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Building Resilient Societies Through a Holistic Approach to Disaster Management: A Perspective Article

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Abstract. The examination of disaster direction is pivotal in comprehending, mitigating, and addressing natural and human-man disasters that put at risk the welfare, safety, and sustainable development of global communities. This perspective article inspects the significance of evidence-based approaches in disaster management for ameliorating resilience and encouraging sustainable development. This perspective article is written on an overview of the literature that emphasises the significance of disaster management research in nurturing resilience, enhancing preparedness, and amplifying response and recovery efforts. This article scrutinises the manifold dimensions of disaster management research that extend from hazard evaluation and early warning systems to community engagement and policy devising. This standpoint advocates for more cooperation among researchers, policymakers, and stakeholders to formulate adaptive and proactive disaster management strategies for instituting resilient societies by advocating for a multidisciplinary and comprehensive approach.

Keywords: disaster management; resilience; preparedness; response and recovery; hazard evaluation

INTRODUCTION

Disasters, instigated by natural phenomena or human actions, can result in substantial loss of human life, property and environmental harm. Disaster management research aims to identify vulnerabilities, evaluate risks, and develop efficient strategies to mitigate the consequences of disasters (Rana et al., 2021). Unforeseen catastrophes can inflict havoc on society, resulting in economic and psychological losses (Supriya et al., 2021). The increase in natural disasters, accompanied by climate change, floods, earthquakes, and fires, has increased the quantity and total damage caused by these occurrences (Sergii et al., 2019). Due to its susceptibility to natural disasters, the United States has seen an increase in the frequency and costs of these events, particularly in urban and coastal areas (Talley, 2019). Natural disasters severely impact the environment, resulting in an alarming rate of environmental degradation (Kamboj et al., 2020). Inopportunely, natural disasters and state fragility can cause significant economic and financial disruption in low-income and middle-income countries (Albuquerque & Rajhi, 2019). Practical strategies for disaster management are essential for minimising the risk of casualties, protecting the environment, and minimising economic losses caused by disasters.

There has been a notable increase in scholarly investigations on disaster management in recent years. These studies have primarily centred around crisis and disaster management, which have become increasingly relevant as the global community grapples with enduring difficulties (Wolbers et al., 2021); enhancing disaster education research has also been favoured by researchers (Roslan et al., 2022). Numerous scholarly investigations have delved into diverse facets of disaster management. These encompass an examination of the proficiencies demanded of personnel engaged in disaster operations (Meduri, 2021), the utilisation of technology-driven proactive strategies for disaster management (Orimoloye et al., 2021), the establishment of a comprehensive national repository of health hazards to enhance disaster management and recuperation efforts (Ramos et al., 2021), and the significance of inter-agency collaboration and coordination in managing the risks associated with disasters (Shah et al., 2022).

This paper aims to underscore the importance of evidence-based approaches in disaster management to strengthen resilience and foster sustainable development. Thus, in this perspective article, we will explore and learn a comprehensive range of crucial aspects, including risk assessment and early warning systems, community engagement and capacity building, technological innovations and data-driven solutions, policy development and governance, climate change and disasters, global collaboration and knowledge sharing, and lastly, the prevailing challenges and intriguing future directions in the realm of building resilient societies through a holistic approach to disaster management.

Risk Assessment and Early Warning Systems

Disaster management constitutes a fundamental element in the pursuit of community resilience. Critical to this pursuit is a profound comprehension of a region's susceptibility to potential hazards. The efficient detection of high-risk areas and vulnerable populations can be accomplished by leveraging cutting-edge research in hazard evaluation, which relies on geospatial information, historical trends, and predictive modelling (Skilodimou et al., 2019). Incorporating such insights into robust early warning systems offers a promising avenue for averting the impacts of disasters, thereby considerably curtailing the loss of life and property.

Disaster management's heart lies in comprehending a region's unique susceptibilities to various hazards. Recognising the intricate interplay between geographical factors, environmental conditions, and community demographics is paramount in devising proactive and effective disaster response plans. Ghawana et al. (2021) emphasised that geospatial analysis is a powerful tool in this regard, enables us to overlay various data sets, such as population density, critical infrastructure, and environmental factors, to identify the most vulnerable areas and communities (Abid et al., 2021; Naqvi & Monasterolo, 2021).

Conducting thorough research and undertaking risk assessments are imperative in strengthening disaster management strategies. By scrutinising geospatial data and examining historical trends, one can decipher patterns and gain insights into past occurrences of disasters (Abid et al., 2021; Nohrstedt et al., 2022). Subsequently, predictive modelling can be used to anticipate potential future hazards, thus enabling the development of targeted preparedness and response measures (Cui et al., 2021). This scientific methodology empowers decision-makers to allocate resources efficiently, focusing on areas at the highest risk and susceptibility (Vinod et al., 2022).

Creating early warning systems results from thorough research and risk assessment. According to Cremen and Galasso (2020), these systems can significantly impact the current landscape, allowing for prompt and resolute actions in the face of impending dangers. He et al. (2020) revealed that using machine learning techniques, particularly semi-supervised learning methods, can potentially develop real-time early warning systems based on risk assessment. Machine learning possesses the capacity to enhance risk assessment to a considerable extent by utilising focused applications that yield evident advantages (Abdullah & Sofyan, 2023). Also, Awang et al. (2020) said risk prediction techniques could contribute to developing a comprehensive comprehension of networks, systems, services, and applications. This can support security operation centres in assessing risks. Sequential analysis can be valuable for detecting unforeseen health policy consequences in advance (Lu et al., 2018). Through the analysis of real-time data and its integration into prediction models, early warning systems can notify communities and decision-makers swiftly. These alerts facilitate the implementation of preventive measures, evacuation strategies, and resource mobilisation, thereby significantly reducing the impact of natural disasters on human lives and property.

Community empowerment is equally vital in guaranteeing the effectiveness of early warning systems. When individuals are knowledgeable and possess sufficient education about potential hazards, they are more inclined to actively engage and contribute to initiatives to prepare for and respond to disasters. Incorporating user-friendly interfaces and accessibility features is vital to developing early warning systems that serve homogeneous populations, including those with ample access to technology and resources (Neußner, 2021). These systems must adhere to standardised schemes across various risks and countries, incorporating standardised colour codes, terminologies, pictograms, and supplementary elements like auditory signals. Implementing multi-hazard early warning systems with consistent alarm levels across risks can minimise confusion and enhance public awareness.

