



Resilient Cities Plug In to Technology for Response and Recovery

Produced in Partnership by:



Consumer
Technology
Association™

Smart
Cities
Council

There is a tremendous pressure on cities; by 2050, they are expected to provide for 70 percent of the world's population. Already, 1.4 million people are moving to cities each week.

Although this influx can fuel economic growth and cultural vibrancy, it can also strain cities' abilities to keep their residents safe, healthy and prosperous. In the wake of recent and repeated natural disasters and civic threats, there is a real sense of urgency to make cities more resilient and sustainable.

The Paris-based Organisation for Economic Co-operation and Development (OECD) identifies resilient cities as ones with the ability to absorb, recover and prepare for future shocks that can vary from environmental, economic, social and institutional.

Smart technologies are helping cities cope with these challenges with preparedness, responsiveness and recovery for a more secure world.

"Over the last decade, successful businesses and governments have been guided by the principle of fostering innovation," said Gary Shapiro, president and CEO of the Consumer Technology Association (CTA)TM. "Looking ahead, resilience is the watchword of the future."

"Recent natural disasters — from floods to fires — as well as manmade tragedies remind us that we need to build preparedness and recovery into everything we do,"

Shapiro said. "We need technology that aids the continuity of critical infrastructure and the ability to operationally bounce back — or keep going — during a crisis."

This is a philosophy embraced by the Smart Cities Council[®], which educates and works with cities to help them become more livable, workable and sustainable. In partnership with Qualcomm, the Council launched the Readiness for Resilience Program to help areas devastated by natural disasters. The goal is to assist cities in rebuilding and becoming more resilient. The initial efforts are focusing on Puerto Rico, which was ravaged by Hurricane Maria, and communities in Texas that were impacted by Hurricane Harvey.

"The history of our country is a history of investing in infrastructure for the benefit of citizens — the transcontinental railroad, the power grid, the telephone system and the internet are just some examples," said Jesse Berst, chairman of the Smart Cities Council. "Today, there is a huge opportunity to create smart cities projects that make our cities more resilient."

Shapiro adds that by 2050, the majority of the world's population will live in cities.

"Now is the time to lay the groundwork for smart building and infrastructure," he writes in *Ninja Future: Secrets to Success in the New World of Innovation*. "This means building buildings with backup water and energy systems that harness the power of renewable energy sources."

2017: The Year of Living Dangerously in the U.S.

Consider these statistics about natural disasters that occurred in 2017 in the United States:



In total, the U.S. was impacted by 16 separate billion-dollar catastrophic events including: three tropical cyclones; eight severe storms; two inland floods; a crop freeze; drought; and wildfires. Even worse, the total cumulative cost of the damage was more than \$300 billion, a new annual record for the country.



In California, it was the second most destructive wildfire season on record. The *Washington Post* reported "nearly 9,000 wildfires tore through the state, burning 1.2 million acres of land (an area the size of Delaware or the Larsen C iceberg), destroying more than 10,800 structures and killing at least 46 people." The California Insurance Commission said the fires resulted in 45,000 insurance claims totaling close to \$12 billion.



Three 2017 hurricanes — Harvey, Irma and Maria — caused a combined \$265 billion in damage and each ranked among the top five costliest hurricanes on record.



There were 3,526 power blackouts in the U.S. lasting longer than 81 minutes — affecting almost 27 million people.

<https://www.climate.gov/news-features/blogs/beyond-data/2017-us-billion-dollar-weather-and-climate-disasters-historic-year>

It means investing in standardized emergency bridges, like those used in Haiti following 2016's Hurricane Matthew, that can be quickly assembled with ready-made, interchangeable pieces. And, it means developing resilient internet systems built on decentralized, distributed networks that can preserve our data in the wake of emergencies."

Creating a culture of responsiveness and resiliency

The U.S. Federal Emergency Management Association (FEMA) stated that as the 2017 calendar year came to a close, more than 25 million Americans (nearly 8 percent of the U.S. population) had been affected by unprecedented disasters.

"The range of disasters from flooding, hurricanes or wildfires and the significant losses didn't affect just one person or one family, the impact of these events is felt by us all," FEMA [staff blogged](#).

"More than anything else, 2017 highlighted the need for the nation to change the way we prepare for and mitigate against future hazards. We need to change the way we think and create a true culture of preparedness. Investing in mitigation activities *before* the next disaster is the key to building a more resilient nation."

During times of crisis and natural disasters, how can cities best prepare for unknown outcomes, protect lives and resources, and support community-wide recovery?

