100 Resilient Cities
RESILIENCE PERSPECTIVE

Technology
During its six years of operations, the 100 Resilient Cities program supported the participating city governments to prepare city-wide resilience strategies for each city. During these strategy development efforts, city governments and their stakeholders considered and prioritized a full range of urban risks and vulnerabilities, which spanned each city’s diverse communities, places, economic sectors, and operations.

As the strategy processes established each city’s resilience priorities and action areas, 100RC staff, together with 100RC’s 115 Platform Partners and scores of Subject Matter Advisors, provided further domain specific support to the cities’ relevant technical and managerial counterparts and stakeholders. These focused efforts led to the preparation of domain specific resilience frameworks and approaches. These approaches are now being summarized in this 100RC Resilience Perspective series.

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Foundational technologies for cities, which include cloud computing, data analytics, mobile communications, and social applications, have a critical role in supporting urban resilience. Without the deliberate use and integration of technology in approaching resilience, cities will be ill-equipped to address the shocks and stresses that are rising with the phenomena of rapid urbanization, climate change, and globalization.

Rapid Urbanization
The population growth and land expansion of cities requires technology infrastructure to grow along with them. One of the most important technology areas for cities to consider with urbanization is ubiquitous coverage of affordable, high-speed internet to ensure the deployment of smart connected solutions citywide and to all residents.

Climate Change
Technology makes an important contribution to preparing for and monitoring the local impacts of climate change through the use of sensors to collect data and the use of applications to analyze and share data and the analysis to help guide action.

Globalization
The ability to collaborate and learn globally is both enhanced by technology and an important way for cities work together to develop and share best practices. Perhaps the biggest connection between resilience, technology and globalization is the ability to identify and source products and services from around the world to solve local needs.

100 Resilient Cities (100RC) defines urban resilience as the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience. The need for resilience in cities is heightened every day by the growing and dynamic effects of climate change, rapid urbanization, and globalization. These and other global demographic, technology, and political trends together expose cities to an increasingly complex set of shocks and stresses. Understanding a city’s risks and the unique vulnerabilities of different groups and systems requires consideration of the interaction between acute shocks and chronic stresses. The exploration of these interactions across the 100RC network of cities and partners has highlighted a key principle for those who seek to build resilience, no matter what the focus or sector: managing the risks of future shocks requires efforts to reduce today’s chronic stresses. Reducing stresses increases the ability of local communities, businesses, infrastructures, and institutions to adapt and thrive in the face of change and unexpected events.

The design of a resilience initiative or investment includes the pursuit of “resilience dividends,” that is, efforts to manage the risks of shocks in a way that also reduces the chronic stresses in the city. In other words, resilient cities better manage both chronic stresses and acute shocks so that people in those cities, especially the poor and vulnerable, are safer, healthier, and have increased livelihood options.

In looking for solutions to resilience challenges, it is clear that the ability of technology to play a meaningful role in both better understanding and mitigating shocks and stresses is increasing every day as new products and services are brought to market and mature. The relatively recent evolutions in cloud computing, data analytics, mobile communications, and social applications are making a whole host of innovative products and services possible in ways they weren’t even a few years ago. All of these technologies are coming together to define and usher in the digital transformation of city operations and service delivery.

Harnessing the power of technology is a way to mitigate the challenges of urbanization and help catalyze urban resilience. These elements are coming together to create a unique moment for cities where increased urbanization, heightened concerns about climate change, and the demands of more engaged residents are pushing city leaders to make infrastructure investments that make cities more resilient. The cities that act now will be the ones best positioned and most able to offset impacts in the future. Harnessing the power of technology is a way to mitigate the challenges of urbanization and help catalyze urban resilience. 100RC is uniquely qualified to bring cities, innovators, thought leaders, and residents together to help make this happen.
Defining the intersection of technology and resilience

This is a unique moment where urban resilience and technology are coming together as cities define specific resilience challenges and both technologies and the ability to apply them to address those challenges in meaningful ways evolve.

For cities to maximize their ability to harness technology to adapt, survive, and grow, there are two important achievements required:

1. To build-up foundational infrastructure, like ubiquitous, high-speed internet, robust cloud computing capabilities, a wide-array of data functionality, and cybersecurity defenses; and
2. To foster internal and external cultures that support operational and service delivery changes on a citywide scale.

