KPMG

Where innovation meets urgency

AI and other tech can transform the way we prepare for and respond to natural disasters

kpmg.com

GenAI was utilized in the creation of this image

Introduction

Our world is witnessing an unprecedented increase in the frequency and severity of natural disasters, from wildfires and heat waves to hurricanes. The National Oceanic and Atmospheric Administration (NOAA) reported 28 weather and climate disasters in 2023, which inflicted $92.9 billion in damages.[1] Over the past five years, the US has seen an average of 20 weather-related disasters a year with a price tag of $1 billion or more, according to NOAA data.[2]

These disasters not only threaten lives—Maricopa County in Arizona had 645 heat-related deaths in 2023, a 1,000 percent increase in 10 years[3]—but also strain the resources of state and local governments, federal response and recovery agencies, as well as private industry. The Swiss Re Institute estimates that the insurance loss from catastrophes has more than doubled in the last 30 years and could double again in the next decade.[4]

In the face of these escalating challenges, agencies and organizations are turning to a powerful ally: artificial intelligence (AI). AI technologies can play a key role in addressing many aspects of the demands of natural disasters, improving our readiness, response, and recovery. Its ability to process vast amounts of data quickly, automate tasks, and provide predictive insights makes it a game-changer in managing disaster.

Key applications of AI include early warning systems that can help predict disasters, damage assessment tools that analyze satellite and drone imagery, and resource allocation platforms that streamline aid distribution. AI also supports communication systems, as well as grants management solutions to expedite funding and compliance processes during recovery.

By improving decision-making, efficiency, scalability, and accuracy, AI is unlocking new potential to advance disaster management capabilities.

Example AI applications in disaster management

Enhancing preparedness and readiness	Optimizing immediate response	Facilitating recovery and reconstruction
Predictive modeling	Automated data analysis and decision support	Data analysis for resource distribution
Digital twins for simulation and scenario modeling	Image understanding systems and drones	AI in fraud detection
AI-powered risk assessment tools	Sensors for real-time monitoring	Automated grants management and compliance
AI for long-term urban planning	Computer vision for damage assessment	Generative AI for two-way communication
Resource planning and logistics tools	Chatbots and AI communication tools	Blockchain for supply chain management
Augmented reality for training	Graph reinforcement learning for smart grids	Internet of Things for enhanced monitoring

[1] Adam Smith, "2023: A historic year of U.S. billion-dollar weather and climate disasters," Climate.gov, January 8, 2024

[2] Phred Dvorak, "The Rush to Shore Up the Power Grid Against Hurricanes, Heat and Hail," The Wall Street Journal, July 29, 2024

[3] Ariel Wittenberg, "'Just brutal': Why America's hottest city is seeing a surge in deaths," Politico, May 28, 2024

[4] Chanan Banjaree, Lucia Nevere, Hendre Garbers, Balz Grollimund, Roman Lechner, Andreas Weigel, "Natural catastrophes in 2023: Gearing up for today's and tomorrow's weather risks," March 26, 2024

Harnessing the power of AI

By harnessing the power of AI, we can help make our communities more resilient while also helping to minimize the impact of natural disasters. Here are three areas where AI can make a significant difference.

01 Readiness

Tech-driven strategies for increased resilience

Every community needs to prepare to meet and manage the effects of a disaster, regardless of whether they've been impacted recently or not in recent memory.

Today, predictive modeling is used for "what-if" scenario planning to help vulnerable communities improve their resilience. Often, this comes in the form of digital twins, which are dynamic replicas that replicate the behavior and characteristics of their real-world counterparts, enabling sophisticated simulation and analysis.

Digital twins can replicate all the supply conditions facing essential products and simulate how an agency will likely perform when faced with a specific emergency. These variables can include when inventory will run out, how much new inventory is needed, availability of alternative resources of supply, optimal points of distribution, and where the major points of vulnerability are throughout a network. Most importantly, these technologies can help emergency management practitioners visualize second- and third-order effects of outages or shortages. These AI-powered simulations can help focus training for emergency personnel, such as how to reflow medical or food supplies if the need arises quickly.

In the longer term, predictive analytics offers opportunities for long-term urban planning, including helping city planners make informed decisions about how to build in resilience and where to build, what materials to use, and how to design structures that can withstand natural disasters.