More than national or state governments, cities are often best positioned to help people recover from a crisis. The United Nations Office for Disaster Risk Reduction (UNISDR) notes that city governments "are often the first responders to citizens' needs (and complaints), provide basic services and oversight, engage in urban development, and manage emergencies and disaster risk. Thus, they need knowledge, tools, capacities and resources to act on these responsibilities. They need to understand how making cities resilient can help them deliver better on their many responsibilities. Local governments are often forgotten as targets by national and international community when policies are set and resources become available."

Technology can breach jurisdictional boundaries and silos to provide rapid response, coordinated communication and improved recovery. Some experts believe artificial intelligence (AI) could be a cornerstone for the future of smart — and resilient — cities.

Phasors that Stun You with Fast Data

Devices known as phasor measurement units (PMU) measure the amplitude and phase of electric current and voltage at various points on the electric grid using a common time source for synchronization. The PMUs can gather data at a rate 100 times faster than most systems currently used in the power industry. The resulting synchrophasor data provides system operators with a near real-time snapshot of the grid's operating status, which can be used to improve grid reliability and efficiency, plus lower operating costs.

The American Recovery and Reinvestment Act of 2009 supported the installation of PMUs across North America. There are now PMUs deployed at more than 2,500 locations across the nation's bulk power system.

<https://www.publicpower.org/periodical/article/does-offers-funding-tied-big-data-ai-machine-learning>

How rapidly advancing technology is responding to crisis mode

Technology has fueled huge improvements in disaster response and recovery in just the past decade. The use of mobile communications, geographic information systems (GIS) and thermal imaging for rescues has become commonplace. And, although much of the focus is on weather-related and natural hazards, communities have also invested in planning and new tools to deal with disruptive incidents of civil unrest, cyber threats, public-health emergencies and acts of terrorism.

"Technology makes us [more efficient in our responses](#)," said Johnson County, Texas Emergency Management Director Jamie Moore. "The key is figuring out how to utilize it most effectively. There's a lot of technology out there, so it's finding the pieces that will work in your community that are affordable and then implementing those pieces."

The emerging technology being developed for disaster response varies by governmental organization and need. Here are some examples of current projects fueled by resilient creativity that provide a fascinating look at the possibilities:

- The U.S. Department of Energy is funding research and development of “advanced tools and controls” to improve the resilience and reliability of the nation’s power grid. The [Transmission Reliability Program](#) is looking for ways to use big data, artificial intelligence and machine learning technology to derive more value from the sensor data already being gathered and used to monitor the health of the grid and support system operations.
- Disaster robotics has been with us for a while, from bomb-defusing robots to drones used to survey damages and map geological activity. But, the field is advancing rapidly.

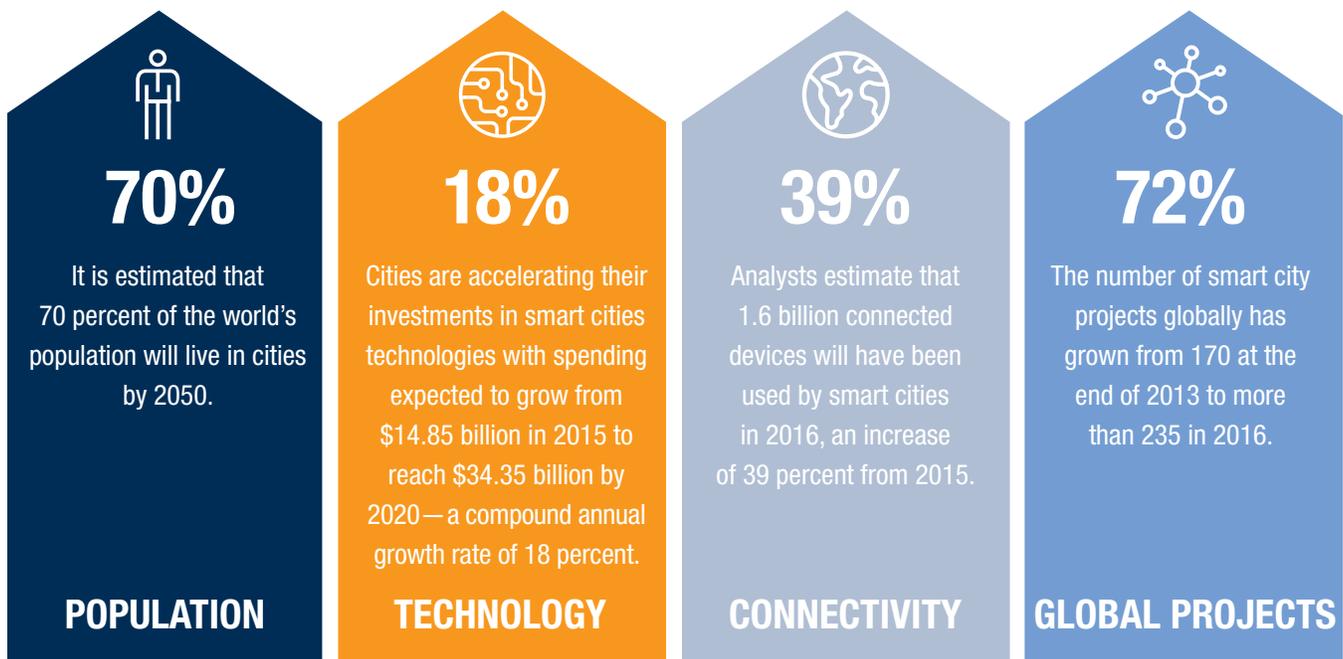
The Texas A&M Center for Robot-Assisted Search and Rescue (CRASAR) has supplied robots for disasters including earthquakes, hurricanes and

