Furthermore, such systems would require massive investments in terms of capital and time. Equipping every Mauritius firm with durable and long-lasting systems that will enable them to achieve higher energy and cost savings is the main objective of the Ministry of Energy and Public Services, firm Mauritius, Agence Française de Développement, and Switch Africa. In the national energy efficiency cluster, this might lead to a reduction of 173,000 tons of CO2 emissions and 40 MW in energy costs.

SESSION 7: TS 7-D

[TS 7-D] - Optimising Radar Technology for Meteorological Early Warning Systems: Insights from Gauteng – Prof. Roelof Burger

North West University, Republic of South Africa

The application of radar technology plays a crucial role in meteorological early warning systems. Weather radar, with its complex architectures and diverse capabilities, provides invaluable data for predicting and mitigating the impacts of various meteorological hazards. This paper examines different radar technologies and their applications, specifically focusing on Gauteng, South Africa, utilising data from the Irene S-band radar. Radar systems come in various types, including S-band, C-band, and X-band radars. Each type offers distinct strengths and weaknesses, influencing their suitability for specific weather phenomena. The deployment of these radars affects the aspects of weather hazards they can be optimised for, enhancing early warning systems for meteorological threats. By analysing data collected from the Irene S-band radar, we identify this technology's specific advantages and limitations within Gauteng's unique weather patterns. Gauteng, a region prone to thunderstorms, heavy rainfall, hail, and occasional tornadoes, presents a challenging meteorological observation and prediction environment. This paper demonstrates the practical applications and benefits of utilising advanced radar technology in early warning systems through a case study of Gauteng. The findings suggest that leveraging the strengths of different radar systems can lead to a more effective and reliable early warning system, better-protecting communities from the impacts of severe weather events. These principles can be applied across SADC nations with unique meteorological hazards. Using radar for early warning systems represents a significant advancement in meteorological science and disaster management. This study underscores the importance of selecting and optimising radar technologies based on specific meteorological hazards and regional characteristics. Insights gained from the Irene S-band radar in Gauteng highlight the critical role of radar technology in enhancing early warning systems and improving public safety amidst increasing weather-related risks.

SESSION 8: TS 8-A

[TS 8-A] - The etymology and understanding of disasters through the lens of Afrikaans as a mother tongue language - Prof. Leandri Kruger, Mr. Gideon Wentink & Prof. Christo Coetzee

North-West University, Republic of South Africa

The historical development of the Afrikaans language had a humble, yet complicated beginning. However, since its development Afrikaans has developed as a full-fledged scientific language in various contexts, including in disaster studies. To better understand disasters and the natural environment, several disaster-related terminologies has emerged in the Afrikaans language, namely, 'disaster', 'crisis' and 'catastrophe'. The aim of this study was firstly to investigate the unique disaster-related terminology used in the Afrikaans language, and secondly to investigate what it tells us about Afrikaans-speakers' understanding of disasters. A qualitative research approach was followed by applying Corpus and N-gram analyses to various disaster-related Afrikaans terminology. The study has found that when Afrikaans speakers refer to terms such as disasters, crises and catastrophes, their focus does differ, but that the core meaning of the three terms is similar. Although the analyses have showed that there is no focus on disaster risk reduction (DRR), it did however demonstrate that a humanitarian component precedes the terms, which indicates that the use of the terms is aligned with how they are contained in the scientific language. Therefore, Afrikaans as a mother tongue language plays a primary role in the etymology and understanding of disasters, as well as in the sustainable development of DRR and disaster management activities.

SESSION 8: TS 8-B

[TS 8-B] - Forecasting the Unpredictable: Integrating AI and ML into Disaster Risk Reduction in Southern Africa – Mr. Pieter-Wernich Bredenkamp

North-West University, Republic of South Africa

As disaster events become increasingly unpredictable and severe in the Southern African Development Community (SADC), there is a pressing need for continuously enhancing predictive models in disaster risk management. This article discusses the ongoing integration of Artificial Intelligence (AI) and Machine Learning (ML) into disaster risk management within SADC, focusing on how these evolving technologies can significantly improve the accuracy and timeliness of disaster predictions to effectively mitigate and manage disasters.

The development of advanced probability predictive models is facilitated by the iterative enhancements to the Regional Emergency Events Database (REM-DAT), which serves as the foundational dataset for applying AI and ML techniques. This integration aims to address the complexity of disaster phenomena, which involve variable factors such as climatic changes, population dynamics, and urban development.

The article outlines the methodologies employed to continuously improve predictive models using AI and ML. This includes data preprocessing to enhance data quality, the development of robust ML algorithms to process complex datasets, and the application of ensemble learning techniques that combine multiple models to improve prediction accuracy. Challenges such as data diversity, computational demands, and ensuring model interpretability are also discussed.
Empirical results from the deployment of these AI-enhanced models are examined to demonstrate their effectiveness in real-world applications. Case studies include the prediction of flood events and cyclone paths within SADC, showcasing significant advancements in emergency preparedness and risk reduction strategies facilitated by these models.

In conclusion, the ongoing integration of AI and ML into disaster risk management represents a dynamic and progressive approach to improving the predictive capabilities within SADC. This advancement not only enhances disaster preparedness but also offers a scalable model for other regions facing similar challenges.

SESSION 8: TS 8-C

[TS 8-C] - Higher Education in Mauritius as a Driver for Sustainable Development Goals : A Focus on Climate Change and Disaster Management - Mr. Laksham Sanassee

University of Mauritius, Republic of Mauritius

This study highlights the strategic importance of higher education institutions (HEIs) to minimize social, environmental, and economic losses from climate change and natural disasters to ultimately contribute to achieving Sustainable Development Goals (SDGs) in Mauritius. HEIs have a fundamental role to empower the communities, raise public awareness and develop environmental policies to move the nation towards a sustainable future. A qualitative exploratory research methodology was employed by analyzing academic journals, university curriculum documents and government disaster policies with the aim to develop a road map for HEIs in addressing the challenges of changing climate and disasters in Mauritius and other countries in the global south. The investigation found that HEIs in Mauritius are actively involved in strengthening professional human development through climate change education and disaster risk management (DRM) to build resilience. Universities are working with communities and vulnerable groups to raise awareness and avert the risks posed by climate change and natural disasters by promoting SDGs through the implementation of climate and disaster management curriculum, research projects, seminars and simulations. HEIs and other learning avenues such as workshops are found to be crucial to empower communities, transform lives and promote well-being in the light of changing climate and disasters. This knowledge transfer is particularly important given that the country faces frequent extreme weather conditions and the inherent connection between climate change, disasters, environmental issues, and the concept of Sustainable Development (SD).