Community Engagement and Capacity Building

It should be noted that the effectiveness of disaster management relies not only on the utilisation of cutting-edge research and modern technological tools but also on mobilising communal resources and collaboration. Recognising the significant contribution made by local inhabitants is a primary focus in disaster management research, underscoring the

importance of actively involving the community (Ishiwatari et al., 2020). Researchers can acquire vital insights into the groups' distinct needs, knowledge, and traditional coping mechanisms by including community engagement in the study process. Furthermore, capacity-building endeavours enable communities to proactively address possible hazards, foster self-sufficiency, and ultimately diminish susceptibility to disasters.

Community engagement in disaster management research is a fluid and evolving procedure that cultivates reciprocal comprehension and cooperation between researchers and residents. By engaging community people from the first stages, researchers can comprehensively understand the locality, its distinct susceptibilities, and cultural intricacies (Poger et al., 2021; Khan et al., 2023). Utilising a collaborative approach guarantees that catastrophe or disaster preparedness and response plans are tailored to the specific setting, considering local customs, and encompassing the different demands of the community (Ingham et al., 2021; Piltch-Loeb et al., 2022). Bidirectional learning is facilitated by this approach, enabling researchers to acquire valuable knowledge and insights from the community. In contrast, community members can enhance their understanding and proficiency in disaster management. This engagement additionally enables the recognition and use of community assets, including communication-based and trust-based local knowledge, which play a vital role in addressing the needs of vulnerable people in times of emergency.

Communities frequently exhibit enduring coping strategies transmitted across generations, originating from their cultural heritage and previous encounters with calamities (Banks et al., 2016). By actively participating in these conventional customs, researchers can develop a deeper understanding and recognition of the profound wisdom inherent in indigenous knowledge systems. Incorporating local knowledge and preserving community cohesion have posed challenges in the planning and execution of relocation initiatives in the United States, which aim to address climate-related concerns (Kumasaka et al., 2021). The use of such practices in disaster management techniques serves to bolster response efforts and augment the resilience of the community.

Using community-based knowledge has been crucial in safeguarding communities from natural hazards for an extended period. This significance has been acknowledged by contemporary catastrophe or disaster risk reduction plans, as highlighted by de Silva et al. (2021). Capacity-building activities are crucial to empowering communities to become proactive disaster preparedness and response agents. Providing pertinent training, information, and resources empowers community members with the necessary skills and knowledge to identify early indicators, effectively respond to emergencies, and engage in activities to enhance resilience is highly vital (Abdullah, 2022). Furthermore, these efforts cultivate leadership skills within the community, building a collective feeling of ownership and responsibility for protecting and preserving their overall welfare (Abdullah et al., 2020).

Disaster management transforms from a top-down approach to a bottom-up model by fostering community engagement and promoting capacity building. As Crow and Albright (2021) highlighted, this shift empowers communities to develop self-reliance. When individuals and local organisations possess the necessary knowledge and skills to respond effectively to disasters, their reliance on external assistance during emergencies is significantly reduced (Imperiale & Vanclay, 2021). The shift facilitates a sustainable recovery process, effectively enhancing communities' capacity to recover and reconstruct after a disaster (Robertson et al., 2021). Furthermore, the development of an enabling environment to sustain the progress made by civil society after a disaster can be achieved through the promotion of local community participation, facilitation of extensive non-government organisation (NGO) cooperation, and streamlining of state-civil society relationships (Yuan

et al., 2021). By fostering partnerships, we can harness collective expertise and resources to develop more comprehensive and effective strategies for disaster management. These collaborative efforts ensure that disaster response plans are based on scientific knowledge and incorporate the perspectives and goals of the communities they seek to safeguard.

Technological Innovations and Data-Driven Solutions

Rapid technological advancements have significantly transformed the landscape of disaster management. Advanced satellite imagery and sophisticated big data analytics have significantly transformed how researchers gather, analyse, and distribute vital information. Incorporating these technological advancements into disaster management strategies enables response teams to improve coordination and make informed decisions during emergencies.

Using satellite imagery has profoundly impacted disaster management by providing the capability to monitor events in real time. Satellite high-resolution sensors offer images with superior spatial resolution and the ability to consistently observe a specific target area. These attributes make them highly desirable for various applications, including but not limited to crop identification, mapping flood extents, and assessing vegetation health (Mazzoglio et al., 2021; Royimani et al., 2019; Yang, 2018). Real-time data enables timely assessment of the situation, promoting early response efforts and effective distribution of resources to areas with the highest demand (Abid et al., 2021; Sousa et al., 2021). Monitoring and forecasting natural hazards through satellite data has become feasible with recent advancements in satellite technologies, statistical and mathematical models, and computational resources (Bernardi et al., 2021). In addition, remote sensing technology, specifically satellite-based systems, can continuously monitor regions prone to geohazards (Bonneau et al., 2019). This functionality facilitates the implementation of proactive measures or timely alerts to safeguard human lives, assets, and commercial enterprises (Henriques et al., 2021). Satellite imagery is crucial in providing vital information for disaster management and response.

A new era of early warning systems has begun with the advent of big data analytics. Researchers can construct predictive models that identify potential disaster risks by utilising vast amounts of data from various sources, such as social media, remote sensors, and historical records (Yuan & Liu, 2018). This can be accomplished by employing big data and data mining techniques to observe and monitor patterns that can be utilised for predictive analysis (Vinod et al., 2022). Analysing historical data, physical, social, and political conditions can help comprehend the risk of natural disasters and identify contributing factors (Mustofa & Cirella, 2022). Big data has the potential to considerably enhance risk forecasting in a variety of domains, including economic and financial risks, environmental and sustainable development risks, and public and national security risks (Kernchen, 2020). In addition, using big data technologies can improve the pace and efficacy of links between disaster information and system response (Sarker et al., 2020). Moreover, the prevalence of social networks and human sensors can provide real-time, live data about actual physical events, which can be used to detect and predict physical events in general (Suprem & Pu, 2019).

