



RESEARCH REPORT

# Technology and Equity in Cities

## Emerging Challenges and Opportunities

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# Executive Summary

Racial and economic inequities in the US are growing, and rapid technological change can either promote inclusion or widen these divides. City leaders can use technological innovations to manage infrastructure and improve services, communicate with constituents, and make better decisions. But they must also be aware of the challenges that come with the disruptive force of new technological advancements.

This report, which is based on a literature review and interviews with experts, explores trends in four areas of technological change: smart infrastructure, shared mobility, civic technology, and technology-enhanced data analytics. We identify how those trends could exacerbate or mitigate inequality in cities, and we provide examples of cities that are leveraging these trends and innovations to advance equity goals. We also synthesize cross-cutting themes and recommend principles to guide local efforts to harness technological innovation and create more equitable cities.

## Emerging Opportunities and Challenges

### SMART INFRASTRUCTURE

Smart infrastructure presents an opportunity for local leaders because combining physical infrastructure and digital infrastructure can connect neighborhoods and residents to information and help cities deliver essential services more efficiently. Smart infrastructure presents a challenge to local leaders because such technologies can widen disparities in access to basic services or divert resources from equity-focused initiatives.

### SHARED MOBILITY

Shared mobility presents an opportunity for local leaders because services that allow residents to share the use of a car, bicycle, or other modes of transportation can reduce transportation costs for low-income riders and expand options in underserved neighborhoods. Shared mobility presents a challenge to local leaders because such platforms can perpetuate discrimination or lead to disinvestment in existing transit systems.

### CIVIC TECHNOLOGY

Civic technology presents an opportunity for local leaders because online and mobile platforms that enable greater participation in government or help residents access services can increase transparency

and accountability and support civic engagement. But civic technology presents a challenge to local leaders because it can exclude residents who lack access to technologies and information, and its improvements may not be sustained over time.

## TECHNOLOGY-ENHANCED DATA ANALYTICS

Technology-enhanced data analytics present an opportunity for local leaders because new data science methods capable of processing vast quantities of data can help city leaders uncover equity challenges and design more effective and evidence-based interventions. These analytic tools present a challenge to local leaders because they can reinforce existing biases in the data or suggest short-term solutions to enduring challenges.

## Paths Forward

We recommend that city leaders and service providers use four principles to ensure technological advancements promote more equitable communities:

- **Combine technological innovation with structural solutions.** Identify ways to combine technological innovation with enabling supports, including policies and investments that address structural issues.
- **Hardwire equity goals into project development and implementation.** Apply an equity lens when evaluating the costs and benefits of new technologies. Build equity goals into the project plan, scope, execution, and evaluation.
- **“Build with, not for,” traditionally excluded communities.** Create an inclusive process that goes beyond transparency and consultation and includes empowerment and codesign.
- **Use technology to track progress.** Monitor and publish progress toward equity goals. Create open-data platforms with robust engagement strategies to help community groups hold public agencies accountable.





# Introduction

Cities and metropolitan areas power the US economy by creating hubs of innovation and generating an outsized share of the nation's productivity and wealth (Berube and Liu 2016). But strong signs suggest that the prosperity in America's cities is not broadly shared (Parilla 2017; Poethig et al. 2018). Income inequality is growing throughout the US, but the gap between the rich and poor is widening the most in our nation's largest and fastest-growing metropolitan areas, where gains at the top of the income ladder have outpaced gains at the bottom (Berube 2018). Even in cities where income inequality has narrowed, racial disparities have persisted or worsened along many dimensions, such as health outcomes and wealth gaps (Darity et al. 2018; National Academies of Sciences, Engineering, and Medicine 2017).<sup>1</sup>

Technological innovation can exacerbate these divides. Recent research suggests that technological innovation and the growth of knowledge-based industries has increased income inequality and economic segregation in major cities (Berkes and Gaetani 2018).<sup>2</sup> Automation has displaced middle-skill jobs and widened wage gaps, and job polarization caused by automation is likely to worsen in the future, with uneven effects across cities and regions (Frank et al. 2018; Moore et al. 2018). Reliance on big data and technology-based decisionmaking tools can also reinforce racial bias and discrimination in criminal justice, housing, financial services, and hiring decisions (Executive Office of the President 2016; Upturn 2014).<sup>3</sup>

At the same time, however, many city leaders in the public and private sectors are finding ways to harness technological innovation to reduce inequalities and improve inclusion (DuPuis et al. 2017; Greene et al. 2016). City leaders can use technological innovations to manage infrastructure and improve services, communicate with constituents, and make better decisions. Tech-savvy city administrators are relying on mobile technologies and open-data platforms to crowdsource information on urban services and planning, such as pothole repairs, public safety, and disaster response. Some cities are using big data and applying sophisticated analytic techniques to deliver better services and improve disinvested communities (Greene and Pettit 2016).