SESSION 8: TS 8-D

[TS 8-D] - Participatory Climate Risk Analysis of Malawi-Zambia Transfrontier Conservation Area - S. Sitali & M. Dennison

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Botswana

"Communities in transboundary conservation areas are fundamentally dependent on agriculture for their livelihoods. While climate change is a threat to agriculture, it also threatens the communities' food security. Understanding risks as well as those related to climate change, is necessary to address future impacts on agricultural systems and support the development of adaptation programmes that are tailored to the needs of communities. The project Enhancing Climate Resilience and Cross-Border collaborations in Kasungu/ Lukusuzi area of the Malawi-Zambia (MaZa) TFCA implemented by International Fund for Animal Welfare and Community Markets for Conservation integrates results of the rapid climate risk analysis conducted in 2022- to promote a risk informed approach that enhances climate resilience.

Step 1: Desk Study
A desk study was conducted to identify scientific climate projections for Malawi and Zambia, specifically for MaZa TFCA.
Step 2: Community-level assessments
1.5-day-workshops were held in three communities using participatory group work exercises. Each community discussed pressing risks at local level, adaptation/ mitigation actions, type of resources needed to implement prioritised actions and potential implementation partners.
Step 3: TFCA-level assessments
Results from the desk study and community assessments were discussed and further enriched during sessions with MaZa TFCA management and local authorities.

The Zambian side of the TFCA is projected to experience more severe drought with pockets of higher rainfall found in the north and eastern border of the TFCA. Zambia is generally considered to be more vulnerable than the Malawian border region due to higher gender inequalities, general aspects of poverty and longer distances to markets. High temperatures and higher prevalence of crop losses are projected and have been observed by communities and there are generally shortened rainy seasons with flooding.

The findings led to systematic mapping of climate risks resulting in the development of a proposed over-arching TFCA-level climate change adaptation/mitigation plan. Further recommendations cover the inclusion of local communities using a gender sensitive approach in climate risk assessments to enrich scientific data and ensure ownership during implementation, and development of an integrated TFCA management plan that mainstreams climate change.

KEYNOTE ADDRESS 4

[Keynote Address 4] - High efficient and net-zero emission marine power system based on SOFC/GT for shipping decarbonization and disaster reduction - Prof.Xiaojing Lv

Shanghai Jiao Tong University, Deputy Director of Shanghai Urban Energy Society & Deputy Secretary General of China Marine Engineering Committee

To combat global climate change and reduce natural disasters, the development of efficient and secure marine equipment power generation systems and post-disaster island energy system fast recovery technologies has become a focal point for maritime powers worldwide. The Ship Solid Oxide Fuel Cell/Gas Turbine (SOFC/GT) power system, with an efficiency of over 70%, fuel flexibility, and near-zero emissions, is considered one of the most promising solutions for shipping decarbonization, increasing the resilience of the island's energy system, and moving towards carbon neutrality. This report elaborates on three key aspects. Firstly, starting from the characteristics of Marine green shipping for the future, how to carry out appropriate and scientific optimization design for the topological structure, component selection, parameter matching, and other aspects of the SOFC/GT power system of all-electric ships, to meet the load requirements of the target ship type. Secondly, how to decarbonize and efficiently convert hydrogen control technology for ship SOFC/GT using hydrocarbon fuel (Marine diesel, LNG, BIO-syngas, etc.) and non-carbonized fuel (NH3). In the last part, it is about how to realize safe and efficient intelligent control strategy of SOFC/GT all-electric in different ocean conditions and different channel environments, and how to realize long endurance and renewable power supply as a rapid recovery technology of island energy system after disaster.

SESSION 9: TS 9-A

[TS 9-A] - Comparison of two different spatial resolution LiDAR DEMs and Hydrologic Models for a Small Island Developing State, Mauritius – Mr. Mohammad Mozaffar Houssein Rasmally

University of Mauritius, Republic of Mauritius

History has witnessed the drastic change over the earth's climate with an alarming increase in flooding throughout the globe. Mauritius, being a Small Island Developing State has not been spared by the flood phenomenon and currently has over 300 flood prone regions. The island of Mauritius is characterized by steep gradients towards the sea, similar to nearby islands, namely, Rodrigues, Reunion and Seychelles. This topography causes surface runoff to move with high velocity during any heavy rainfall event, resulting in a rapid increase of flood depth. Most of the infrastructural development including built-up areas are located along the flat plains, foot of mountain and hills, near rivers and around the coast. As such, by nature of their location itself, the infrastructure is at high risk of flooding. It has also been observed that drainage infrastructure around the island is very limited in terms of channelling surface runoff. The problem of miscalculating the size of drainage networks is highly observed due to wrong estimation of catchment areas. The present study is an attempt to compare hydrologic models' response in terms of stream flow networks and catchments in two inland regions in Mauritius including Quatre Bornes and Saint Pierre using two different LiDAR Digital Elevation Models with 1-meter and 10 cm spatial resolution respectively in Geographical Information System (GIS) software. Hydrology toolset in ArcMap was used to generate the hydrologic models using the two dissimilar DEM resolutions. A reconnaissance was conducted to validate whether the stream flow networks obtained in GIS correspond to the existing watercourses on sites from the two types of DEM resolutions.

The output of the study has showcased the importance of using a high-resolution DEM (10-cm) for analyzing flooding more accurately for any small island characterized by steep slopes. The high-resolution DEM (10-cm) has aided in developing more realistic hydrologic models where the results obtained in terms of area coverage of catchments and longest distance of water flow path within a catchment would be accurate to facilitate the real calculation of drainage, culverts and bridges sizes based upon the surface runoff. Hence, the methodologies and findings adopted through the GIS platform produced could assist planners, engineers, decision makers and other relevant stakeholders in formulating effective flood mitigation strategies to reduce the vulnerability of the flood disaster.

SESSION 9: TS 9-B

[TS 9-B] - Towards Generation Resilience: A Comprehensive Optimization Model for Diversified Generation in the Democratic Republic of Congo's Power Sector – Ms Galila Khougali

University College of London, United Kingdom (UK)

The Democratic Republic of Congo (DRC) possesses significant hydroelectric potential, yet its heavy reliance on hydroelectric power plants, such as Ruzizi and Inga, renders its power sector vulnerable to climate-induced disruptions. Increasing occurrences of droughts and floods exacerbate water availability instability, and consequently energy access challenges. To address climate risks and enhance resilience, diversifying the generation mix—particularly through solar energy—offers a viable solution. This paper utilizes the PLEXOS techno-economic model to analyze DRC's electricity system, assessing the impact of diversification while considering hydroelectric plant seasonality. The results underscore the importance of diversifying electricity generation to mitigate climate-related risks and ensure power generation resilience amidst the country's growing energy access needs.