Drones and robotics are invaluable assets in disaster-stricken areas, assisting with damage assessments and rescue efforts. Drones outfitted with cameras, sensors, and Artificial Intelligence (AI) capabilities provide real-time visual data to response teams, assisting in surveying impacted areas (Alsamhi et al., 2021). Similarly, robotics can be employed in hazardous areas, lowering the hazards to human responders and assisting in

search-and-rescue missions (Li, 2021). These technologies increase access in disaster zones, allowing for faster assessments and shorter response periods (Choi et al., 2021). They also help to reduce preventive risk and enable more precise mission planning and management (Feng et al., 2021). However, advancements in drone-helicopter communication and picture analysis are required to increase their utility in emergencies (Wankmüller et al., 2021). Drones and robotics are critical for efficient and safe disaster relief activities.

AI plays a crucial role in disaster management because it can effectively handle substantial volumes of data and detect patterns that would be disregarded through human analysis (Valle-Cruz et al., 2019). AI-based algorithms enhance the efficiency of resource allocation, enabling authorities to deploy emergency services more effectively. According to Chamola et al. (2020), machine learning algorithms improve disaster response tactics through iterative refinement, leveraging historical incidences to adapt to evolving conditions. Wong (2021) mentioned that AI has the potential to guarantee the provision of information to citizens, consumers, and customers in a highly efficient manner during periods of crisis. AI technologies, including robotics, drones, and sensors, have contributed to mitigating human casualties and reducing rescue operation duration (Serey et al., 2021). Integrating AI with big data facilitates the efficient provision of information during emergencies. In general, AI plays a crucial role in augmenting decision-making capabilities and optimising processes related to disaster management.

Modern technology has transformed disaster management communication and information sharing, enabling seamless coordination and collaboration among stakeholders (Covey, 2021; Mora et al., 2021). Real-time data exchange between local authorities, reaction teams, and relief organisations allows for better decision-making and resource allocation (Hassankhani et al., 2021). Advanced communication technologies guarantee that affected communities receive fast updates and counsel during critical moments, building confidence and transparency (Sakurai, 2021). However, using technology in disaster management poses problems and ethical concerns. Data privacy and security must be prioritised to safeguard individuals from potential threats from large-scale data collection (Ivanov et al., 2021). Furthermore, closing the digital divide is critical to ensuring equal access to technical solutions for all populations. By tackling these concerns, modern technology can improve disaster management efforts and promote more effective and inclusive responses.

Policy Development and Governance

In order to construct resilient societies, it is critical to integrate effective disaster management research with evidence-based policies and governance frameworks. Policymakers can make informed judgements to build catastrophe or disaster risk reduction plans, allocate resources efficiently, and construct robust regulatory systems by leveraging research findings (Aghapour et al., 2019). Policymakers can leverage this information to develop targeted interventions that address the specific needs of each region and ensure effective disaster risk reduction strategies (Nohrstedt et al., 2022). Aligning research findings with policy development promotes the implementation of comprehensive and adaptable disaster management frameworks, strengthening communities against the ever-changing challenges of natural and human-caused catastrophes or artificial disasters.

Policymakers can prioritise high-risk locations and allocate resources where they are most needed via research-driven policies (Hempel et al., 2021). Governments should direct funds and support towards developing resilience and assuring rapid response capabilities by identifying the potential impact of catastrophes on critical infrastructure, essential services,

and vulnerable populations (Nateghi et al., 2021). However, the database for catastrophe resource allocation techniques is sparse, with few solutions empirically validated in rigorous study designs (Fang et al., 2019). Transdisciplinary disaster research also understudies uncertainty assessment and communication (Behnassi et al., 2021). Furthermore, solid regulatory systems that handle land-use planning, construction rules, and emergency response protocols are required for efficient disaster management. Policymakers can use research findings to identify loopholes in existing legislation and implement new measures to improve preparedness and response (Lindner et al., 2021). Policymakers can enhance the safety and resilience of communities in the face of catastrophes by implementing regulatory frameworks that decrease exposure to risks and promote safety standards (Nohrstedt et al., 2022). As a result, more research is required to fill these gaps to build complete ways for assessing and managing disaster risks, combining varied data types, and recognising the significance of information variety in transdisciplinary modelling. This research can help policymakers make informed decisions about investing in various system protection initiatives while balancing desired resilience with budget restrictions.

The importance of adaptation in the face of evolving dangers is emphasised in disaster management studies. Governments may keep disaster management frameworks relevant and successful by constantly revising rules based on recent research findings and technological improvements. The ability to cope with developing issues is enhanced through flexibility and reactivity to changing conditions, establishing a culture of continuous growth and learning (Wolbers et al., 2021). Traditional disaster response strategies are straining to keep up with the increasingly complex, one-of-a-kind, and unpredictable catastrophic impacts. Decision-making under extreme uncertainty necessitates the development of novel methodologies and techniques to confront shifting risks (Meduri, 2021). The ability to predict, mitigate, and adapt to disaster risk is critical for preventing risks from becoming disasters. Investing in disaster resilience, adequate governance arrangements, and integrating disaster risk reduction, climate change, and sustainable development goals are all necessary for effective disaster management (Brown et al., 2021). The floods in Germany in 2021 highlighted the importance of enhanced early warning systems, information and data exchange, and critical infrastructure resilience (Thieken et al., 2023). The rising frequency of extreme occurrences due to climate change presents a problem that necessitates a flexible and responsive disaster management strategy (Behnassi et al., 2021).

Active involvement with stakeholders and impacted communities is required for effective policy creation in disaster management. Policies become more inclusive, relevant, and responsive by incorporating various viewpoints, local expertise, and feedback from individuals on the frontlines of catastrophes. Such participation ensures that policies are effective, acceptable, and accepted by the individuals they are meant to protect. The effectiveness of disaster management research is determined not only by generating valuable results but also by translating those discoveries into meaningful policies. Researchers and policymakers must work together to ensure that research findings are communicated and understood. Furthermore, policy implementation should be monitored and evaluated regularly to identify improvement areas and resolve any unexpected issues.

Climate Change and Disasters Introduction

Climate change is an irrefutable phenomenon that significantly impacts the frequency and intensity of disasters around the planet. As the world's temperatures rise, weather patterns shift, and extreme climatic events become more often, disaster management research becomes increasingly important in understanding the intricate interplay between climate

change and disaster occurrences. Recognising this connection and including climate change adaptation in disaster management techniques might help society increase its resilience to the changing environmental situation and reduce the catastrophic effects of disasters.