In this report, we explore both the opportunities and challenges associated with the digital transformation in cities. Based on a literature review and interviews with experts, we explore trends in four areas of technological change: smart infrastructure, shared mobility, civic technology, and technology-enhanced data analytics. For each area, we identify how trends could exacerbate or mitigate inequalities by looking at current challenges and opportunities, providing examples of cities that are harnessing technology to address equity and inclusion challenges, and exploring where the technology is heading next. We also identify common themes across these areas and provide recommendations for local leaders committed to harnessing technological innovation to create more equitable cities.

# Smart Infrastructure

In recent years, city governments have increasingly relied on smart technologies to upgrade, manage, and improve the efficiency of urban infrastructure. We define smart infrastructure as the combination of “physical infrastructure with digital infrastructure, providing improved information to enable better decision making” (adapted from Bowers et al. 2017). Smart infrastructure technologies range from parking meters that notify drivers when their time is running out to networked sensors that direct traffic flows or geolocate threats to public safety. These technologies often operate in concert with robust data-processing systems that enable data-driven management of infrastructure and basic services.

Global technology giants such as IBM, Siemens, and Cisco were early players in developing and marketing smart infrastructure technologies and helped define what has become a burgeoning field. Although early efforts focused on discrete flagship projects driven by technology providers, municipal leaders today are increasingly designing unique, comprehensive smart solutions that respond to residents’ needs and improve the quality of life in their neighborhoods.<sup>4</sup> Federal grant programs such as the US Department of Transportation’s Smart City Challenge<sup>5</sup> and the National Science Foundation’s Smart and Connected Communities Program<sup>6</sup> have helped cities create blueprints for deploying smart infrastructure technologies and sharing lessons learned.

The shift from technology-driven projects to smart city planning has also helped draw attention to how smart technologies can advance local equity and inclusion goals. Kansas City, Missouri;<sup>7</sup> Philadelphia;<sup>8</sup> and Pittsburgh,<sup>9</sup> for example, have led public engagement efforts to ensure an inclusive agenda-setting process and develop community-informed priorities. But cities rarely focus explicitly on using smart infrastructure to reduce racial and economic inequalities, and the central focus for most projects remains on meeting efficiency and cost-cutting goals. As the field grows, integrating equity and efficiency goals will be paramount, and cities will need better metrics to simultaneously measure progress on both sets of goals.

## Opportunities

Cities can use public and private investments in smart infrastructure advance equity not only to improve efficiency but also to connect residents to opportunity, target investments in disconnected or disinvested communities, and apply revenue generated from efficiency gains to equity-focused initiatives.

### Connecting Neighborhoods and Residents to Information and Services

The most direct way cities can use smart infrastructure investments to improve equity is to connect marginalized residents and disinvested neighborhoods to information, jobs, and services. Expanding

access to broadband and providing free public Wi-Fi are good starting points: both actions can help close the digital divide, which is foundational to many of the other equity interventions discussed in this report. Broadband is the essential infrastructure for accessing economic opportunities on the internet and, as described in the civic tech section later in this report, an ever-widening range of public services are delivered through the web.

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#### BOX 1

##### **Strengthening Connections to the Digital Economy in Kansas City, Missouri**

Kansas City aims to be the world's most connected smart city. City leaders want to use advances in technology to innovate the way cities work, from more efficiently managing infrastructure such as stormwater systems to increasing new ways to engage with residents and visitors. This desire is based on the three main goals of the city's Digital Roadmap:

1. Improve city service delivery
2. Enhance the experience of city residents
3. Support entrepreneurship and economic development<sup>a</sup>