SESSION 9: TS 9-C

[TS 9-C] - Disaster Risk Reduction & Management downstream of the Bagatelle Dam in the event of a dam failure - Mr. Deejaysing Jogee

University of Mauritius, Republic of Mauritius

Dams are essential infrastructures for water storage, flood control, and hydropower generation. However, climate change poses new challenges to their safety. Dam failures due to climate change are a critical concern, and their impact can be significant. More frequent and intense cyclone and rainfall events can lead to overtopping or structural instability of dams. The collapse of two Michigan dams in 2020 highlighted the inadequacy of dam infrastructure to handle severe weather events. Since 2000, there have been at least 40 dam failures, resulting in hundreds of deaths. Communities downstream of dams should have robust emergency plans. The Bagatelle Dam is a newly constructed dam upstream of an existing highly urbanised area, the Ebene Cybercity, in Mauritius. This study attempts to identify the extent of downstream areas that would be affected in case of an unexpected failure of the dam and define critical zones which should be excluded from future developments. A conceptual model is proposed and numerical modelling was used to carry out a dam break analysis. GIS and HEC-RAS tools were used to identify the high-risk areas and assess dam break flooding events. It is observed that a dam break flood would have minimal impact on Ebene Cybercity and would follow the topography along the River Cascade towards the G.R.N.W. However, areas immediately downstream the dam and beyond the study area towards Reduit will be the most affected. A flood inundation map was prepared together with emergency action and preparedness plans for disaster management.

SESSION 9: TS 9-D

[TS 9-D] - Optimising the design of steel trusses withstanding tropical cyclonic wind load resulting from 3s gust of up to 280 km/hr - Mr. Sailesh Kumar Singh Nunkoo & Mr Varounen Pyaneeandee

University of Mauritius, Republic of Mauritius

Several researches have been carried out to optimise the design of steel trusses, but these mainly consider the combined effect of lower wind speed, compared to the combined effect of high wind speed which has been being studied in this research. Steel trusses subject to 3s gust of up to 280 km/hr has been considered in this research. This wind speed had been reached during tropical cyclones in the Indian Ocean. This research is expected to be very helpful for practising designers, who need to decide on the truss configuration that would optimise resource in such situation.
Five pinned-truss configurations, namely Pratt, Howe, Warren, Fink and Fan were analysed and designed with spans of 10m, 20m, 30m, 40m and 50m. The slope, height to eave, truss spacing, and width of building parallel to the trusses were kept constant. Loads were applied only at joints and the wind load combinations were considered. Square Hollow Sections for web and chords that satisfy the limit states were determined.

Warren truss configuration was found to be the most economical, followed by the Pratt configuration (except for the 30 m span, whereby Pratt configuration was more economical than the Warren configuration). The difference of weight of trusses increases with span. Warren configuration allows for a cost saving of about 20% compared to the Howe and Fan trusses. For the Pratt truss, the cost saving is about 10%.

It is concluded that the triangular arrangement of truss, which is subjected to cyclonic wind, has a considerable effect on the cost of the structure. This needs to be kept in mind by the designers. It is recommended that options with Warren and Pratt configuration of trusses be considered by the designers mainly for spans above 30m.

***Keywords**: Steel trusses, truss configuration, tropical cyclonic wind speed, optimisation*

SESSION 9: TS 9-E

[TS 9-E] - Using technology to bring coherence between climate change adaptation and disaster risk reduction for food security in South Africa - Dr. Annegrace Zembe

North-West University, Republic of South Africa

As disasters and climate change risks such as droughts and floods continue to affect food security (FS) globally, most governments, including South Africa, have resorted to the use of technology to incorporate climate change adaptation (CCA) and disaster risk reduction (DRR) to address FS issues. This is because most institutions and policies that address CCA, DRR and FS operate in parallel, which usually lead to polarisation of interventions and conflicting objectives, thus leaving the issue of FS unresolved. The purpose of the study was to investigate how FS projects are incorporating CCA and DRR using technology. A qualitative research design was applied; whereby in-depth interviews were conducted with ten project participants from two projects, while 24 key informants were purposively selected from government and research institutions. The main findings of the study revealed that both projects incorporate CCA and DRR measures in most of their food value chains. Although the projects are different in nature, they still face similar challenges, such as a lack of expertise, resources, funding, and an inadequate regulatory environment to improve their farming practices. The study brings in the practical side of addressing coherence between FS, CCA and DRR through technology and recommends a review of policies that support agriculture innovation to accommodate CCA and DRR measures.

SESSION 9 – TS 9-F

[TS 9-F] - Evaluating hydrological drought severity and duration with the application of the standardized precipitation index (SPI) – Dr. B. M. Hlalele

Human Sciences Research Council, South Africa

Hydrological droughts pose significant challenges to water management and require accurate and timely assessment for effective mitigation. These droughts have far-reaching implications that range from agricultural productivity to environmental degradation, thereby posing a complex challenge for policymakers as well. An evaluation of the severity and duration of such droughts is essential to serve as an early warning system to aid proactive intervention to protect livelihoods, the economy, human life and environment. The current study therefore aimed to evaluate the severity and duration of hydrological droughts using the Standardized Precipitation Index (SPI) across ten selected meteorological stations take at districts in Lesotho. Several statistical methods such as ANOVA, K-means clustering, and Mann-Kendall trend tests were deployed to identify significant variations in precipitation levels and drought patterns across different stations. The findings pointed at the existence of distinct clusters with varying degrees of drought severity and duration levels. Significant variations in precipitation levels were observed across the ten stations, as confirmed by an F-value of 15.462 and a p-value of less than 0.001 in the ANOVA test. K-means clustering identified four distinct clusters with varying mean precipitation levels. The Mann-Kendall trend test revealed significant trends in SPI values for Clusters 1 and 2 across all time scales and for Cluster 4 at the SPI-24 scale. Cluster 3 did not exhibit any statistically significant trend. Drought severity and duration also varied across these clusters, with Cluster 1 experiencing the most frequent and intense droughts, particularly on the 6 and 9-month scales. The study successfully identifies significant variations in drought patterns across different regions in Lesotho. The findings suggest the need for targeted water management strategies that are tailored to the specific characteristics of each cluster. Given that only 4.1% of the observed variance in precipitation could be attributed to the station factor, further research is recommended to identify additional contributing variables.

SESSION 10: TS 10-A

[TS 10-A] - Integrating disaster risk reduction and climate change adaptation: Challenges and Strategies for Improvement. – Dr. Daniel Etongo

University of Seychelles, Republic of Seychelles

Climate change is widely acknowledged as responsible for increasing the scale and intensity of disasters. The literature stresses the need to link disaster risk reduction (DRR) and climate change adaptation (CCA) to use scarce resources and avoid overlapping efforts efficiently. Both approaches have similar aims to reduce vulnerabilities and increase resilience. However, mainstreaming interventions for DRR and CCA are still not well understood due to insufficient scholarship in this domain. No study has been conducted in Seychelles that addresses this topic, given that adaptation is a national priority in Seychelles due to its vulnerability. To address this knowledge gap, an in-depth interview was conducted with 30 key stakeholders to explore the practices surrounding the integration of DRR and CCA in Seychelles. Barriers that impede the effective mainstreaming of DRR and CCA include i) lack of human and financial resources, ii) inadequate understanding of mainstreaming, iii) a lack of coordination and collaboration, iv) competing actors and institutions, v) lack of information, communication, knowledge sharing, and community involvement, and vi) policy gaps. Climate change is a cross-cutting issue that affects all sectors directly or indirectly, and by extension, it's a development challenge for Seychelles that depends on climate-sensitive livelihood activities. Overcoming these barriers to mainstreaming DRR and CCA would require Seychelles to fully implement the four priority areas in the Sendai Framework for Disaster Risk Reduction as follows: (1) understanding risk in its multiple dimensions; (2) strengthening disaster risk governance; (3) investing in disaster risk reduction for resilience; and (4) enhancing preparedness and build back better in response, recovery, and reconstruction. These challenges are underpinned by the political economy, which is the nexus of influencing actors relevant to DRR and CCA. This study thus recommends that an in-depth political economy analysis of these challenges be undertaken to identify reoriented institutional arrangements and efficient governance frameworks to assist the effective integration of DRR and CCA in Seychelles.

