



## Managing disasters with advanced technology solutions: Introduction to the special issue

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### ABSTRACT

This Special Issue explores how technology-based regenerative services can strengthen disaster management and foster resilient communities. Drawing on 11 peer-reviewed articles, the collection advances two interlinked themes: (1) regenerative services that move beyond short-term recovery to actively restore ecosystems, social systems, and livelihoods; and (2) technology management in disaster contexts, where tools such as AI must be adapted to unstable, resource-constrained environments. The contributions demonstrate that resilience is multi-dimensional—ecological, socio-technical, and economic—and that technology acts both as an enabler and a barrier, depending on its accessibility, adaptability, and governance. Across the studies, three insights emerge: resilience requires proactive and regenerative strategies, technology is a catalyst for coordination when effectively managed, and equity is central to sustaining resilience. Collectively, the Special Issue underscores the need for interdisciplinary approaches that integrate environmental science, social sciences, and technology management to design inclusive, adaptive, and regenerative disaster responses.

### 1. Introduction

This Special Issue (SI) will examine how the coordination of technology-based regenerative services improves the management of disasters to build a resilient community (NRC, 2012; Yang et al., 2023). This SI aims to explore the cutting-edge intersections between technology, regenerative services, and disaster management, highlighting research, case studies, and innovative technologies that can help mitigate, prepare for, respond to, and recover from disasters (George et al., 2016). Sustainable Development Goal (SDG) 11 is about Sustainable Cities and Communities, which focuses on making cities and human settlements inclusive, safe, resilient, and sustainable (IPCC, 2023). It directly addresses disaster risk reduction by emphasizing the need for resilient infrastructure, disaster preparedness, and effective response to natural and human-made hazards. Hence, a special issue related to SDG 11 might contribute to the overall global attention of researchers to global challenges such as disasters.

Strategic planning in response to disasters distinctly differs from strategic planning in everyday situations. Similarly, technologies functioning in normal cases might not necessarily work in emergency

environments (Ghadge, 2023; O'Donnell, 2017). However, people are becoming more exposed and vulnerable to social and environmental changes, ranging from natural disasters like earthquakes and floods to uncertainties caused by issues related to climate change (IPCC, 2023). Many debates have been about implementing resilience thinking, allowing communities to prepare for possible stresses and shocks. Although a few frameworks are aimed at building inclusive resilience strategies fostering participation and engagement, there needs to be more resilience-related literature on conceptualizing participation backed by technologies in emergency contexts.

We think the SI papers can contribute to developing technology-based regenerative services that can be instrumental in sustainably managing natural and physical resources. These services could be instrumental in immediate recovery and resilience building and establish a base to ensure communities' long-term sustainability and well-being (Mahajan et al., 2022; Undheim, 2024).

Any research on regenerative services for resilient communities necessitates an interdisciplinary approach, requiring integration of environmental science, social sciences, technology management, and more (Helfgott, 2018; Naderpajouh et al., 2018). Further, the role of

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technology in supporting or hindering regenerative services and community resilience needs more exploration, especially considering issues of access, equity, and sustainability by increasing stakeholder involvement in the process (Bridoux & Stoelhorst, 2022).

### 1.1. Specific areas addressed

**Regenerative services.** We seek contributions that shed light on challenges and opportunities for services that could improve their regenerative potential, referring to sustainably managing natural and physical resources (Russell-Bennett et al., 2024). Following what Paul Hawken (2021) suggests, putting life at the center of every action and decision, many decisions are needed during services designed and offered in a disaster context. Studies show how technical practices evolve to incorporate interdisciplinarity (Helfgott, 2018). Technical tools for understanding climate and disaster risk should address the complexities of community vulnerability and its causes beyond technical interventions. This approach requires understanding the complex interplay between various actors and the socio-technical systems in which they operate.

**Technology management knowledge.** We welcome studies exploring how technology management could be adapted to disasters to cope with grand societal challenges, particularly emphasizing community resilience (Aldrich & Meyer, 2015; George et al., 2016; Lusiantoro & Pradipto, 2022). While technologies such as AI, IoT, and blockchain have been applied in disaster management, their full potential, especially in integrated systems, has yet to be realized (Comes et al., 2020; Morton et al., 2023; Wilk-Jakubowski et al., 2022). By bridging technology management and disaster management, the advancements and limitations in how technology is applied, managed, and optimized during disasters could be better understood.