02 Response

Enhancing emergency response efficiency

In the immediate aftermath of a disaster, AI's ability to quickly process large amounts of data makes it an important tool to help ensure swift aid delivery to those most in need. AI can form the backbone of emergency response, beginning at the command center, where it can help automate centralized emergency operations by analyzing data, disseminating information, monitoring new threats, and streamlining a response. For example, when a natural disaster is imminent, chatbots can offer tips to help the public prepare and stay informed by delivering critical information quickly. This also reduces the burden on emergency staff.

Image-understanding systems enable aerial system damage assessment without sending people into dangerous and unstable situations. First responders utilize drone footage and satellite imagery to assess housing damage and identify fire outbreaks. Computer vision technology extracts essential data from visual images, and machine learning algorithms analyze the information to help responders understand the extent of the damage and calibrate a response. Well-placed sensors can be critical—small, unattended warning systems are already used in forests to detect wildfires by monitoring temperature, humidity, and air quality changes and by quickly identifying hydrogen, carbon monoxide, and other gases emitted by fires in their early stages.

As the emergency response kicks into gear, decision-support systems help optimize logistics for efficient supply and distribution management. This optimization helps ensure emergency responders have what they need to do their jobs efficiently, resulting in less waste of critical supplies. Utilizing location-based data and graphical analysis, authorities can track evacuation patterns before a hurricane or storm hits. This technology provides near-real-time information to decision-makers, showing which areas are evacuated and which routes and destinations are most used.[5]

Machine learning can also play a vital role in real-time problem-solving to help ensure that bottlenecks or breakdowns are dealt with immediately. For instance, researchers now use machine learning to ensure that electrical power grids remain functional during a disaster. The "self-healing" smart grid machine learning technique known as graph reinforcement learning analyzes and manages aberrations in a complex power grid network. Tests have shown that the AI system can reduce energy loss during outages and reroute electricity in milliseconds. A human-controlled system may take hours.

Transcription summarization tools enhance recovery by monitoring social media to gather real-time information about disaster-affected areas. This is invaluable for coordinating the distribution of food, water, and medical supplies. Generative AI chatbots also facilitate two-way communication between government agencies and the public to answer questions, provide accurate updates on recovery efforts, and gather feedback for long-term recovery. Automating these communication processes via AI can lessen the burden on emergency response teams and speed up help to those in need.

[5] Justin Agan, "Researchers propose using AI for all phases of disaster management," Phys.org, July 22, 2024

03 Recovery

Create timely and transparent rebuilding efforts

Once the immediate event concludes, the work of recovery begins, and AI can have many roles.

First, AI can help coordinate resource allocations so supplies and funds get to the right people at the right time. Natural disasters often have a disproportionate impact on marginalized communities, exacerbating the challenges faced by those already struggling with poverty, housing insecurity, and other issues. Without adequate post-disaster support, these communities lose more economic assets, including employment, property, livestock, and equipment, perpetuating generational poverty cycles. AI can analyze data on the ground, such as population density, infrastructure damage, and resource availability, to help ensure the efficient distribution of recovery efforts.

After a disaster, federal relief funds are often directed to state and local agencies. However, outdated systems and manual processes can become overwhelmed by this influx, leading to delays in application reviews, approvals, and fund disbursements.

This also makes these funds a tempting target for fraud. A Government Accountability Office report suggests that $39.5 billion in Community Development Block Grant Disaster Recovery (CDBG-DR) funds that Congress appropriated between 2017 and 2019 may be at risk of fraud from contractors, applicants, grantees, and subrecipients.[6]

Speed, accuracy, and transparency are crucial. AI can streamline the grants management process, from application processing and document review to fraud detection, compliance monitoring, and reporting. AI can automate application processing, document reviews, and workflow management. It can conduct real-time compliance checks and automate fraud detection, flagging errors and anomalies, reducing compliance risks and ensuring funds are used appropriately. Real-time dashboards and automated reporting enhance transparency, enabling tracking of fund distribution, spending, and performance metrics.

By reducing administrative burdens, accelerating funding distribution, and ensuring efficient resource allocation to impacted communities, AI not only speeds up recovery but also helps protect the integrity of relief funds.

[6] GAO, "Disaster Recovery: HUD should take additional action to assess Community Development Block Grant fraud risks," May 5, 2021

How to accelerate the adoption of AI in disaster response

Enable interagency data sharing
Before, during, and after disasters, agencies will need to be able to quickly utilize and share data. Doing so could involve standardizing databases, API, data formats, and protocols across different agencies and domains for seamless data integration and efficient cross-agency communication. This will help improve operational efficiency and speed in decision-making and help ensure that the generated insights are aligned and uniform across all platforms.