SESSION 10: TS 10-B

[TS 10-B] - Building Resilience Against Climate Change Disasters Through Indigenous Knowledge Systems in South African Communities - Ms. Noncedo Rofhiwa Maphosho

Human Sciences Research Council, South Africa

The Intergovernmental Panel on Climate Change defines vulnerability as the extent to which a natural or social system is prone to or incapable of dealing with the negative impacts of climate change, which includes climate variability and extremes. With a ranking of 96 out of 182 countries, South Africa is classified as severely vulnerable to climate change. However, climate resilience has mostly been studied from a modern contemporary lens thus creating a gap in knowledge on the potential importance of indigenous knowledge systems as a mechanism of creating climate resilience. The objective of this paper is to investigate the methods used by South African communities to develop resilience against climate-related disasters such as floods, droughts, and wildfires through their preparedness strategies. Research question: How have indigenous knowledge systems promoted resilience and mitigated climate change disasters in South African communities?

Methodology: A desktop review was used as the method of collecting data by analysing information from secondary sources obtained from PreventionWeb, Google Scholar, ReliefWeb, and EBSCOhost. The study further incorporated a wide range of sources including research reports, dissertations, and documents obtained from the United Nations Office for DRR, National Climate Change Information System (NCCIS), and South African Statistics, alongside government outputs. To ensure the relevance of the data obtained during the desk review, specific inclusion-exclusion criteria were applied.

Results: The strategy for addressing climate change relied on factors such as resource availability, knowledge, and location, whether rural or urban. As an illustration, farmers employed IKS techniques to enhance their crop preservation methods during severe weather, thereby supporting food security in neighbouring communities. Modern systems play a crucial role in helping urban communities prepare for and bounce back from disasters, often involving infrastructure damage that requires government assistance.

Implications: One possibility in disaster risk management is for communities to adopt a hybrid approach. The first element is effectively handling disasters by taking steps to mitigate their impact, being prepared for them, responding accordingly, and recovering from their consequences. Secondly, it should incorporate the experiential wisdom obtained from indigenous communities regarding their environment in order to foster resilience.

SESSION 10: TS 10-C

[TS 10-C] - Water Management Public Awareness: A social capital approach in a South African Semi - Informal Settlement - Mrs. Mojatsohle Kumang

Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform, Republic of South Africa

Public Awareness campaigns are imperative in explaining and disseminating information about sustainable water use and management. The study explored social capital factors and community building theory variables to assess the community's social cohesion and knowledge of water conservation. Furthermore, the study investigated whether public awareness could help reduce water scarcity. Empowering the community with scientific information and exchanging knowledge can influence better public behaviour change towards water management. A mixed - method approach assisted in answering the study research questions. During a transect walk through the community, the researchers randomly collected data through a semi - structured questionnaire from 108 participants that were available in each household. The study uncovered a steady degree of water supply disruptions in the settlement. During such periods, they were unable to afford to buy water. The results also indicated that the community lacked sustainable water use and management knowledge, further exacerbated by poor social ties that can assist in resolving water problems. Sanitation and hygiene issues were a problem for the community, such a blocked sewer system translating into waterborne infectious diseases. The increase in population in the informal settlement meant that the water demand exceeded the water supply. The study recommended transparency and accessibility of the municipality by the community to create trust. Local authorities must facilitate public awareness programmes to educate the community about minimizing water losses and promote effective water management. Another recommendation was rainwater harvesting for domestic use.

SESSION 10: TS 10-D

[TS 10-D] - Mapping sea water intrusion in a basaltic formation using geophysical techniques – Dr. Parvesh Balloo

University of Mauritius, Republic of Mauritius

Mauritius is a small island developing state and is seriously affected by the effects of climatechange as described through the Intergovernmental Panel on Climate Change (IPCC) report in 2014. The impacts of global warming, coupled with sea level rise owing to increasing rise in the temperature of the Indian Ocean, is resulting in severe impacts on water resources including groundwater resources. Actually, the aquifers of the island exist in dynamic hydraulic contact with the sea and are consequently subject to the growing risk of more severely being affected by seawater intrusion. This situation puts additional pressure on the limited fresh water resources of the island, in addition to the already growing demand which are due to the expanding economy of the country and the population increasing demand. During the dry periods, the water sector faces some challenges.

The need for better understanding of the coastal dynamics to guide more appropriate regulations that would ensure safe exploitation of brackish water was noted. Several approaches can be used for understanding coastal dynamics, but given the basaltic formation, characterized by highly heterogeneous subsurface formations, the use of the geophysical technology was selected to study the fresh water seawater interface.

In Mauritius, past studies revealed that the use of geophysical techniques to study the hydrogeology of the island dates back to 1962. Detailed investigation undertaken by Sentenac (1962) to map groundwater resources of the island, revealed the aquifers of the island were since then under the influence of seawater intrusion, with some regions being more at risk than others.

The aim of the present study was to characterise the freshwater seawater interface with map so as to define safe setback for exploitation of brackish water. It was found that the safe zone for the exploitation of brackish water was at a range of 42m form the high water mark up to a maximum distance of 188m which would therefore ensure a better management of seawater and reduce the negative impacts on groundwater resources.

SESSION 10 – TS 10-E

[TS 10-E] - Strengthening Disaster Resilience in Africa: Transdisciplinary Approaches and Sustainable Solutions: The Case Study of Metolong Dam, Maseru-Lesotho – O. Joseph & M. Setlhako

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Botswana

Every year, billions of dollars are being invested into long-term infrastructure projects, however, their planning processes often fail to take account of future climate change and related impacts, leading to high risks of damage and misguided investments that harbour potentially disastrous consequences for the economy and society at large. Against this background, a risk assessment process was conducted on the Metolong dam, supported by a series of complementary methodologies and tools, including the PIEVC Tool for Infrastructure Vulnerability and Risk Assessment, the PIEVC High-Level Screening Guide (HLSG), and the PIEVC Green Tool. The methodology was guided by five steps being: step 1: scope, context, and criteria, step 2: data gathering and sufficiency, encompassing climate and infrastructure data, step 3: risk assessment, involving a) the development of an impact chain to conceptualize climate related and other drivers of vulnerability and their impacts, b) scoring of climate hazard likelihood and severity of impact, and c) evaluation of key impacts and risk prioritization. Step 4: engineering analysis, which is an optional process not covered in this assessment and step 5: reporting, which presents key findings and recommendations.