To the city's former chief innovation officer, Bob Bennett, meeting these goals means making access to the internet as "ubiquitous as the telephone."<sup>b</sup> The path toward becoming the world's most connected smart city began in June 2015 with a \$15.7 million investment through a public-private partnership with Cisco, which the City used to install technology such as public Wi-Fi and a series of 25 interactive digital kiosks along the streetcar line and nearby downtown locations to help residents and tourists access city services, local business information, local history and entertainment, and other features. The kiosks can connect with smartphones to let users purchase tickets to events before boarding the streetcar and allow advertising to help bring new revenue to the city. The city is also attempting to expand mobility through its public transportation system. For example, the city partnered with Cisco to offer Cisco certifications at its high schools and is making sure that graduates can access jobs at Cisco by creating bus routes from their neighborhoods to Cisco's server farms. By coupling smart investments in schools with increased access through transit investments, the city is ensuring residents can reap the benefits of new investments.

And to address digital inequities among school-aged children, the city is facilitating the creation of computer labs at existing public assets, such as libraries and police stations, to help youth build digital literacy skills.

<sup>a</sup> "Emerging Technology Initiative (SmartCity) History," City of Kansas City, Missouri, accessed November 6, 2019, <https://www.kcmo.gov/programs-initiatives/smartcity-kcmo/smartcity-kcmo-history>.

<sup>b</sup> Andrew Soergel, "How Kansas City, Missouri Aims to Become the World's Most Connected Smart City," *US News & World Report*, September 27, 2018, <https://www.usnews.com/news/cities/articles/2018-09-27/how-missouris-kansas-city-aims-to-become-the-worlds-most-connected-smart-city>.

However, expanding broadband access alone may be insufficient to close the digital divide. Recognizing this, several cities have embedded broadband expansion efforts within digital equity plans aimed at ensuring all residents and neighborhoods have the information technology capacity needed for civic participation, employment, lifelong learning, and access to essential services. For example, in response to a report that showed wide disparities in digital technology use and literacy across the city's neighborhoods, Seattle launched a digital equity initiative in 2015 that combines improvements in internet connectivity with skills training, outreach, and technical support "for all disadvantaged residents, small businesses, organizations, and communities" (City of Seattle 2015, 5). By 2018, nearly 4,700 residents had received skills training, 2,500 low-income residents had signed up for discounted internet access, more than 205,000 households had gained access to gigabit-speed broadband internet services, and the city government had committed over \$1.4 million to community organizations for services related to digital equity.<sup>10</sup>

More recently, Kansas City, Missouri, launched an ambitious effort to become the "world's most connected smart city" with an explicit emphasis on equity and inclusion. The city is tying together several elements of smart infrastructure (broadband access, public transportation and smart streetlights) to achieve a more expansive vision of digital equity (box 1).

## Targeting Interventions for Greater Impact

Smart infrastructure investments can also be used to focus on disinvested or low-income neighborhoods and ensure they are receiving the resources and services afforded to higher-income neighborhoods. For example, Pittsburgh leaders are working to embed sensor infrastructure into the city's streetlights, which will generate data used for service delivery. Currently the city has 40,000 streetlights, and leaders are looking to convert 90 percent of them to use LEDs and to integrate sensor technology capable of detecting pedestrians and monitoring air quality to reduce emissions.<sup>11</sup> As city leaders embark on this process, they are planning to reconfigure the streetlights to ensure that historically disinvested neighborhoods get equal access to the embedded technologies.<sup>12</sup> Moreover, the city government has experience investing in pilot programs to understand how smart data and infrastructure can help promote safety and improved access for underserved neighborhoods. For example, the city has partnered with the Homeless Children's Education Fund to develop a web-based app for computers and smartphones to provide location-specific services for homeless residents. The city is also partnering with the Allegheny County Department of Human Services and ACCESS Paratransit to provide a transportation pilot in the East Liberty neighborhood to provide quicker access to health care.<sup>13</sup>

Cities such as Kansas City, Missouri, and Washington, DC, have implemented ShotSpotter, which uses an acoustic radar to triangulate where gunshots originate to save time in emergency situations and better predict where threats to public safety will occur.<sup>14</sup> The technology combines its sensor and mapping functions to communicate a specific location, such as a front yard or stretch of alley, to responding officers. This allows them to better locate physical forensic evidence that is critical to understanding the event.<sup>15</sup>