Climate change adaptation methods must be included in disaster management to handle the increased hazards caused by climate change. Investing in resilient infrastructure that can endure extreme weather events is one example (Ledda et al., 2021). Furthermore, creating specialised early warning systems for climate-related disasters is critical (Jia et al., 2021). Another significant part of climate change adaptation in disaster management is the promotion of sustainable land-use practices (Cubie & Natoli, 2022). These preventative strategies allow communities to better prepare for, respond to, and recover from disasters, decreasing human and economic losses (Mondragon Regalado & Arbul Pérez Várgas, 2021). Communities can successfully address the impacts of climate change and increase resilience to future climate-related hazards by including adaptation techniques in disaster preparedness, response, and recovery operations. In addition, disaster management research is crucial in improving risk assessments to account for the effects of climate change. Policymakers thoroughly grasp potential vulnerabilities and challenges by adding climate predictions and future scenarios into risk calculations. This method enables the development of targeted disaster management policies that consider the long-term effects of climate change on populations and ecosystems (Mondragon Regalado et al., 2021; Nohrstedt et al., 2022).

Active involvement with affected communities, climate knowledge and education, and community participation in co-designing adaption methods are all required for effective disaster management. By actively incorporating communities, disaster management can better understand the climate-related risks individuals and local organisations face (Bouzidi et al., 2022). This participation ensures that policies and actions are culturally relevant, inclusive, and tailored to the specific needs of each region (Behnassi et al., 2021). Involving communities in co-designing adaptation strategies also provides a more thorough grasp of each location's difficulties and potential (Imperiale & Vanclay, 2021). This method fosters community members' sense of ownership and empowerment, resulting in more effective and sustainable disaster management measures (Hidayat & Rasadi, 2020). Disaster management can improve resilience and mitigate the effects of climate-related risks by integrating climate knowledge, education, and community involvement.

Global Collaboration and Knowledge Sharing

The importance of global collaboration and knowledge-sharing in disaster management cannot be overstated, as the impact of disasters extends beyond national borders. This scenario highlighted the importance of disaster education in confronting the enormous challenge posed by natural disasters (Roslan et al., 2022). To effectively address cross-border challenges, it is crucial for disaster management research to foster international partnerships that facilitate the exchange of best practices, expertise, resources, and technology. Through the utilisation of collective efforts, societies have the potential to enhance resilience and foster a sense of unity to effectively address the challenges presented by disasters on a global scale.

Natural or man-made disasters have little regard for geographical boundaries. Many locations confront similar vulnerabilities and risks, necessitating global cooperation (Wolbers et al., 2021). Nations can overcome political divisions and collaborate towards a common aim of disaster resilience and response by pooling resources and expertise (Le Tissier & Whyte, 2022). This necessitates international coordination and cooperation (Sun et al.,

2021). For instance, controlling pandemics requires a strong government response, and critical for a successful health response to share resources and experiences through collaboration. This indicated that a global network is necessary to improve integrated human health risk resilience. Thus, future studies should identify universal crisis and disaster management trends and comprehend transboundary crisis management.

It is critical to share knowledge and best practices to improve disaster preparedness and response (Kontar et al., 2021). Nations can modify and improve their methods by learning from past experiences and effective interventions in various parts of the world (Crow & Albright, 2021). This knowledge exchange makes it easier to identify novel methods, new technology, and alternative methodologies that might not have been considered otherwise (Wolbers et al., 2021). International alliances facilitate capacity growth, particularly in places with inadequate disaster management resources or knowledge. More developed countries can help their counterparts better plan for and respond to disasters by providing training, technical aid, and knowledge transfer. This capacity building leads to a more cohesive and coordinated disaster management approach by strengthening the worldwide network of responders.

Global collaboration is essential for addressing different locations' specific disaster management concerns. Global institutions such as the United Nations and the World Bank enable dialogue, support collaborative projects, and create frameworks for standardised disaster management practices by encouraging international collaboration. This partnership provides for a better knowledge of the unique issues that each region faces, as well as the development of customised solutions that consider local realities. Global institutions use their influence and convening capacity to boost the collective global response to disasters. Regional disaster management bodies are also crucial in promoting international collaboration and ensuring that disaster management strategies are tailored to the specific demands of each region. Due to these coordinated efforts, disaster management becomes more effective and sensitive to the different contexts in which catastrophes occur.

Challenges and Future Directions

Disaster management research has significantly advanced, but the road to full resilience is challenging. Challenges like limited finance, data sharing obstacles, and cultural and societal intricacies necessitate inventive and collaborative solutions. Researchers can address complex crises proactively and pave the road for a more resilient future by emphasising interdisciplinary approaches and encouraging collaboration.

Inadequate financing and resource constraints make disaster management research difficult. Investing in research endeavours necessitates a financial commitment, which competing objectives may hamper. To address this issue, governments, international organisations, and the business sector must understand the fundamental value of disaster research and provide adequate financing to support long-term studies and initiatives.

Data is the foundation of disaster management research, yet sharing and obtaining helpful information remains challenging. Due to security concerns or a lack of agreed formats, data may be siloed across various agencies or countries. To facilitate collaboration and improve study quality, researchers must lobby for open data policies, promote data-sharing agreements, and adopt uniform data standards.

Cultural and socioeconomic complexities pose new obstacles to disaster management research. Risk perception, reaction tactics, and the importance of external interventions may differ between cultures. Researchers must use culturally sensitive methodologies that consider local knowledge and norms. Engaging with communities and stakeholders is critical

for understanding their needs and creating trust, ensuring inclusive and effective disaster management plans.

Interdisciplinary teamwork is required to address complicated crisis scenarios. Environmental scientists, social scientists, engineers, and public health researchers must collaborate to evaluate and handle multiple concerns. Interdisciplinary approaches foster complete understanding and allow for holistic disaster management plans considering physical and socio-cultural factors.

It is critical to change from reactive to proactive disaster management. Researchers should prioritise studies focusing on risk reduction, preparedness, and prevention. Disaster management solutions can be modified to avoid impacts before disasters by recognising vulnerabilities and potential risks. Proactive actions also save money in the long run and improve community resilience.

Global problems necessitate global solutions. Researchers must promote international cooperation and knowledge exchange. Collaboration can help to standardise procedures, build shared datasets, and facilitate cross-border learning from previous experiences. Global networks and partnerships are critical to developing a collective storehouse of information and expertise.