Foundational technologies will be essential to build off of as viable problem-specific solutions become available. For example, it will be hard to deploy an Internet of Things (IoT) sensor solution without a communications network to connect to and cloud and data capabilities in place ensure the sensor-generated data more accessible, digestible, and protected. Cybersecurity is another example of an essential city capability as the deployment of digital solutions also creates new threats.

Over the last 30 years, technology has greatly advanced, while the organizational structure of cities has largely remained the same. Digital transformation is putting pressure on cities to examine their leadership and governance structures to become flexible to the continuing advances and in turn resilient. For instance, infrastructure that was recently single purpose and governed by a single agency, like street poles, now have multiple purposes across multiple agencies and those same poles may host cameras for the police, air quality sensors for the health department, and pedestrian counters for economic development.

Today much of the energy in the civic tech/smart cities/digital transformation space is centered around a small number of city services – mostly ones with an associated revenue like parking or mobility solutions. The successful application of technology-based solutions to mitigate resilience challenges is entirely about use cases. Inside city business processes are potential use cases where technology can be applied.

A great example of a company that has found success with a niche use case is Remix. Remix is a California startup that began with a novel application for developing public bus routes. Remix embedded its team in the City of San Francisco Transportation Department and identified the legacy process San Francisco and many other cities use to plan and maintain bus routes. Through this, they discovered a laborious process of using pivot tables that took up to four days to analyze options. Using a software application, Remix has shortened the process to four hours through the evolution of the existing business process. No need to get rid of staff or completely upend the way buses are routed - Remix took the existing process and digitized it.

City agencies and departments have numerous potential applications for using technology to significantly improve city operation and service delivery, making them faster, easier, and less expensive than current practices.

There are three key elements to the 100RC model for identifying use cases for technology to address resilience challenges:

1. Conceives of and develops use cases through a resilience-based process.
2. Exhibits reliable performance and intended outcomes in both routine and extraordinary situations over the delivery life span of the project.
3. Creates positive “co-benefits” and minimizes short- and long-term negative impacts by recognizing the systemic interdependencies that exist in cities.

Successful application of civic technology solutions to resilience challenge will support intra-agency collaboration facilitating cities as an enterprise and not limiting by program, department, or agency boundaries or budgets.

What is a Smart City?
Smart Cities is a term most often associated with the use of innovative technology solutions in urban environments. But the smart cities movement is much more than just technology. Smart Cities is really a combination of three things – urban planning, public administration, and community engagement – all powered by innovation and expressed through real use cases that improve government operations or service delivery.
Global cities vary wildly in the current state of maturity and complexity of information technology infrastructure and operations, as well as the need, interest, capability, and planning for adoption of resilience state technologies. However, reviews of city technology strategic plans and other research show commonality in current state challenges and technologies, like cloud and cyber strategies, regardless of maturity.

Leading cities around the world are trying to figure out how to build capacity with investments in foundational technologies, while at the same time planning, setting the stage, and positioning for innovation without the foresight to know what the next advancement will be.

Many basic technologies like access to high-speed broadband and robust data capabilities might not be immediately associated with urban resilience initiatives. However, they are essential to be able to deploy advanced solutions like IoT sensors, blockchain, data analytics, machine learning, and automated devices that can directly address resilience challenges like transportation, public safety, health, and urban planning.

Reviews of 100RC network city information technology strategies show that common initiatives currently underway include negotiating small cell/5G deployments with vendors, migrating legacy services to the cloud, maximizing data capabilities, and shoring up cybersecurity defenses. One of the largest resilience challenges continuing to face cities that hinders the integration of technology is the siloed approach – agency versus enterprise. Cities need to break down agency-level silos and deploy enterprise systems that allow for the city to function as one entity and implement niche solutions that address specific agency missions and functions.