When asked about what value this kind of technology adds in a city like Washington, DC, the CEO of the company behind ShotSpotter replied, “For me it’s like equalizing the service level agreements that police departments have with their communities. We all know if a gun was fired in Georgetown, you’re going to get a very robust response. Anacostia deserves the same response that Georgetown does. Even if the residents don’t call 911.”<sup>16</sup> Instead of measuring success in terms of the arrests made directly from ShotSpotter activations, the CEO sees ShotSpotter as a way to change the relationship between police and communities facing frequent gun violence. On top of apprehending shooters, treating victims, and collecting forensic evidence, police officers can use ShotSpotter information to knock on doors, inform community members about gun violence, and make sure they are okay. However, as discussed in the challenges section later in this report, the deployment of ShotSpotter technology in communities of color and lower income communities also raises civil rights and equity concerns.

## **Generating Revenue to Support Equity-Focused Initiatives**

Cities are using infrastructure updates to generate revenue that can then be used to support services for historically excluded populations. One promising example is New York City’s LinkNYC, which replaces pay phones with kiosks called Links. Each of these Links is equipped with high-speed Wi-Fi, phone service, outlets to charge devices, and city maps, and all services come at no cost to taxpayers.<sup>17</sup> As of September 2018, the kiosks had more than 5 million registered users and an average of 500,000 phone calls a month had been placed through them.<sup>18</sup> The city plans to use the revenue generated from targeted digital advertising to support creating more hotspots in disconnected areas of the Bronx, the borough with the largest share of families without broadband.<sup>19</sup> The kiosks can also contact emergency and civil services and display a government benefits portal, which became very useful to the city’s homeless population. Recognizing this, LinkNYC added access to Aunt Bertha, an “app modeled as a Yelp for social safety-net services,” to support the households most likely to use the kiosks.<sup>20</sup> Since the introduction of Aunt Bertha, over 5,000 programs have been made available across the app, which has generated over 23,500 searches a month from 10,300 monthly users.<sup>21</sup> Although we must consider the

privacy and security concerns raised by the public kiosks (discussed in the next section), LinkNYC's model of revenue generation and redeployment is promising.

## Challenges

Smart infrastructure investments must be carefully designed to avoid widening disparities in access to basic services, reinforcing bias, or diverting resources from inclusion initiatives.

### Risking Misuse of Data

The equity dimensions of the privacy, security, and surveillance issues raised by smart technologies disproportionately affect people with lower incomes and raise concerns about potential misuses of data collected through these technologies (Eubanks 2018). Privacy advocates are concerned about personal user data that may be collected in exchange for free internet access.<sup>22</sup> Advocates have complained of LinkNYC's "opaque processes" and its lack of a "redress mechanism for potential violations," despite recent improvements to an even weaker initial privacy policy.<sup>23</sup> When providers of smart infrastructure are vague about the exact data retained and those data's intended uses, and when the technology is primarily used by marginalized residents (such as LinkNYC's large user base of homeless New Yorkers), the risks are heightened.<sup>24</sup>

Another example affects Washington, DC, where more ShotSpotter sensors have been placed in neighborhoods in the southeast and northeast quadrants of the city, which have higher shares of black residents.<sup>25</sup> We discussed ShotSpotter's intent to change community relationships with police, but in the District, the disparate placement of sensors could contribute to the sense of harassment some residents already feel because of an increased police presence there.<sup>26</sup> The city's lack of transparency on sensor locations, footage captured by the sensors' cameras, or data about police activity stemming from sensor activations could also contribute to resident wariness around increased police presence. ShotSpotter has been installed in many cities to date, and to reduce tension, police must be more open with residents on the locations of the microphones and the arrests that result from shot detections.

Involving lower-income and marginalized communities in the design of smart city projects and informing them of the data being collected requires more targeted outreach, because these populations are often hardest to reach in community engagement efforts. Making sure incentives for signing away personal data are not coercive for certain populations is also complicated. Transparency and consent must be priorities from the outset: cities must inform residents of the kinds of data being collected and their use

and design systems that allow residents to opt out of data collection. The City of Seattle took the bold step in 2017 of adopting a surveillance ordinance, which aims to ensure that the public can weigh the costs and benefits of new surveillance technology—including its effect on civil rights and liberties—before the City obtains it.<sup>27</sup> Although implementation of the ordinance has been slowed by “bureaucratic processes” and onerous reporting guidelines, it is widely seen as a potential model for other cities.<sup>28</sup>