Building capacity is critical for long-term progress in disaster management research. Supporting training programmes and seminars, especially in low-resource areas, improves the capabilities of local researchers and practitioners. Investing in the next generation of researchers promotes resilience and continuity in the face of future problems.

CONCLUSION

Disaster management research is essential to protecting lives, property, and the environment. It is crucial, as climate change and other issues impact the future. Building resilience and readiness at all levels requires risk assessment, community engagement, technological innovation, and policy formation. Real-time monitoring and big data analytics can help researchers identify possible threats and respond swiftly. Engaging local communities and providing knowledge promotes ownership and active engagement in disaster preparedness and response. Adapting to climate change in disaster management prepares societies for climate-related calamities. This article also emphasises the importance of implementing effective policies that are informed by evidence-based research. Such policies are crucial for guiding decision-makers in developing proactive and adaptable disaster management frameworks. Also, through enhanced global collaboration and knowledge exchange, esteemed individuals such as government officials and authorities from various countries can effectively address cross-border issues and exchange valuable insights to foster resilience. In a nutshell, disaster management research is essential to a safer and more sustainable future. By focusing on global collaboration, interdisciplinary methods, and capacity building, we can face the future with resilience and resolve. Together, we can improve disaster management, promote sustainable development, and make the world safer for future generations.

REFERENCES

Abdullah, K. H. (2022). Mapping of literature on safety knowledge research using ScientoPy and VOSviewer. *Journal of Metrics Studies and Social Science*, *1*(1), 36–49. https://doi.org/10.56916/jmsss.v1i1.75

Abdullah, K. H., & Sofyan, D. (2023). Machine learning in safety and health research: a scientometric analysis. *International Journal of Information Science and Management*, *21*(1), 17-37. https://doi.org/10.22034/ijism.2022.1977763.0

Abdullah, K. H., Hashim, M. N., & Abd Aziz, F. S. (2020). A 39 years (1980-2019) bibliometric analysis of safety leadership research. *Test Engineering and Management*, *83*, 4526-4542.

Abid, S. K., Sulaiman, N., Chan, S. W., Nazir, U., Abid, M., Han, H., ... & Vega-Muñoz, A. (2021). Toward an integrated disaster management approach: how artificial intelligence can boost disaster management. *Sustainability*, *13*(22), 12560. https://doi.org/10.3390/su132212560

Aghapour, A. H., Yazdani, M., Jolai, F., & Mojtahedi, M. (2019). Capacity planning and reconfiguration for disaster-resilient health infrastructure. *Journal of Building Engineering*, *26*, 100853. https://doi.org/10.1016/j.jobe.2019.100853

Albuquerque, P. H., & Rajhi, W. (2019). Banking stability, natural disasters, and state fragility: Panel VAR evidence from developing countries. *Research in International Business and Finance*, *50*, 430-443. https://doi.org/10.1016/j.ribaf.2019.06.001

Alsamhi, S. H., Almalki, F. A., Al-Dois, H., Shvetsov, A. V., Ansari, M. S., Hawbani, A., ... & Lee, B. (2021). Multi-drone edge intelligence and SAR smart wearable devices for emergency communication. *Wireless Communications and Mobile Computing*, *2021*, 1-12. https://doi.org/10.1155/2021/6710074

Awang, N., Xanthan, A., Samy, L. N., & Hassan, N. H. (2020). A review on risk assessment using risk prediction technique in campus network. *International Journal of Advanced Trends in Computer Science and Engineering*, *9*(3), 251-257. https://www.doi.org/10.30534/IJATCSE/2020/3891.32020

Banks, L. H., Davenport, L. A., Hayes, M. H., McArthur, M. A., Toro, S. N., King, C. E., & Vazirani, H. M. (2016). Disaster impact on impoverished area of US: an inter-professional mixed method study. *Prehospital and Disaster Medicine*, *31*(6), 583-592. https://doi.org/10.1017/S1049023X1600090X

Behnassi, M., Gupta, H., Ramachandran, N., Winniefridah, M., Ramachandran, G., Lakeman, S., & Ashfaq, M. (2021). Effectiveness of disaster risk governance and resilience building: linkages, knowledge, inclusiveness, and regulation. *Social-Ecological Systems (SES) From Risks and Insecurity to Viability and Resilience*, 1-37. https://doi.org/10.1007/978-3-030-76247-6_1

Bernardi, M. S., Africa, P. C., de Falco, C., Formaggia, L., Menafoglio, A., & Vantini, S. (2021). On the use of interferometric synthetic aperture radar data for monitoring and forecasting natural hazards. *Mathematical Geosciences*, *53*(8), 1781-1812. https://doi.org/10.1007/s11004-021-09948-8

Bonneau, D. A., Hutchinson, D. J., DiFrancesco, P. M., Coombs, M., & Sala, Z. (2019). Three-dimensional rockfall shape back analysis: methods and implications. *Natural Hazards and Earth System Sciences*, *19*(12), 2745-2765. https://doi.org/10.5194/nhess-19-2745-2019

Bouzidi, Z., Boudries, A., & Amad, M. (2022). Deep learning and social media for managing disaster: survey. In *Intelligent Systems and Applications: Proceedings of the 2021 Intelligent Systems Conference (IntelliSys) Volume 1* (pp. 12-30). Springer International Publishing. https://doi.org/10.1007/978-3-030-82193-7_2

Brown, C. O., Hayes, J. L., & Milke, M. W. (2021). Planning to adapt: identifying key decision drivers in disaster response planning. *Civil Engineering and Environmental Systems*, *38*(1), 20-35. https://doi.org/10.1080/10286608.2021.1887155

Chamola, V., Hassija, V., Gupta, S., Goyal, A., Guizani, M., & Sikdar, B. (2020). Disaster and pandemic management using machine learning: a survey. *IEEE Internet of Things Journal*, *8*(21), 16047-16071. https://doi.org/10.1109/JIOT.2020.3044966

Choi, K., & Kim, J. H. (2021). UAV path planning method for avoiding restricted areas. *Intelligent Service Robotics*, *14*, 679-690. https://doi.org/10.1007/s11370-021-00386-3