nuclear accidents. In 2018, a CRASAR team was dispatched to Hawaii to join the [response effort at the Kilauea Volcano eruption](#). Using small unmanned aerial systems (sUAS) together with air-quality sensors, advanced imaging tools, and GIS data for spatial analytics and mapping, the team provided real-time aerial views of the eruption. They were able to identify a new fissure not visible from the ground, project the lava flow rate during the night when manned helicopters were not allowed to fly, and provide ongoing data collection from new thermal sensors technology.

- The city of Miami used support through the Smart Cities Council Readiness Challenge to help with its Sea Level Rise Pilot Program to [battle reoccurring flooding](#). The program, a collaboration with the Environmental Systems Research Institute (ESRI), is a high-tech approach that will integrate geographic information systems, 3D modeling, waterfront sensors and LIDAR (light detection and ranging data) to give the city information about its most vulnerable areas and provide timely flooding alerts.

Smart Cities by the Numbers

The rapid growth in urbanization and increasing demand for quality lifestyles are some of the factors supporting the development of the smart community concept.



<https://www.cta.tech/Research-Standards/Reports-Studies/Studies/2017/The-Evolution-of-Smart-Cities-and-Connected-Commun.aspx>

- Mass casualty incidents can overwhelm medical facilities and personnel, especially when there is a lack of communication and coordination. The Columbus, Ohio area uses a system called Real Time Activity Status (RTAS) that [connects all the hospitals in four counties](#). It notifies ambulance dispatchers when emergency rooms are too busy so that patients can be diverted to other hospitals. A similar system saved many lives after the 2013 Boston Marathon bombing.
- Health care providers have been looking at ways to leverage technology. Data analytics have made it possible to [hot-spot vulnerable populations](#) through programs like emPOWER, a database of 2.5 million Medicare beneficiaries reliant on electric medical and assistive equipment. The database integrates Medicare data with real-time weather tracking services to identify at-risk individuals affected by natural disasters.
- The use of [autonomous vehicles for mass evacuations](#) is being explored, particularly in areas vulnerable to hurricanes and floods. The U.S. Department of Transportation has been studying how car-to-car communications — a critical piece of the anticipated self-driving future — might improve evacuation procedures. The use of these vehicles could be especially helpful in evacuating the elderly, infirm or those who do not have a way to drive themselves away from the oncoming disaster.
- Other developing technologies that cities could tap into include: advanced driver-assistance systems; distributed energy generation; wearables for real-time health tracking; robotics to automate routine or dangerous tasks; and weather-resistant vertical farming for small spaces.

Challenges to overcome

Although the possibility to improve response and recovery efforts through the use of new technologies is exciting, it is not always developed or implemented easily. Cities — like almost all government entities — must deal with the thorny issues of governance, policy support, funding and political unpredictability.

Once those are addressed, then the challenges that are technology-related come into play, such as data sharing/privacy, interoperability, and ongoing support for research and development. It's great to collect a huge

amount of data from new technologies, but how does a city use it to create systems that can talk to each other and allow responders to work together?

According to a guide on data interoperability produced by the UN World Data Forum, “organizations are often overloaded with day-to-day operations and have little time left to introduce and adopt standards, technologies, tools and practices for greater data interoperability.”

The guide states that technologies and methods already exist to make data speak to each other, but serious impediments to interoperability are tied to how data is managed and how the lifecycle of data within and across organizations is governed. Resolving the problem requires a [coordinated approach and set of common guidelines](#) to ensure that data management and governance principles become integral components of organizational strategies and business processes — as well as a key factor in response and recovery planning.

Finding the right technology and solving the implementation issues is probably the biggest issue facing cities.

“Some of this is going to boil down to how fast do we want to do this and where do we want to start?” said Todd Thibodeaux, president and CEO of Computing Technology Industry Association (CompTIA).