More importantly, allowing public participation when creating privacy policies and establishing processes to hold providers accountable in case of policy violations is essential. As Nigel Jacob, the cofounder of the Boston Mayor’s Office of New Urban Mechanics, said in an interview, “there has to be diversity in the process, both in terms of administrators in the process and recipients of the technology.” As described in box 2, the Array of Things in Chicago provides a promising example of how cities can include residents in decisionmaking on smart infrastructure investments to address privacy concerns.<sup>29</sup>

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## BOX 2

### Supporting Collaborative Design in Chicago’s Array of Things

Cities have been using developments in the Internet of Things—connected computing devices and sensors embedded in everyday objects—as an opportunity to engage residents about the kinds of innovations they’d like to see in their cities and increase government transparency around big investments. Chicago’s Array of Things is an “urban sensing network of programmable, modular nodes that . . . collect real-time data on the city’s environment, infrastructure, and activity for research and public use.”<sup>a</sup> Data collected by the Array is open, available, and free to the public. The data are published openly by Argonne National Lab, and they can be used by individuals to study urban areas and inform planning decisions. As of June 2019, there are 200 nodes installed throughout the city.<sup>b</sup> The Array has committed to recruiting a community of residents for regular feedback. Though community meetings, the city uses the Array of Things to educate residents about sensor capacities and the aims of the project, understand what residents want out of the sensor project and the data it will produce, and garner feedback on the project’s privacy and governance policies.

Chicago’s Array of Things project adopted several engagement strategies early on that supported a collaborative design process: engaging residents online and in person, meeting residents where they were in terms of their familiarity with smart infrastructure and digital privacy policies, and thoughtfully navigating language barriers.<sup>c</sup> These engagement processes will help spur necessary conversations with residents about the opportunities and concerns that smart infrastructure investments bring.

<sup>a</sup> See the Array of Things at <https://arrayofthings.github.io/>.

<sup>b</sup> See the Array of Things FAQ at <https://arrayofthings.github.io/faq.html>.

<sup>c</sup> Laura Bliss, “Who Wins When a City Gets Smart?” CityLab, November 1, 2017, <https://www.citylab.com/transportation/2017/11/when-a-smart-city-doesnt-have-all-the-answers/542976/>.

## Diverting Resources from Equity-Focused Initiatives

Smart infrastructure projects tend to garner a lot of attention and require significant resources. That can divert attention and resources from inclusion initiatives even when those initiatives are highlighted in smart infrastructure plans. For example, Columbus won a \$50 million Smart Cities grant from the US Department of Transportation in part by focusing on the need to reduce extremely high infant mortality rates in one of its poorer neighborhoods, South Linden. The city planned to accomplish this by increasing mobility options for its residents using the grant money, but critics say that the initial equity focus of the Smart Cities money (which the city has grown to over \$500 million through fundraising) has fallen by the wayside in favor of flashier plans for autonomous vehicle fleets.<sup>30</sup>

When the city held focus groups with mothers in South Linden, less-tech-intensive solutions, such as retooling the city's existing paratransit system to get mothers to medical providers on demand, emerged as viable solutions. The city has responded by adjusting its portfolio of projects approved by the Department of Transportation to include a service for low-income expectant mothers.<sup>31</sup> The city council approved the use of \$1 million from the grant fund to pay for the pilot, which is currently under way. This example shows how strong and sustained community engagement can prevent “mission creep” when smart infrastructure projects that start with equity commitments move to implementation.

## Looking Ahead

With a growing share of US cities investing in smart city plans and projects that embed technologies into the physical infrastructure of the city, formalizing equity and inclusion goals during the planning and implementation of these investments is essential to the future well-being of urban residents.<sup>32</sup> Increasingly, cities are producing master plans for their smart investments, and incorporating diverse expertise and perspectives into these plans will be key to realizing benefits beyond pure efficiency and modernization.<sup>33</sup> These discussions with experts will be important as trends such as digital payments and blockchain experimentation take hold.<sup>34</sup> The importance of having an equity discussion as these technologies grow cannot be overstated. As cities look to expand their sensor deployments and integrate them into more robust and wide-reaching analytic systems, they should prioritize the opportunities these technologies present to redress spatial inequities, improve access to basic internet functions, and engage communities in new ways. Philanthropy can play an important role by supporting community-led pilot programs and helping local nonprofits both participate in planning efforts and hold city leaders accountable for advancing equity.