Covey, H. (2021, October). Disaster documentation revisited: the evolving damage assessments of emergency management in Oregon. In *Proceedings of the 39th ACM International Conference on Design of Communication* (pp. 70-84). https://doi.org/10.1145/3472714.3473625

Cremen, G., & Galasso, C. (2020). Earthquake early warning: recent advances and perspectives. *Earth-Science Reviews*, *205*, 103184. https://doi.org/10.1016/j.earscirev.2020.103184

Crow, D. A., & Albright, E. A. (2021). *Community disaster recovery: moving from vulnerability to resilience*. Cambridge University Press. https://doi.org/10.1017/9781009053457

Cubie, D., & Natoli, T. (2022). Coherence, alignment and integration: understanding the legal relationship between sustainable development, climate change adaptation and disaster risk reduction. *Creating Resilient Futures: Integrating Disaster Risk Reduction, Sustainable Development Goals and Climate Change Adaptation Agendas*, 45-64. https://doi.org/10.1007/978-3-030-80791-7_3#DOI

Cui, P., Peng, J., Shi, P., Tang, H., Ouyang, C., Zou, Q., ... & Lei, Y. (2021). Scientific challenges of research on natural hazards and disaster risk. *Geography and Sustainability*, *2*(3), 216-223. https://doi.org/10.1016/j.geosus.2021.09.001

de Silva, A., Haigh, R., & Amaratunga, D. (2021). A systematic literature review of community-based knowledge in disaster risk reduction. *Multi-Hazard Early Warning and Disaster Risks*, 303-320. https://doi.org/10.1007/978-3-030-73003-1_20

Fang, Y. P., Fang, C., Zio, E., & Xie, M. (2019). Resilient critical infrastructure planning under disruptions considering recovery scheduling. *IEEE Transactions on Engineering Management*, *68*(2), 452-466. https://doi.org/10.1109/TEM.2019.2902916

Feng, X., Murray, A. T., & Church, R. L. (2021). Drone service response: spatiotemporal heterogeneity implications. *Journal of Transport Geography*, *93*, 103074. https://doi.org/10.1016/j.jtrangeo.2021.103074

Ghawana, T., Pashova, L., & Zlatanova, S. (2021). Geospatial data utilisation in national disaster management frameworks and the priorities of multilateral disaster management frameworks: case studies of India and Bulgaria. *ISPRS International Journal of Geo-Information*, *10*(9), 610. https://doi.org/10.3390/ijgi10090610

Hassankhani, M., Alidadi, M., Sharifi, A., & Azhdari, A. (2021). Smart city and crisis management: lessons for the COVID-19 pandemic. *International Journal of Environmental Research and Public Health*, *18*(15), 7736. https://doi.org/10.3390/ijerph18157736

He, R., Li, X., Chen, G., Chen, G., & Liu, Y. (2020). Generative adversarial network-based semi-supervised learning for real-time risk warning of process industries. *Expert Systems with Applications*, *150*, 113244. https://doi.org/10.1016/j.eswa.2020.113244

Hempel, S., Burke, R., Hochman, M., Thompson, G., Brothers, A., Shin, J., ... & Ringel, J. (2021). Allocation of scarce resources in a pandemic: rapid systematic review update of strategies for policymakers. *Journal of Clinical Epidemiology*, *139*, 255-263. https://doi.org/10.1016/j.jclinepi.2021.04.021

Henriques, M., Valério, D., & Melicio, R. (2021). Fractional order processing of satellite images. *Applied Sciences*, *11*(11), 5288. https://doi.org/10.3390/app11115288

Hidayat, B., & Rasadi, A. (2020). Disaster-based participatory development planning. In *E3S Web of Conferences* (Vol. 156, p. 01010). EDP Sciences. https://doi.org/10.1051/e3sconf/202015601010

Imperiale, A. J., & Vanclay, F. (2021). Conceptualising community resilience and the social dimensions of risk to overcome barriers to disaster risk reduction and sustainable development. *Sustainable Development*, *29*(5), 891-905. https://doi.org/10.1002/sd.2182

Ingham, V., Islam, M. R., Hicks, J., & Burmeister, O. (2021). Guide for community leaders to meet the challenges of personal preparation in the event of a disaster. *Australian Journal of Rural Health*, *29*(4), 502-511. https://doi.org/10.1111/ajr.12753

Ishiwatari, M., Koike, T., Hiroki, K., Toda, T., & Katsube, T. (2020). Managing disasters amid COVID-19 pandemic: Approaches of response to flood disasters. *Progress in Disaster Science*, *6*, 100096. https://doi.org/10.1016/j.pdisas.2020.100096

Ivanov, D., Blackhurst, J., & Das, A. (2021). Supply chain resilience and its interplay with digital technologies: making innovations work in emergency situations. *International Journal of Physical Distribution & Logistics Management*, *51*(2), 97-103. https://doi.org/10.1108/IJPDLM-03-2021-409

Jia, H., Chen, F., & Du, E. (2021). Adaptation to Disaster Risk—An Overview. *International journal of environmental research and public health*, *18*(21), 11187. https://doi.org/10.3390/ijerph182111187

Kamboj, N., Bisht, A., Kamboj, V., Pandey, N., & Bisht, A. (2020). Role of natural disasters in environmental degradation: an overview. *Environmental Degradation: Causes and Remediation Strategies*, *1*, 21-35. https://www.doi.org/10.26832/AESA-2020-EDCRS-02

Kernchen, R. (2020). Risk forecasting in the light of big data. *Journal of Risk Analysis and Crisis Response*, *10*(4), 160-167. https://doi.org/10.2991/jracr.k.201230.001

Khan, A. S., Wittenauer, R., Patel, R., Baseman, J., Miller, A., & Errett, N. A. (2023). Developing a concept of operations template to guide collaborative disaster research response between academic public health and public health agencies. *Disaster Medicine and Public Health Preparedness*, *17*, e39. https://www.doi.org/10.1017/dmp.2021.280

Kontar, Y. Y., Ismail-Zadeh, A., Berkman, P. A., Duda, P. I., Gluckman, P., Kelman, I., & Murray, V. (2021). Knowledge exchange through science diplomacy to assist disaster risk reduction. *Progress in Disaster Science*, *11*, 100188. https://doi.org/10.1016/j.pdisas.2021.100188