## 2. The details about the contributions on managing disasters with advanced technology solutions

We are delighted to introduce our Special Issue on “Managing Disasters with Advanced Technology Solutions: Designing Regenerative Services that Sustainably Manage Natural and Physical Resources.” The issue was open during November 2024–March 2025. Our target audience with the Special Issue was academics, executives, and policy makers who could illustrate innovative approaches, resolutions, and solutions to the described tensions, risks, and opportunities. We especially sought papers that offered theoretical models along with observations or evidence of consequences related to these models.

Overall, our call yielded 22 submissions. Submissions were screened for fit by the Special Issue guest editors and were sent out for review to at least two reviewers. After more than two rounds of revisions, 11 papers were accepted for publication.

We were able to map each of the articles into the two key challenges as demonstrated in our call for papers on the Special Issue: Regenerative services and technology used in disasters.

Traditional disaster management often prioritizes short-term recovery and returns to “normalcy.” This Special Issue challenges that paradigm by advocating for regenerative services, interventions that actively restore, renew, and revitalize communities and ecosystems during and after disasters. As inspired by thinkers like Paul Hawken (2021), these interventions demand placing life at the center of service design: decisions made in the crucible of disaster must foster long-term socio-ecological health, resource circularity, and community well-being, moving beyond mere damage mitigation.

Simultaneously, the role of technology in disasters is paradoxical. While Artificial Intelligence (AI), blockchain, remote sensing, and data analytics hold transformative potential, their application in chaotic, resource-constrained emergency environments remains fraught with challenges. Technology designed for stable conditions often falters when infrastructure fails or demands shift radically. Furthermore, strategic

planning for disasters fundamentally differs from routine operations, requiring adaptive, flexible, and often improvised approaches.

Papers accepted for this Special Issue (SI) confront these dual challenges head-on:

**Regenerative Services in Disasters:** How can services actively restore social fabric, economic vitality, and environmental integrity during response and recovery? How do we embed principles of interdisciplinarity, inclusion, creativity, and reflexivity into their design and delivery?

**Technology Management for Emergencies:** How can technology management frameworks be adapted or reinvented for disaster contexts? How do we integrate disparate technologies into cohesive systems that function under duress? Crucially, how do we ensure these technologies enhance, rather than hinder, equitable access and community participation?

We were able to map articles into the two key themes as shown in Table 1.

Based on the 11 articles, we learn that resilience in disaster contexts is not just about recovery; it requires proactive, adaptive, and regenerative strategies enabled by integrated technology management. Here are the three key lessons.

### 2.1. Resilience is multi-dimensional

Article 3 shows that flash droughts threaten biodiversity hotspots, while Article 5 demonstrates how climate-smart innovations in agriculture (e.g., precision farming) rebuild ecological and economic stability. Article 9 highlights the role of institutions responsible for digital transformation (e.g., South Korea’s COVID-19 response), whereas Article 11 further emphasizes socio-technical resilience by focusing on sustainable communities based on multi-actor collaboration. Turning to economic/innovation resilience, Article 4 explains how resilient innovation requires institutional support and financial safeguards.

### 2.2. Technology is a catalyst for coordination

Article 7 identifies AI/ML as predictors of disasters. Articles 1 and 8 describe how UAVs, IoT, and blockchain enhance real-time response, while Article 9 shows how social media bridges formal and informal aid gaps. At the same time, several articles underscore barriers: Article 1 warns that UAVs may fail under extreme weather, Articles 6 and 10 both reveal that digital divides exclude vulnerable groups, and Article 4 stresses that over-reliance on technology without institutional support undermines resilience.

### 2.3. Equity is central to resilience

Article 6 insists that pollution technologies must prioritize marginalized communities. Article 11 demonstrates how local communities ensure humanitarian services. Article 4 shows that corporate innovation resilience often favors state-backed entities, thereby risking inequality. Finally, Article 5 reveals how regenerative services actively restore communities, moving beyond temporary fixes.

## 3. Insights on future research

The study of disaster management has evolved into a rigorous interdisciplinary field essential for understanding modern disaster management, technological advancement, regenerative services, and resilient development. This Special Issue charts a path toward technology stewardship—where tools like AI, IoT, and social media are harnessed not just to react to disasters, but to build regenerative socio-technical systems aligned with SDG 11.