# Shared Mobility

The automobile has been the primary mode of transportation in the United States for almost a century. With a 2018 Gallup poll showing that 83 percent of adults drove a car at least several times a week,<sup>35</sup> that trend continues, but in recent years, technological advances coupled with urban development patterns have spurred new developments in transit. These technologies have spread in cities across the country and the world, with ridesharing, carsharing, docked and dockless bikes, electric scooters, and potentially shared autonomous vehicles (“vehicles that can guide themselves without human conduction”) becoming more common.<sup>36</sup> Cities such as San Francisco; Atlanta; and Portland, Oregon, faced with increasing congestion, have embraced “mobility as a service,” meaning many residents do not own cars but can call on several different transportation options through applications on a smartphone. City leaders have desired to integrate these new modes of movement into their current public transportation network to develop an integrated system for movement without the use of a personal vehicle. The integration of services that reduce or eliminate the need for a car has many terms, including “new mobility,” “emerging mobility,” “micromobility,” and the term we use in this report, “shared mobility.”

Shared mobility is the collection of “transportation services and resources that are shared among users, either concurrently or one after another . . . this includes public transit; taxi and limos; bikesharing; carsharing (round-trip, one-way, and peer-to-peer); ridesharing (i.e., noncommercial services like carpooling and vanpooling); ridesourcing or ridehailing; ride-splitting; scooter sharing (now often grouped with bikesharing under the heading of ‘micromobility’); shuttle services and ‘microtransit,’ and more.”<sup>37</sup>

Shared-mobility services often operate through transportation network corporations (TNCs), organizations that pair passengers with drivers through websites or mobile apps to provide transportation-related services. Similar technologies provide bikes, scooters, or cars for shared use. Shared mobility may eventually include autonomous vehicles that can operate within TNCs or on their own. These shared autonomous vehicles could provide last-mile transportation or operate on specific routes as complements to existing public transit nodes (Ezike et al. 2019). Companies such as Uber, Lyft, Ford, Tesla, and Waymo are investing billions of dollars to bring the technology to maturity as quickly as possible, but most experts believe the technology is many years away from becoming widespread.

Given this expanded ecosystem of mobility options, city leaders will face more complex decisions, especially regarding how new technologies integrate with existing modes of transit in their cities. But the wider array of transit options and providers also broaden the range of tools available to address barriers to mobility.

## Opportunities

Proponents of shared-mobility innovations often tout their potential to reduce traffic and improve travel times. For example, some studies suggest that ridesharing could cut traffic by a factor of three without significantly affecting travel times by transporting many more people using fewer vehicles (Alonso-Mora et al. 2017). But for fostering inclusion, the main opportunities lie in improving affordability, access, and options for residents who face barriers to accessing quality and reliable transit in traditional systems. As Matt Hoffman at Innovation Ventures described, “the potential for [shared mobility technologies] is in allowing lower-income people to access jobs that were not previously accessible.”<sup>38</sup> If shared mobility technologies can reduce cost and time barriers to mobility, “then where you live will be less determinant of what education and economic opportunities you can access.”<sup>39</sup>

### Reducing Transportation Costs for Low-Income Residents

Ridesharing apps and other shared-mobility innovations can help reduce transportation costs for lower-income residents, especially in areas poorly served by public transit. Ridesharing options are often cheaper than owning a personal car or hailing taxis in most cities across America.<sup>40</sup> <sup>41</sup> Though the research is limited, a recent study found that “summoning an UberX, the company’s budget tier, took less than half as long as calling for a taxi in several low-income neighborhoods in Los Angeles,” and the trips were found to cost less than half what the same taxi ride would cost.<sup>42</sup> In an effort to further improve transit in Los Angeles’s low-income neighborhoods, the city partnered with the car-sharing company BlueLA to provide yet another mobility option to these residents (box 3).

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### BOX 3

#### Combining Environmental and Equity Goals in Los Angeles's Car Sharing Program

BlueLA is part of a large carsharing company that serves various cities around the world, but its Los Angeles outfit is the first to target low-income and otherwise underserved residents. With support from the City of Los Angeles and the California Air Resources Board, the company launched 25 cars and 35 charging stations in Chinatown, Echo Park, Westlake, Koreatown, MacArthur Park, Silverlake, and downtown in late April 2018.<sup>a</sup> The fleet has now expanded to 100 cars and 40 stations across the city.<sup>b</sup> BlueLA's entire vehicle fleet is electric, and the company hopes to improve the environmental quality of low-income neighborhoods by reducing emissions.