Kumasaka, O., Bronen, R., Harrington, E., Knox-Hayes, J., Laska, S., Naquin, A., ... & Tom, S. (2021). Planning for resettlement: Building partnerships for, by, and with indigenous peoples. *GeoJournal*, 1-21. https://doi.org/10.1007/s10708-021-10518-y

Le Tissier, M., & Whyte, H. (2022). Why does making connections through resilience indicators matter?. *Creating Resilient Futures: Integrating Disaster Risk Reduction, Sustainable Development Goals and Climate Change Adaptation Agendas*, 23-44. https://doi.org/10.1007/978-3-030-80791-7_2#DOI

Ledda, A., Di Cesare, E. A., Satta, G., Cocco, G., & De Montis, A. (2021). Integrating adaptation to climate change in regional plans and programmes: the role of strategic environmental assessment. *Environmental Impact Assessment Review*, *91*, 106655. https://doi.org/10.1016/j.eiar.2021.106655

Li, X. (2021). Some problems of deployment and navigation of civilian aerial drones. *arXiv preprint arXiv:2106.13162*. https://doi.org/10.48550/arXiv.2106.13162

Lindner, R., Lückerath, D., Milde, K., Ullrich, O., Maresch, S., Peinhardt, K., ... & Jaca, C. (2021). The standardisation process as a chance for conceptual refinement of a disaster risk management framework: the ARCH project. *Sustainability*, *13*(21), 12276. https://doi.org/10.3390/su132112276

Lu, C. Y., Simon, G., Soumerai, S. B., & Kulldorff, M. (2018). Counterpoint: early warning systems are imperfect, but essential. *Medical care*, *56*(5), 382. https://doi.org/10.1097%2FMLR.0000000000000896

Mazzoglio, P., Ajmar, A., Schumann, G. J., Balbo, S., Boccardo, P., Perez, F., & Borgogno-Mondino, E. (2021). Satellite-based approaches in the detection and monitoring of selected hydrometeorological disasters. *The Increasing Risk of Floods and Tornadoes in Southern Africa*, 19-37. https://doi.org/10.1007/978-3-030-74192-1_2

Meduri, Y. (2021). Personnel needs assessment in times of crisis: a focus on management of disasters. *RAUSP Management Journal*, *56*, 390-407. https://doi.org/10.1108/RAUSP-12-2019-0260

Mondragon Regalado, J. R., & Arbulú Pérez Várgas, C. G. (2021, July). Decision support systems in disaster risk management policies for adaptation to climate change. In *International Conference on Human-Computer Interaction* (pp. 506-512). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-78645-8_64

Mora, L., Kummitha, R. K. R., & Esposito, G. (2021). Not everything is as it seems: digital technology affordance, pandemic control, and the mediating role of sociomaterial arrangements. *Government Information Quarterly*, *38*(4), 101599. https://doi.org/10.1016/j.giq.2021.101599

Mustofa, I., & Cirella, G. T. (2022). Understanding the disaster risk of human settlements: Case research. *Human Settlements: Urbanisation, Smart Sector Development, and Future Outlook*, 43-57. https://doi.org/10.1007/978-981-16-4031-5_3

Naqvi, A., & Monasterolo, I. (2021). Assessing the cascading impacts of natural disasters in a multi-layer behavioral network framework. *Scientific Reports*, *11*(1), 20146. https://doi.org/10.1038/s41598-021-99343-4

Nateghi, R., Sutton, J., & Murray-Tuite, P. (2021). The frontiers of uncertainty estimation in interdisciplinary disaster research and practice. *Risk analysis*, *41*(7), 1129-1135. https://doi.org/10.1111/risa.13337

Neußner, O. (2021). Early warning alerts for extreme natural hazard events: A review of worldwide practices. *International Journal of Disaster Risk Reduction*, *60*, 102295. https://doi.org/10.1016/j.ijdrr.2021.102295

Nohrstedt, D., Parker, C. F., von Uexkull, N., Mård, J., Albrecht, F., Petrova, K., ... & Di Baldassarre, G. (2022). Disaster risk reduction and the limits of truisms: Improving the knowledge and practice interface. *International Journal of Disaster Risk Reduction*, *67*, 102661. https://doi.org/10.1016/j.ijdrr.2021.102661

Orimoloye, I. R., Ekundayo, T. C., Ololade, O. O., & Belle, J. A. (2021). Systematic mapping of disaster risk management research and the role of innovative technology. *Environmental Science and Pollution Research*, *28*, 4289-4306. https://doi.org/10.1007/s11356-020-10791-3

Piltch-Loeb, R., Bernard, D., Vallejo, B. Q., Harriman, N., & Savoia, E. (2022). Engaging community leaders in sharing local knowledge for emergency preparedness to leverage communication and trusted assets for vulnerable populations. *Disaster Medicine and Public Health Preparedness*, *16*(4), 1452-1458. https://doi.org/10.1017/dmp.2021.103

Poger, J. M., Murray, A. E., Schoettler, E. A., Marin, E. S., Aumiller, B. B., & Kraschnewski, J. L. (2021). Enhancing community engagement in patient-centered outcomes research: equipping learners to thrive in translational efforts. *Journal of Clinical and Translational Science*, *5*(1), e172. https://www.doi.org/10.1017/cts.2021.835

Ramos, C. D., Clamor, W. L., Aligaya, C. D., Te, K. N., Espiritu, M. R., & Gonzales, J. P. (2021). A disaster management system on mapping health risks from agents of disasters and extreme

events. In *Proceedings of the Future Technologies Conference (FTC) 2020, Volume 2* (pp. 523-537). Springer International Publishing. https://doi.org/10.1007/978-3-030-63089-8_33

Rana, I. A., Asim, M., Aslam, A. B., & Jamshed, A. (2021). Disaster management cycle and its application for flood risk reduction in urban areas of Pakistan. *Urban Climate*, *38*, 100893. https://doi.org/10.1016/j.uclim.2021.100893

Robertson, T., Docherty, P., Millar, F., Ruck, A., & Engstrom, S. (2021). Theory and practice of building community resilience to extreme events. *International Journal of Disaster Risk Reduction*, *59*, 102253. https://doi.org/10.1016/j.ijdrr.2021.102253

Roslan, M. Z. H., Sofyan, D., Oluwatoyin, I. M., Rojo, J. R., & Abdullah, K. H. (2022). A scientometric review of disaster education: Does it matter?. *Journal of Metrics Studies and Social Science*, *1*(2), 101-111. https://doi.org/10.56916/jmsss.v1i2.241