Results of applying the PIEVC methodology revealed that the infrastructure components for the Metolong Dam and its supporting systems were generally resilient, but with a significant sub-set of risks which indicate potential vulnerability. The results suggested that little had been done in the past to consider the potential impacts of climate change on the water supply system and how climate change may influence the ability to deliver its intended services over time. Climate change represents an additional factor that can shift and increase existing threats to the structural integrity and the service reliability of the water supply system and its functional green and grey sub-systems, including the catchment, the reservoir, water treatment, dam, and water distribution network. Some of these risks can be managed through usual operating practices, however additional remedial measures are required to reduce significant and major risks in future time horizons.

SECTION 10 – TS 10-F

[TS 10-F] - Trends, Challenges and the Way Forward: Lessons learnt from the African Union Bi-annual Reporting on the implementation of the SFDRR and POA targets – C. Ceetzee

North West University, Republic of South Africa

Africa is a continent that is particularly vulnerable to disasters due to its geographic location, climatic conditions, and socio-economic factors. The frequency and severity of disasters such as floods, droughts, cyclones, and epidemics have devastating impacts on the region, resulting in loss of lives, displacement, and damage to infrastructure and the economy. The impacts of disasters are particularly acute in Africa's vulnerable communities, where poverty, poor infrastructure, and limited access to resources exacerbate their vulnerability. Due to the acute disaster risk the continent faces, the majority of the member states of the African Union signed the Sendai Framework for Disaster Risk Reduction in 2015. Subsequently, the African Union has been tasked to monitor the progress of member states in achieving the various SFDRR targets, as well as the additionally created Programme of Action (POA) targets ratified by African Union's Heads of State and Government at the 28th Extraordinary Summit in January 2017 in Addis Ababa. A major output of the monitoring task of the AU is the production of the biennial report containing results and trends crucial to inform decision-making relating to DRR on the continent. Currently, two reporting cycles have been completed (2015-2017 & 2019/2020) with the third report (2021/2022) currently being completed. Using a case study design this paper evaluates the major trends in disaster impacts on the continent during the past 3 reporting cycles. Additionally, it illuminates some of the key challenges in generating a clear picture of the continent's achievement of the SFDRR and POA targets such as lack of data collection and data management within member states, poor data coordination between government departments, disparate data collection methodologies and reluctance to engage with international existing disaster data platforms such as EMDAT and the Sendai Framework monitor. Finally, the paper looks at the potential way forward in improving data collection and management within member states to generate more accurate reporting during subsequent reporting cycles.

POSTER – 1

[POSTER 1] - Multiplicative model application to poverty vulnerability index construction: A study for Eastern Cape in South Africa - Prof. Bernard Moeketsi Hlalele

Human Sciences Research Council, Republic of South Africa

An assessment of vulnerability allows for a proactive rather than reactive approach. An identification of populations, communities or regions that are most susceptible to falling into poverty, is a critical component of the proactive disaster management activity. The Eastern Cape province of South Africa, with its predominantly rural population, is one such region characterised by significant poverty levels. The current study employed a multiplicative model as a framework to construct a poverty vulnerability index (PVI) aimed at quantifying poverty levels after a decade of government interventions. This model evaluates vulnerability based on three primary dimensions: Exposure, Sensitivity, and Adaptive Capacity. Data used was collected on proxy variables across these three dimensions from Statistics South Africa census 2022. All data from these variables were min-max normalised and aggregated first at municipality and finally district level with equal weighting of 0.2. The results indicated an observable increase in PVI from 2011 to 2022. However, statistical tests, the Mann-Whitney test in particular, revealed that this change was not statistically significant. Moreover, tests of normality and equality of variances highlighted the presence of heteroscedasticity and deviations from normal distribution, which underlined the importance of using non-parametric test. The rise in the Poverty Vulnerability Index (PVI) from 2011 to 2022 in Eastern Cape suggests limited success of governmental efforts in addressing poverty challenges. A thorough review of these interventions is necessary for improvement. The findings of this study urge policymakers to allocate resources to highly vulnerable districts and emphasise ongoing evaluation of poverty alleviation programs. Collaboration with local communities and NGOs is encouraged for impactful interventions. Districts with low Adaptive Capacity should prioritise capacity-building. The study accentuates the need for persistent actions to tackle poverty vulnerability in Eastern Cape given that it is one of the poorest provinces in South Africa.

POSTER – 2

[POSTER 2] - An on-line information and warning system for the water industry – D. Jogee & V. Proag

University of Mauritius, Republic of Mauritius

When industrial plants and processes are monitored manually, they rely on personnel to be on site during production. The personnel has to oversee and control operations and react to emerging issues. This is not only costly but can be dangerous for the personnel. In the water industry, the number of sampling locations have scaled up and become more remote, with a need for more automatic solutions. Supervisory Control and Data Acquisition (SCADA) systems are used for controlling, monitoring, and analyzing industrial devices and processes.

This paper proposes to show how the SCADA methodology can be used as an on-line information and warning system. A SCADA system, with the correct set of sensors, can collect any type of data from plant equipment, such as temperature, pH, conductivity, turbidity, and a host of other test parameters as long as there is a connection to the equipment. Data from the equipment is the raw data that the programmable logic controllers or remote terminal units then translate into comprehensible information for human operators to act upon. The SCADA systems help optimize production and control the production according to regulations within the industry. A SCADA system typically collects both live and historical data. While live data is often used for maintenance purposes as well as real-time tracking, historical data is often used for reporting and to improve plants' performance, using artificial intelligence principles.

POSTER – 3

[POSTER 3] - Making Existing Buildings Resilient to Flood: The Case Study of the Republic of Mauritius - Dr. Asish Seeboo

University of Mauritius, Republic of Mauritius

This study intends to develop means and methods of rendering existing buildings more resilient to disaster and flood. The emphasis is on residential buildings within the Republic of Mauritius, a member of the Small Island Developing States (SIDS). An observational study was carried out on 97 residences around the island to take stock of the current vulnerability of the structures to flooding. The potential sources of flooding were identified as (i) topography of the terrain, (ii) soil percolation, (iii) structure's floor level relative to adjacent terrain topography, (iv) effectiveness of drainage infrastructure within the plot area, and (v) the effectiveness of drainage infrastructure within the neighbourhood. For each of the identified flood sources, mitigating measure(s) were proposed and constituted of the following: (i) implementation of the on-site drainage system, and (ii) upgrading of existing drainage infrastructure within the plot as well as within the neighbourhood. A sample of TEN residences was used to determine the cost of flood resilience. A bill of quantities (BOQ) was made using the international measurement method. Using rates from graded contractors, the cost of making the buildings more resilient to flooding was determined to range between USD 2,000 and USD 8,000 for individual houses.