The system works on a station-to-station basis, much like bikesharing. At launch, the stations were focused in the downtown and Koreatown areas and had offered stations at community colleges in the area, because students will often commute between two or three of the campuses to take courses. Station locations are determined using four components: community meetings, suggestions from community organizations serving the target population, data analysis on neighborhoods that have dense populations of low-income residents and that are affected by greenhouse gas emissions, and an open voting system on the system's website.

To offset costs for its low-income users, BlueLA uses an income qualifier to determine who can access its "community membership" tier. People with incomes at or below \$35,000 qualify, and these residents can access BlueLA's cars for just \$1 a month and \$9 an hour (compared with \$5 a month and \$12 an hour for general membership). In the future, BlueLA hopes to establish stations in high-traffic - usage locations such as airports and "point of interest" locations (such as the Staples Center, LA Live, and Griffith Park) to serve more residents. BlueLA is also interested in using the user data it derives to better understand mobility challenges for its target population, including changes to the average length of commute times and whether having reliable transportation options induces changes in employment or income for low-income residents.

<sup>a</sup> Nicholas Slayton, "Electric Vehicle Car-Sharing Service Brings a New Kind of Drive Time to Downtown," *Los Angeles Downtown News*, April 23, 2018, [http://www.ladowntownnews.com/news/electric-vehicle-car-sharing-service-brings-a-new-kind-of/article\\_4e89fb2c-44db-11e8-923f-9b8f9e229708.html](http://www.ladowntownnews.com/news/electric-vehicle-car-sharing-service-brings-a-new-kind-of/article_4e89fb2c-44db-11e8-923f-9b8f9e229708.html).

<sup>b</sup> See BlueLA at [www.bluela.com](http://www.bluela.com).

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## Improving Transportation Access in Underserved Neighborhoods

Ridesharing is being used across the country both as a connector between modes of transit and as a transportation solution for neighborhoods underserved by existing public transit networks. And many cities are introducing bikesharing systems, which provide residents with a relatively low-cost mobility option.

Apps such as Uber and Lyft can provide first- or last-mile ridesharing services to connect people in underserved areas with public transit. Lyft's app integrates directly with public transit, and the company has partnered with more than 25 cities and counties across the US to have its app allow a user to see nearby transit stations when requesting a ride.<sup>43</sup> For example, the company partnered with the transit agency in Pierce County, Washington, to bridge first-and last-mile gaps, and with the city of Monrovia, California, to allow users to connect to the Los Angeles Metro Gold Line from anywhere in the city for 50 cents. Lyft is also exploring in-app connections with urban public transport systems, though these efforts are nascent: its first partnership, with Dallas Area Rapid Transit, integrated Lyft options into the city's trip-planning and payment apps.<sup>44</sup> Uber rolled out a similar effort in Pinellas County, Florida, in early 2017. Through the county's Direct Connect Program, trips taken to or from eight bus stops in the area are discounted by \$5.<sup>45</sup> The program, which was created to support commuters who don't live within walking distance to public transit and don't have access to cars, has since been expanded to 24 stops in the area and now includes providers such as United Taxi, Wheelchair Transport, and Lyft.<sup>46</sup>

Bikeshare systems can also improve the mobility of low-income communities and communities of color in cities. Although expanding bikeshare stations to more diverse neighborhoods has often required targeted advocacy in cities such Detroit, Minneapolis, Austin, the District of Columbia, and Los Angeles, the results of such advocacy have been positive. For example, Chicago's Divvy bikeshare system started a \$5 membership option to low-income residents, and the Department of Transportation has expanded bike lanes to the south and west sides of the city, which have higher shares of low-income and black residents.<sup>47</sup> In Washington, DC, Capital Bikeshare participates in the Community Partners Program, which offers a \$5 annual membership that provides unlimited rides with the first hour free, a free helmet, and free city cycling classes with the Washington Area Bicyclist Association.<sup>48</sup> The Department of Transportation of Montgomery County, Maryland, offers free Capital Bikeshare memberships for low-income people who live, work, or attend school in the county.<sup>49</sup>

Where bikesharing stations are unevenly distributed across a city or don't reflect demand for bikesharing services by population or geography, dockless bikes may provide a more equitable solution. Dockless bikes offer more flexible service areas and may require less infrastructure and sidewalk space than docked systems.<sup>50</sup> As described in box 4, dockless options in Washington, DC, are increasing bikesharing services' diversity of ridership and reach.