Establish clear leadership roles for AI readiness and use
As more federal agencies appoint chief AI officers, state and local agencies can follow suit, creating a new leadership office or empowering an existing office with ownership of AI integration. There must also be clearly defined roles and expectations for human oversight of AI-informed decision-making.

Road-test your AI tools
Disaster personnel should rigorously test AI systems through emergency scenario simulations to understand their capabilities and limitations comprehensively. This helps ensure AI acts as a reliable enhancer, not a source of overconfidence or complacency. Additionally, establishing manual backup processes is crucial for maintaining operational continuity if AI technologies fail during an actual crisis.

Ensure AI data security
AI systems and vast amounts of data must be securely stored and processed. Stringent cybersecurity measures, regular testing, and prompt vulnerability management are vital to prevent breaches.

Develop a comprehensive AI policy and regulatory framework
This should guide proper and ethical AI use and include appropriate data handling and privacy procedures. It should also test and address potential AI bias. For deeper redundancy, agencies should establish contingencies for low-tech solutions in crises if more advanced technologies do not function or work as expected.

How KPMG can help

Our practitioners have supported some of the largest global disasters and emergencies in the last 40 years, including 9/11, Hurricane Katrina, Superstorm Sandy, Hurricane Ian, and the COVID-19 pandemic. We integrate a variety of disciplines to help you mitigate risk, expedite assistance, effectively manage post-disaster recovery funding, and strengthen trust and resilience.

With extensive experience, advanced AI technologies and accelerators, and a powerful network of strategic alliances and investments, we can help you unlock the power of AI and emerging technologies to advance disaster management. Our multidisciplinary approach includes:

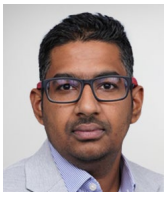
- Enabling state and local governments to connect constituents and communities to assistance faster, and effectively manage post-disaster recovery grant programs, including funding from the Federal Emergency Management Agency, U.S. Department of Housing and Urban Development, and other sources.
- Implementing versatile data analytics and visualization tools to sharpen risk and vulnerability assessments.
- Applying leading-edge analytical techniques, AI, and automated anti-fraud models to mitigate and detect fraud and duplication of benefits to help safeguard disaster recovery funds.
- Advising on public-private financing, asset management, and supply chain strategies to increase the resilience of public infrastructure, ports, and power, water and electric utilities.

Our KPMG Smart Grants Platform managed services suite helps enhance, accelerate, automate, and augment your grants management processes, so you have the support and tools needed to drive better outcomes for constituents. The modular platform features user-friendly interfaces, AI, process automation, advanced data and analytics, and client-informed workflows and processes. With the KPMG Smart Grant Platform, you can automate and improve risk assessment, application intake, case management, fraud detection, compliance management, construction management, closeout, reporting, and more.

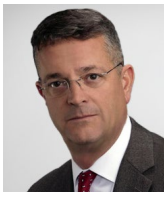
Discover how we can assist you in integrating AI into your emergency management operations in a safe, trustworthy, and ethical manner at visit.kpmg.us/ai.

Contact us

Rory Costello
Principal, US Grants Management Lead,
KPMG LLP
rcostello@kpmg.com



Bharat Gorantla
Principal, Government Data & AI Leader,
KPMG LLP
bgorantla@kpmg.com

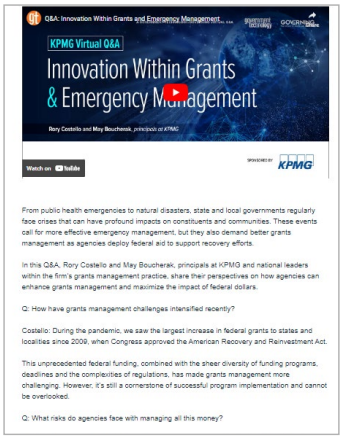


Ross Ashley
Senior Director, Emergency Management
KPMG LLP
rossashley@kpmg.com

Related thought leadership:

Combatting post-disaster housing recovery grant fraud

GenAI in state and local governments



Innovation within Grants & Emergency Management

Some or all of the services described herein may not be permissible for KPMG audit clients and their affiliates or related entities.

Please visit us: **kpmg.com**

DASD-2025-16837