Thibodeaux said cities are “notoriously risk adverse when considering new technology.” He outlines three approaches cities can use to [mitigate risk and help lower implementation costs](#): pilot programs, regulatory sandboxes, and university-based IoT innovation labs.

Pilot programs allow cities to try out ideas without committing to ongoing investment. Calumet City, Illinois — a suburb south of Chicago — is [using money recovered from drug seizures](#) and illegal activity to pay for the first-stage implementation of SpotShotter, a gunshot detection system that uses acoustic sensors to alert police in real-time to the location of gunfire, which can then improve response times.

Regulatory sandboxes create public-private partnerships that allow entrepreneurial companies to conduct live experiments in a controlled environment under a regulator’s supervision. Arizona is the first state in the U.S. to establish a sandbox to test new products using financial technology.

University-based innovation labs let researchers test and validate IoT-enabled technologies, which can mitigate the risk to cities before the actual technology is implemented. The city of Pasadena, California had one of the [first open data sites in Southern California](#) and proactively shares its data with the California Institute of Technology for use in data analytics courses. In return, the city has been able to use the school's results to gain insights into its operational areas.

Taking the next steps

In 2010, the United Nations Office for Disaster Risk Reduction (UNISDR) and its partners launched a 10-year Making Cities Resilient campaign to address issues of local governance and urban risk. The campaign

The 10 Essentials for Making Cities Resilient

United Nations Office for Disaster Risk Reduction (UNISDR)

1. Organize for disaster resilience.
2. Identify, understand and use current/future risk scenarios.
3. Strengthen financial capability for resilience.
4. Pursue resilient urban development and design.
5. Safeguard natural buffers to enhance the protective functions offered by natural capital.
6. Strengthen institutional capacity for resilience.
7. Understand and strengthen societal capacity for resilience.
8. Increase infrastructure resilience.
9. Ensure effective disaster response.
10. Expedite recovery and build back better.

<https://www.unisdr.org/campaign/resilientcities/home/toolkitblkitem/?id=1>

has produced a number of tools to help local leaders assess, monitor, document and improve their disaster-risk reduction activities, starting with a “Ten Essentials” checklist for making cities resilient.

A Roadmap to Resilience, produced by the Smart Cities Council, states that resilient infrastructure systems, like many distributed and smart infrastructure networks, are often made of many small pieces and parts.

A large, aging power plant might be replaced with a more sustainable network of small neighborhood generators that turn food waste into energy or electricity to reduce waste every day and create a more secure energy source in case of emergency. These systems are deliberately designed to provide the same services as traditional infrastructure, but they also offer the added resilience benefit of flexibility so that they can easily expand and adjust or facilitate repair and replacement of parts to meet changing needs and conditions.

The [Smart Cities Council resilience roadmap](#) states that meeting the demand for infrastructure using sustainable and resilient solutions requires new approaches to realign incentives and design new delivery mechanisms at the right scales to systematically aggregate, monetize and capture benefits that are usually left off project balance sheets.

In an interview with the Thomson Reuters Foundation about disaster planning, Marc Forni, lead specialist for urban resilience at the World Bank, was optimistic.

“Investment in resilience isn’t just about avoiding losses and keeping bad things from happening. It’s about [catalyzing growth and opportunity](#),” Forni said. “One of the things that makes urban resilience an exciting topic is that it’s quite entrepreneurial — you have interesting innovation from all different areas.”

CTA’s Shapiro calls this entrepreneurial spirit associated with resilience “grit.” Some have it, he said, and others don’t.

“Businesses, governments and individuals who invest in resilience — who think four-dimensionally, who are willing to stick it out and delay gratification — are most likely to succeed in our connected future,” he said. ●



About Consumer Technology Association:

Consumer Technology Association (CTA)[™] is the trade association representing the \$377 billion U.S. consumer technology industry, which supports more than 15 million U.S. jobs. More than 2,200 companies — 80 percent are small businesses and startups; others are among the world's best-known brands — enjoy the benefits of CTA membership including policy advocacy, market research, technical education, industry promotion, standards development and the fostering of business and strategic relationships. CTA also owns and produces CES[®] — the world's gathering place for all who thrive on the business of consumer technologies. Profits from CES are reinvested into CTA's industry services.



About the Smart Cities Council:

The Smart Cities Council envisions a world where digital technology has been harnessed to improve livability, workability, and sustainability. A leader in smart city education, the Council has worked with cities and states that are collectively home to more than 200 million people, including Austin, Dallas, Indianapolis, Illinois, Jaipur, Miami, New Delhi, Orlando, Philadelphia, Sydney, and many others.