POSTER – 4

[POSTER 4] - Towards sustainable pervious concrete solution to promote sustainable drainage systems (SuDs) - Mrs. Reshma Rughooputh

University of Mauritius, Republic of Mauritius

Rapid urbanisation has led to increased imperviousness of the land cover. At the forefront of resilient cities, sustainable development and thus, sustainable development goals 11 (Sustainable Cities and Communities) and 13 (Climate Action), established by United Nations in 2015, lie the efforts required for countries in particular, small island development states (SIDS) to develop and improve on existing practices and technologies that are compatible to the global mandate. According to the executive opinion survey in the World economic forum report 2024, extreme weather events identify among the five risks the country faces. Consequently, flash floods are being witnessed more frequently with the heat island effect. Existing drains are often poorly maintained and extreme weather events urge to strategies and practices towards re- thinking and restoration of the urban drainage system (UDS). Sustainable development and construction need to be inclusive of engineering design and circularity concepts of materials use. The implementation of pervious concrete aligns itself with the concept of sustainable drainage systems (SUDs). In this study, the ceramic waste (CW) originating from construction and demolition waste (CDW), is used as replacement to virgin aggregate in percentages of 5%, 10%, 15% and 20% respectively. The testing programme for the pervious concrete properties comprised determination of density, porosity, compressive strength, flexural strength, elastic modulus, split tensile strength and permeability. A pavement model was constructed and subjected to oil dripping, sediment, fertiliser and rainfall simulation. The effluent was collected to assess its quality in each case. The most effective replacement was at 20% of CW and; there was a notable decrease in suspended solids (TSS) with the pavement model.

POSTER – 5

[POSTER 5] - Critical success factors for the implementation of Sustainable Drainage Projects in Small Island Developing States to improve infrastructure resilience – Case study of Mauritius -

Mr. Zaheer Doomah

University of Mauritius, Republic of Mauritius

Infrastructure forms the backbone of a country's economy and is required to function under both routine and extreme circumstances of emergency. Roads form part of the essential physical infrastructure and provide numerous benefits to society including lowered displacement costs, improved accessibility and increased value of land. However, road networks are subjected to numerous external threats throughout their lifespan ranging from physical, meteorological and even operational threats. With the advent of climate change, roads are becoming increasingly vulnerable to adverse events, with an urgent need for "climate proofing" through measuring and eventually building resilience in this type of critical infrastructure. This study focused on the adaptation of the Critical Infrastructure Elements Resilience Assessment (CIERA) method for measuring the resilience of road infrastructure with respect to climate-related events.

A qualitative approach was adopted to identify the parameters to be measured under the three main components of the CIERA framework, namely robustness, recoverability and adaptability. Semi-structured interviews were carried out with a purposive sample of 25 experts in the transportation field working in both the public and private sector. This yielded the various subcomponents of road infrastructure resilience for inclusion in the CIERA framework.

The study identified thirty-six parameters to be assessed for road infrastructure resilience. The three most important ones for the robustness component are implementation of protective security measures, adoption of new standards and design criteria and availability of alternative routes whereas for the recoverability component fund allocation, pre-approved response plans and robust emergency procurement processes have been most frequently cited. Lastly, appropriate risk management practices, investment in technological innovation and provision of training are considered important aspects for the adaptability component.

The study has provided a useful tool that can help to guide professionals in the transportation sector to better plan their road project and policy makers to\ create the necessary environment for building resilience in this critical infrastructure.

POSTER – 6

[POSTER 6] - Assessing the Resilience of the Chikwawa District in Malawi against Hydrometeorological Hazards using the UNDRR Disaster Resilience Scorecard Method - Mr. Japhet Khendlo

University des Mascareignes, Republic of Mauritius

Worldwide, the impacts of climate change are increasing in frequency and intensity, particularly in terms of hydrometeorological hazards such as floods, cyclones, landslides and mudslides. African countries are among regions having many LMICs which are increasingly experiencing the destructive effects of extreme weather events. This study concerns Malawi a LIC which has been witnessing the devastating effects of tropical cyclones, torrential rain and flash floods during the last decade on a regular basis. During the latter period millions of people have been affected, about 1500 human lives have been lost and an economic loss of totals to more than $ 800 million. This study adapts the UNDRR Disaster Resilience Scorecard for Cities to assess the resilience baseline for the Chikwawa District in Malawi with regard to hydrometeorological hazards. The methodology is structured around the Sendai Framework for Disaster Risk Reduction 2015-2030, and the UNISDR's Ten Essentials for Making Cities Resilient. Each of the ten essentials represent one of the main pillars that contribute to making a city climate resilient. The Preliminary level of assessment consist of 47 questions indicators each rated from 0 to 3. The detailed assessment level consists of 10 main criteria, the 10 Essentials which are further sub-divided into 117 indicator criteria rated from 0 to 5 which are used for a more in-depth analysis of the resilience of the area. Primary data sources obtained from 17 organizations from multi-stakeholder consultation meetings involving 243 participants were used for this assessment exercise. The outcome of this evaluation exercise shows that the actual capacity of the Chikwawa District for resilience against hydrometeorological risks is at 27% with regard to governance and financial capability and at 25% with regard to the dimensions of planning and disaster preparation, and 25% equally regarding disaster response and post-event recovery. This assessment provided a comprehensive snapshot of Chikwawa's exposure to hazard, its resilience status, and compliance to global resilience frameworks. It serves as a clarion call for concerted action, urging stakeholders to prioritize investments in critical areas while fostering collaborative approaches to disaster risk reduction

POSTER – 7

[POSTER 7] - A review of the Sustainable Drainage System (SuDS) in view of its application in Mauritius for achieving urban flood resilience - Dr. Roodheer Beeharry

Université des Mascareignes, Republic of Mauritius

Mauritius, a Small Island Developing State , is amongst the most vulnerable countries to climate change and one of the most exposed to natural hazards due to its geographical location in an active tropical cyclone basin. Due to Climate Change, serious threat to many African countries is the exposure to more intense tropical cyclones and/or more frequent torrential rains resulting in catastrophic floods. Compounding the problem is the way cities are expanding and the expansion of hard impermeable surfaces on the ground, which drastically changes the hydrological response of an area. The conventional solution to flooding problems is the provision of bigger and/or deeper drains which are still being highly inefficient with the increasing intensity of rainfalls. Building flood-resistant urban infrastructure, which is resilient to both future climate changes and increasing urbanization, is one of the pressing challenges of this century. The issue argues for a paradigm shift which moves from merely managing the risks of draining water 'away' to creating the opportunities of capturing stormwater locally and using it as a component of urban regeneration and urban greening and as a potential resource for water supply, local energy production and environmental restoration. The challenge of urban flood management is now seen as how to deal with stormwater at source through storage and infiltration systems, which attempt to recreate the characteristics of pre-development hydrology across an urban landscape. Sustainable Drainage Systems (SuDS) aim to control surface water run off close to where the rain falls and optimize natural drainage as closely as possible. The requisite components of a SuDS are; Source control, Swales, conveyance channels, Filtration, Infiltration, Retention & detention and Inlets, outlets & control structures. This study review existing literature about the Sustainable Drainage system in view of highlighting the practical and technical details for promoting its application in Mauritius and the African region where it has not been implemented and where it is much required in response of the deadly floods devastating the region.