Royimani, L., Mutanga, O., Odindi, J., Dube, T., & Matongera, T. N. (2019). Advancements in satellite remote sensing for mapping and monitoring of alien invasive plant species (AIPs). *Physics and Chemistry of the Earth, Parts A/B/C*, *112*, 237-245. https://doi.org/10.1016/j.pce.2018.12.004

Sakurai, M. (2021). Communication structure, protocol and data model toward resilient cities in Japan. *Emerging Technologies for Disaster Resilience: Practical Cases and Theories*, 83-99. https://doi.org/10.1007/978-981-16-0360-0_6

Sarker, M. N. I., Peng, Y., Yiran, C., & Shouse, R. C. (2020). Disaster resilience through big data: way to environmental sustainability. *International Journal of Disaster Risk Reduction*, *51*, 101769. https://doi.org/10.1016/j.ijdrr.2020.101769

Serey, J., Quezada, L., Alfaro, M., Fuertes, G., Vargas, M., Ternero, R., ... & Gutierrez, S. (2021). Artificial intelligence methodologies for data management. *Symmetry*, *13*(11), 2040. https://doi.org/10.3390/sym13112040

Sergii, I., Azarov., Oleksii, S., Zadunaj. (2019). Analysis of natural disasters and their impact on the environment, *32*(4), 78-91. https://www.doi.org/10.32347/2411-4049.2019.4.78-91

Shah, I., Mahmood, T., Khan, S. A., Elahi, N., Shahnawaz, M., Dogar, A. A., ... & Begum, K. (2022). Inter-agency collaboration and disaster management: A case study of the 2005 earthquake disaster in Pakistan. *Jàmbá-Journal of Disaster Risk Studies*, *14*(1), 1088. https://doi.org/10.4102%2Fjamba.v14i1.1088

Skilodimou, H. D., Bathrellos, G. D., Chousianitis, K., Youssef, A. M., & Pradhan, B. (2019). Multi-hazard assessment modeling via multi-criteria analysis and GIS: a case study. *Environmental Earth Sciences*, *78*, 1-21. https://doi.org/10.1007/s12665-018-8003-4

Sousa, J. J., Liu, G., Fan, J., Perski, Z., Steger, S., Bai, S., ... & Peres, E. (2021). Geohazards monitoring and assessment using multi-source earth observation techniques. *Remote Sensing*, *13*(21), 4269. https://doi.org/10.3390/rs13214269

Sun, Y., Liu, T., Ye, T., & Shi, P. (2021). Coordination and cooperation are essential: a call for a global network to enhance integrated human health risk resilience based on China's COVID-19 Pandemic coping practice. *International Journal of Disaster Risk Science*, *12*, 593-599. https://doi.org/10.1007/s13753-021-00364-4

Suprem, A., & Pu, C. (2019, December). Event detection in noisy streaming data with combination of corroborative and probabilistic sources. In *2019 IEEE 5th International Conference on Collaboration and Internet Computing (CIC)* (pp. 168-177). IEEE. https://doi.org/10.1109/CIC48465.2019.00029

Supriya, M. S., Manjunath, K., & Kavana, U. R. (2021). The rise of IoT and big data analytics for disaster management systems. In *Handbook of Research on Innovations and Applications of AI, IoT, and Cognitive Technologies* (pp. 42-62). IGI Global. https://www.doi.org/10.4018/978-1-7998-6870-5.CH003

Talley, J. W. (2019). Disaster management in the digital age. *IBM Journal of Research and Development*, *64*(1/2), 1-5. https://doi.org/10.1147/JRD.2019.2954412

Thieken, A. H., Bubeck, P., Heidenreich, A., von Keyserlingk, J., Dillenardt, L., & Otto, A. (2023). Performance of the flood warning system in Germany in July 2021–insights from affected residents. *Natural Hazards and Earth System Sciences*, *23*(2), 973-990. https://doi.org/10.5194/nhess-23-973-2023

Valle-Cruz, D., Alejandro Ruvalcaba-Gomez, E., Sandoval-Almazan, R., & Ignacio Criado, J. (2019, June). A review of artificial intelligence in government and its potential from a public policy perspective. In *Proceedings of the 20th annual international conference on digital government research* (pp. 91-99). https://doi.org/10.1145/3325112.3325242

Vinod, A. M., Venkatesh, D., Kundra, D., & Jayapandian, N. (2022). Natural disaster prediction by using image based deep learning and machine learning. In *Second International Conference on Image Processing and Capsule Networks: ICIPCN 2021 2* (pp. 56-66). Springer International Publishing. https://doi.org/10.1007/978-3-030-84760-9_6

Wankmüller, C., Kunovjanek, M., & Mayrgündter, S. (2021). Drones in emergency response–evidence from cross-border, multidisciplinary usability tests. *International Journal of Disaster Risk Reduction*, *65*, 102567. https://doi.org/10.1016/j.ijdrr.2021.102567

Wolbers, J., Kuipers, S., & Boin, A. (2021). A systematic review of 20 years of crisis and disaster research: Trends and progress. *Risk, Hazards & Crisis in Public Policy*, *12*(4), 374-392. https://doi.org/10.1002/rhc3.12244

Wong, Y. K. (2021, September). Dealing Crisis Management using AI. In *CS & IT Conference Proceedings* (Vol. 11, No. 14). CS & IT Conference Proceedings. https://doi.org/10.5121/ijcsea.2021.11502

Yang, C. (2018). High resolution satellite imaging sensors for precision agriculture. *Frontiers of Agricultural Science and Engineering*, *5*(4), 393-405. https://doi.org/10.15302/J-FASE-2018226

Yuan, F., & Liu, R. (2018). Feasibility study of using crowdsourcing to identify critical affected areas for rapid damage assessment: Hurricane Matthew case study. *International Journal of Disaster Risk Reduction*, *28*, 758-767. https://doi.org/10.1016/j.ijdrr.2018.02.003

Yuan, Y., Zomorodian, S., Hashim, M., & Lu, Y. (2021). Devastating earthquakes facilitating civil societies in developing countries: across-national analysis. *Earthquake Disasters*, 84-102. https://doi.org/10.4324/9781003173328-6