Use Case and Resilience Challenges
The defining achievement of resilient cities in terms of technology will be the successful design of impactful use cases that, through either improving city operations or service delivery, help mitigate shocks and stresses. These use cases will guide sound investments in the right technologies at the right time to make a meaningful difference in a city’s resilience. Resilient digital investments will come in two forms:

1. **Evolutionary** - incremental advancements to existing city practices to do something better, faster, or less expensive; and
2. **Revolutionary** - those entirely new solutions that will require cities to make significant changes.

The resilient city will be hallmarked by the complete digital transformation of cities and the development of enterprise-wide capabilities that break down silos between agencies, establish interoperability, and provide the flexibility and standardization to support the deployment of solutions both citywide and at specific locations.

A resilient city includes more digital city service delivery and digital engagement with residents and other stakeholders – an essential component will be increased investment in and prioritization of community inclusion and education to help design, develop, and drive the adoption of new services that protect privacy, security, and digital rights. This will require a sincere cultivation of community-based partners to help drive citizen education, adoption, and digital equity where all people have equal access to city services.
The most important step for cities to leverage the full capabilities of technology to support urban resilience will be to build a culture that supports innovation and the adoption of new technologies and the change these technologies will drive. This is more important than funding, procurement, or security.

As cities contemplate digital transformation and deploying technology to support urban resilience, there are many tools to help plan for and manage this change and develop and implement strategies. City Resilience Strategies are just one. In theory, some cities will use these tools to succeed at innovating and others will lag behind. The common traits of leading cities will be less about the technologies they deploy and more on how well they worked to prioritize city resilience needs and find real solutions to address those needs in a timely way. Below are some anticipated elements of resilient cities:

City Innovation Culture
Establishing and sustaining a culture that encourages and supports innovation is essential to advancing the digital transformation of cities and the adoption of technology solutions for urban resilience. Educating and securing the support and collaboration of executive leadership and other stakeholders, including the community, is key to building a supportive culture and governance structures for the digital transformation.

City Organization
As cities mature and work to address resilience challenges, it may be necessary to refine their organizational structures. The organization of most cities has not changed significantly to address and leverage changes in technology that demand more intra-agency collaboration. It is expected that resilient cities will make shifts in city structure as technology further impacts missions, roles, and capabilities of agencies, programs, and staff. The convergence and expanded capabilities of technologies will allow for more collaboration amongst agencies if cities develop a culture and structure to support.

Project Prioritization and Preparation
Cities have no shortage of issues and projects demanding time, money, and other vital resources. New ideas can be difficult to prioritize and move forward, and future demands can struggle to compete with immediate need for critical services (or “immediate needs”). Prioritizing and investing in tomorrow is sometimes not as exciting or politically expedient, but it is essential while cities have more time to make an impact in long-term resilience planning and projects. Increased use of data, data analytics, and data visualization are being deployed to help diagnose problems, quantify decisions, measure performance, predict outcomes, and lessen the weight of politics and emotions in decision making.

Citizen Engagement and Adoption
A frequent complaint around large innovation projects is that the public believes technology is something that is done to them and not with them or for them. The way to change this perception and to improve the adoption of innovative solutions is to engage communities upfront. Cities should design and implement successful community engagement and inclusion efforts that help drive support for and adoption of urban resilience and digital transformation initiatives.
Time is the most valuable resource any city has in its effort to achieve urban resilience.

If we flash forward 30 years to 2050, many cities – especially those on coasts or other sensitive locations – will be impacted by climate change, globalization, and urbanization. Some will be more resilient than others. Some perhaps may have more favorable genetics to start and less work to do and more resources to do it with, but the one characteristic that the most resilient cities in 2050 have in common is that they will most likely be the ones that started planning for tomorrow today.

No one can say for sure what technology will look like in 2050. Innovation is a journey and those cities most likely to survive and benefit from the trip will be the ones that create a culture that is open and supportive of innovation and both able to make informed decision and successfully act on those decisions.

The ability to act is an iterative process. It’s like saving for retirement – it’s much easier to do a little at a time and methodically move toward identified goals while being flexible enough to adapt as the world evolves.

Smart Gap
Some cities will do a good job of strategically deploying technology to successfully mitigate resilience shocks and stresses. Others – for a host of challenges like prioritization, capability, capacity, political will and public support – will not. These cities will be on the wrong side of the Smart Gap.