POSTER – 8

[POSTER 8] - Adaptation to climate change in a SIDS country, Mauritius - Dr. Yashwaree Baguant-Moonshiram

University of Mauritius, Republic of Mauritius

Climate change is a persistent worldwide challenge that poses substantial threats to susceptible countries, including small island states like Mauritius. This paper analyses the impacts of climate change on Mauritius and evaluates the country's adaptive and mitigation measures to address the challenges posed by the altering climate. The historical climate data has been analysed to comprehend the deviations in sea temperature and rainfall. Spatial and seasonal differences in rainfall, as well as inter annual and decadal differences, pose challenges in detecting longer-term trends due to natural variability. The research examines the specific impacts of climate change on several sectors in Mauritius, such as agriculture, coastal ecosystems, water resources, and public health. Increasing temperatures and varying rainfall patterns pose dangers to crop harvests, while amplified heat combined with decreased precipitation worsens water stress. Furthermore, coastal areas are susceptible to rising sea levels, leading to increased flooding and erosion threats.

The study assesses the efficiency of Mauritius' climate change policies, action plans, and approaches. These initiatives intend to encourage adaptation and mitigation measures, such as coastal protection, reforestation, sustainable land use practices, and the promotion of renewable energy sources. The role of climate indicators, worldwide collaboration, financial support, and technology transfer in assisting Mauritius and using case studies of other SIDS in building climate resilience is also explored. To attain a sustainable and climate-resilient future, the research recommends science-based adaptation plans and policy responses to safeguard native fauna and flora and encourage a sustainable management. The enactment of the Climate Change Act (2020) serves as a basis for formulating and adopting effective adaptation policies, stressing the importance of scientific knowledge in modelling effective strategies. In conclusion, this paper sheds light on the many-sided effects of climate change in Mauritius. It highlights the firmness of implementing wide-ranging and sustainable climate change adaptation and mitigation actions to safeguard the nation's ecosystems, communities, and economy from the challenges posed by a changing climate.

POSTER – 9

[POSTER 9] - Infrastructure facing Severe Weather Conditions - Dr. Virendra Proag

University of Mauritius (Retired), Republic of Mauritius

Infrastructure systems are vulnerable and sensitive to two threats: (a) extreme weather events - heavy rainfall, strong winds, cyclones, droughts, etc.(b) long-term climate variations, which influence average weather conditions. Half a century ago, there was a hypothesis in Mauritius that strong cyclones occurred every 15 years. Then the tide changed. There does not seem to be stronger cyclones, but the probability of having a strong one is still there. Infrastructure deteriorates with climatic conditions, and judging by present ambient conditions, it is likely that future climates might not be different from present ones – with an added possibility of intense rainfalls, and higher temperatures. Infrastructure service quality, quantity or reliability can be adversely affected by weather conditions, the more so during or just after cyclonic conditions when the services attain a critical period of use. Infrastructure facilities are usually in service during decades, if not centuries, and given the constraints of planning associated with the uncertainty accompanying climate change predictions, it is judicious that resilience of infrastructure should be studied from a new standpoint, namely, the possibility of extreme events with "Long Return Periods", occurring within human lifetimes that constructive action be started in due course.

This paper will examine how cyclonic conditions have merged with climate change to affect infrastructure conception and design, with a need to redefine the criteria set out in building codes.

POSTER – 10

[POSTER 10] - Building Infrastructure Resilience for the Community - Dr. Virendra Proag

University of Mauritius (retired), Republic of Mauritius

Resilience indicates the possibility of an infrastructure system to perform properly even when subjected to critical conditions or the ability of the infrastructure systems to absorb and recover from the impact of disruptive events without fundamental changes in function or structure. This is in contrast to the concept of vulnerability which implies a measure of risk associated with the physical, social and economic aspects and implications arising from the system's ability to cope with the resulting event. Looking at the components of a water supply network quickly reveals its vulnerable spots, and the possibility to improve its resilience. As an infrastructure system is required to face disasters, it is necessary that features be inbuilt in the said facility (design, normal operation, etc) so as to provide better, if not complete, resilience to the system. Increasing the resilience of a system means that the degree of damage for a given intensity hazard will decrease. Unfortunately, it is not easy to measure resilience as this is influenced by the infrastructure system under study.

This paper first examines the ways resilience is being considered and then discusses them to determine methods to measure resilience, either qualitatively or quantitatively. Using the several approaches proposed in this paper, it should be possible to measure or compare resilience of two infrastructure systems. This should certainly be helpful when considering system alternatives for an infrastructure project.

POSTER – 11

[POSTER 11] - How to Communicate Disasters through the Media - Dr. Virendra Proag

University of Mauritius (retired), Republic of Mauritius

Nature still works and behaves according to some mysterious rules that are yet secret. If there is no critical examination of disasters, it is likely that the previous conditions that existed are repeated once more (same mistakes, similar type of construction, same place, with the possibility of similar risk hazards, etc). Should it be a surprise then if history does not just repeat itself with a similar occurrence. This paper presents a risk management framework to address the multiple goals of disaster risk reduction in order to be coherent with the planning of social and economic development, providing a design concept for the development of risk management policies. The legal basis for risk reduction policies is critical for transparent decision-making and allocating public funding for disaster mitigation. Risk management actually takes place on three different levels: (1) before the disaster – planning, drills and communication (2) during the event – communication, operations associated with the operation of existing systems (3) after the disaster – assessment and reconstruction and lessons learnt for starting all over. On a general note, however, after a disaster a priority list is established for rehabilitation works and reconstruction. Most infrastructure networks (such as roads, water, electricity, telephones, etc) should be in working condition as soon as possible. Often the repairs are provisional in nature with the result that they should be carried out again - at some other time in the future - when there is hopefully more money.
This paper uses examples from Mauritius to present broad guidelines that could be generally applicable.

ATTENDANCE WITHOUT PRESENTATION

Grassroots leadership: The role of Headmen in flood disaster risk management in the Cuvelai-Etosha basin of northern Namibia - Dr. Loide V Shaamhula

Faculty of Agriculture, Engineering & Natural Sciences, University of Namibia.

Floods are one of the common hazards that affect many people all over the world. Disaster risk reduction promotes Community Based Disaster Risk Reduction whereby solutions to hazards must come from the affected population themselves. The Sendai Framework for Disaster Risk Reduction advocates for collaborations between the affected communities, local leaders and municipalities to optimize risk reduction initiatives. However, local leaders (headmen) in the Cuvelai-Etosha basin of Northern Namibia, who are supposed to be key stakeholders in these collaborations, are mostly sidelined or not recognized. Their contribution to reducing risks is usually passive in most cases. Pertaining to the recurring floods (locally known as efundja) of the Cuvelai-Etosha basin, the main question of the study is; what is the role of local leaders (locally known as headmen) of the Cuvelai-Etosha basin in reducing the negative impacts of the recurring efundja? This question is answered by describing various activities headmen engage in dealing with efundja of northern Namibia.