The Special Issue’s published 11 groundbreaking papers collectively push the boundaries of our comprehension by addressing critical gaps along two themes: regenerative services and technology management in

**Table 1**  
Contributions of papers on resilience and technology management themes.

Article #	Tech Management Dimension	Resilience Dimension
1 (Ozbittekin et al., 2025)	Analyzes drivers (high-tech solutions) and barriers (weather, regulations) for unmanned aerial vehicle (UAV) adoption	Proposes corrective actions to optimize UAV deployment for efficient emergency response in disasters
2 (Mulligan et al., 2025)	Maps the role of Information and Communication Technology (ICT) in enabling societal adaptation to climate threats	Positions digital tech as foundational for resilient socio-ecological systems (e.g., Himalayan food systems)
3 (Rakkasagi et al., 2025)	Uses spatial analytics to quantify environmental risks	Urges tech-integrated conservation policies for biodiversity hotspots facing climate extremes
4 (Lei & Xu, 2025)	Identifies typhoon-induced disruptions to R&D (funding, talent, infrastructure)	Advocates for institutional support to sustain innovation ecosystems in disaster-prone regions
5 (Zewdu et al., 2025)	Reviews tech-driven solutions (precision agriculture) for livelihood sustainability	Links climate-smart practices to SDGs 1, 2, and 13 via risk reduction and income stability
6 (Rautela & Goyal, 2025)	Deploys AI/Machine Learning (ML) models to predict pollution-related mortality	Recommends tech-enhanced monitoring systems for proactive public health interventions
7 (Ahmad et al., 2025)	Applies AI forecasting to track SDG progress	Enables data-driven policy to reduce mortality in high-risk regions
8 (Kordi & Ertz, 2025)	Integrates Big Data and AI/ML for end-to-end disaster coordination	Optimizes supply chains and real-time response across pre-/post-disaster phases
9 (Kiavash et al., 2025)	Uses natural language processing to extract real-time demand data from social media	Bridges supply-demand gaps in crisis logistics, improving aid responsiveness
10 (Park & Choi, 2025)	Proposes a 4-pillar model (sensing–absorption–adaptation–transformation) for digital governance	Positions crises as catalysts for regenerative systemic change (e.g., South Korea’s COVID-19 response)
11 (Ciasullo et al., 2025)	Explores digital tech’s role in sustaining multi-actor service continuity during crises	Emphasizes socio-ecological resilience through tech-enabled humanitarian ecosystems

terms of disaster management. Collectively, these studies demonstrate that resilience is not merely about recovery but about tech-enabled regeneration. Successful technology management in disasters requires.

- Adaptive Design (e.g., weather-proof UAVs, modular digital platforms),
- Equitable Access (e.g., grassroots digital inclusion, rural monitoring),
- Ecosystem Coordination (e.g., cross-sector data sharing, humanitarian partnerships).

Further, the Special Issue demonstrates that resilience thrives when technology is managed as a transformative tool—embedded in inclusive, adaptive, and regenerative systems that anticipate shocks, empower communities, and catalyze sustainable renewal.

Even though the Special Issue focused on disasters, a few papers (Articles 2, 3, and 5) don’t clearly focus on “disasters” but highlight climate change emergencies such as flash droughts (Article 3). While climate-related issues are indeed described as risk factors, the literature seems to be generally detached from the core challenge of how technologies used in fighting climate change should also be applied when disasters occur (CRED & UNDRR, 2018; Wisner et al., 2004). Developing resilient disaster management plans could cover not only traditional disasters but also increasingly climate-related challenges, expanding our understanding of what constitutes a disaster. Hence, we believe that the Special Issue collection proactively addresses disasters and includes discussions on related environmental changes.

In sum, we hope the SI readers find a wide range of topics on “Managing Disasters with Advanced Technology Solutions: Designing Regenerative Services that Sustainably Manage Natural and Physical Resources” to be current and informative.

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#### CRediT authorship contribution statement

**Dilek Cetindamar:** Conceptualization, Writing – original draft, Writing – review & editing. **Kunio Shirahada:** Writing – original draft,

Writing – review & editing. **Yucel Saygin:** Writing – original draft, Writing – review & editing.

#### Data availability

No data was used for the research described in the article.

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