Drawing from the recurring efundja events of the Cuvelai-Etosha basin of northern Namibia, this article demonstrates the vital role rural headmen can play in disaster risk reduction. Using a qualitative approach, the study draws data from continual engagements with rural headmen, researchers and practitioners in DRR over the past 12 years. 16 interviews with headmen, six interviews with government officials and six interviews with local councilors were conducted. The findings reveal that headmen indeed participate in various key activities of disaster risk reduction. They coordinate and encourage their communities to implement various preventative and mitigative strategies. These headmen coordinate preparatory activities such as promoting building concrete foundations rather than clay; building of dykes around homesteads and encouraging people to work hard to improve food security to reduce overall vulnerability. Since preparatory and mitigative measures are not always feasible, headmen participate in emergency response activities such as temporally relocating residents to higher grounds, distribution, and transportation of relief aid. With limited literature demonstrating the role of headmen in flood risk management, this study fills this gap and concludes that their participation in all these activities highlights their capacity and ability to run effective DRR initiatives. Though they may require further training and skill development, the results of this study demonstrate that their actions warrant their active participation in flood-risk management strategy development and implementation thereof.

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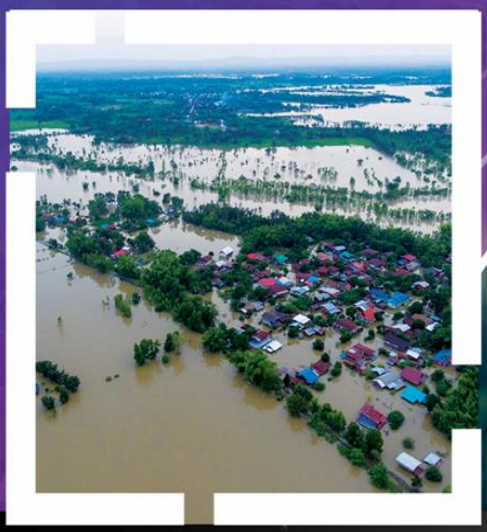

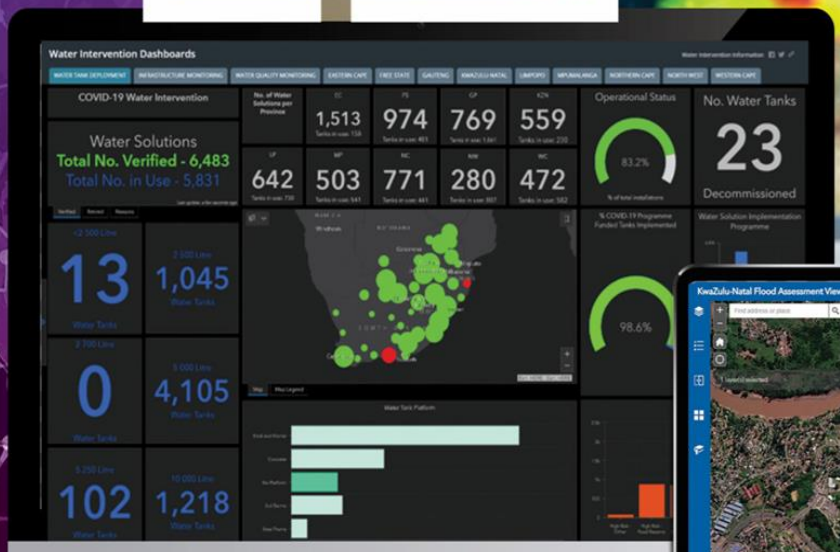

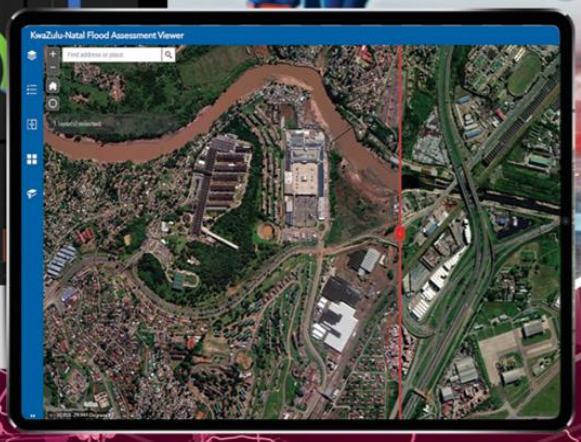

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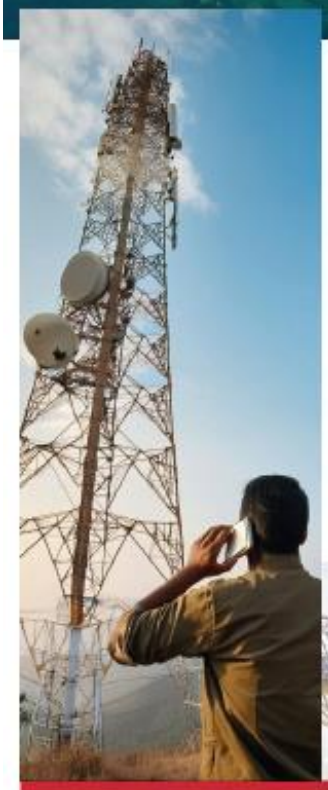

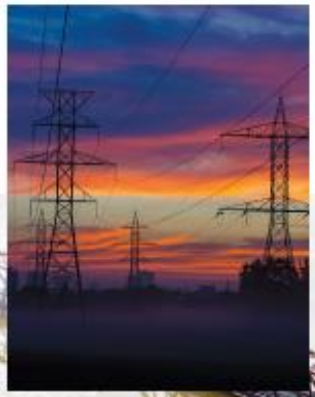

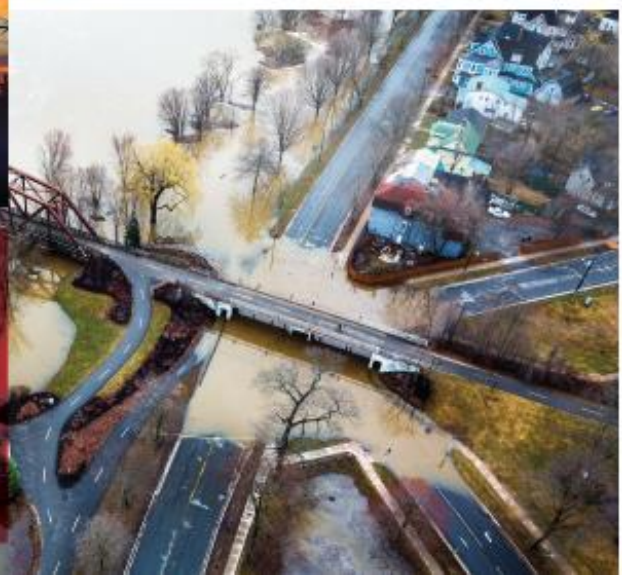

Promoting resilience of existing and future infrastructure systems to climate and disaster risks