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#### BOX 4

##### Going Dockless in Washington, DC

In August 2017, the District of Columbia's Department of Transportation initiated a pilot program that challenged seven bikeshare and scooter-share providers to increase mobility options in the city. Unlike Capital Bikeshare, all seven providers run on the dockless model, meaning their bikes and scooters can be deposited anywhere in the city and are then retrieved for their next use through a geolocating mobile app.<sup>a</sup> The new providers aim to complement Capital Bikeshare by providing options for first- and last-mile transit in areas where both kinds of systems operate and by providing new transit options in neighborhoods without Capital Bikeshare docks.

Preliminary analyses indicate that the dockless options are increasing the diversity of ridership in the District as well as the geographic reach of shared bike and scooters. One study found that dockless riders tended to be "somewhat more diverse than capital Bikeshare users and [...] more likely to have lower incomes."<sup>b</sup> The much older and more established Capital Bikeshare program still only has 12 percent of its stations in neighborhoods east of the Anacostia river, which are home to mostly black residents. Most stations follow existing transportation infrastructure and are located in areas where it is more likely that residents earn over \$75,000 annually.<sup>c</sup> In comparison, some of the dockless bike providers placed 7 percent of their bikes east of the Anacostia at their outset and increased that share to around 17 percent within two months.

Aside from the greater flexibility that dockless bikes offer, lower barriers to entry may also contribute to these systems' increased ridership diversity. Dockless providers charge just \$1 per half-hour ride (compared with \$2 on Capital Bikeshare), and some dockless providers are partnering with groups serving Washington, DC, youth to offer special pricing plans. According to the director of the Washington Area Bicyclist Association, "The sensitivity of the dockless providers to the way . . . members of communities with financial hardship make investment decisions" is central to growing the diversity of ridership in the District and increasing mobility options across the city.<sup>d</sup>

<sup>a</sup> Jeff Clabaugh, "DC extends dockless bike pilot program," WTOP, April 27, 2018, <https://wtop.com/dc/2018/04/dc-extends-dockless-bike-pilot-program/>.

<sup>b</sup> Christina Sturdivant-Sani, "Can Dockless Bikeshare Pump Up Cycling's Diversity?" CityLab, January 9, 2018, <https://www.citylab.com/transportation/2018/01/can-dockless-bikeshare-pump-up-cyclings-diversity/549629>.

<sup>c</sup> Yipeng Su and Robin Wang, "Three ways bikeshare can counteract, not reinforce, DC's disparities," *Urban Wire (blog)*, Urban Institute, February 11, 2019, <https://www.urban.org/urban-wire/three-ways-bikeshare-can-counteract-not-reinforce-dcs-disparities>.

<sup>d</sup> Yipeng Su and Robin Wang, "Three ways bikeshare can counteract, not reinforce, DC's disparities."

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## Expanding Transportation Options for Underserved Groups

Shared mobility platforms may also create more accessible or convenient options for populations inadequately served by public transit systems, such as seniors, people with disabilities, and nightshift

workers. For example, one group of customers benefiting from van pools in Kings County, California, are the county's agricultural workers, who cannot use fixed-route busses because the routes are not flexible enough for their varying workweeks and nontraditional hours. Government subsidies allow the agricultural workers to pay just \$2.19 per trip for these alternative pooled rides rather than \$4.10 per trip for the bus (Transportation Research Board 2012).

A more recent iteration of Lyft's Dallas partnership is slated to "provide on-demand transportation to seniors and people with disabilities" to expand the capacity of its existing citywide system. Before the partnership, paratransit riders had to book their rides a day in advance.<sup>51</sup> The cost-saving possibilities of an on-demand arrangement are being explored in many cities across the country, because paratransit can be particularly expensive in dense cities (with costs ranging between \$45 and \$60 per ride in areas of Boston, the District of Columbia, and New York), especially in comparison to public transport.<sup>52</sup> Boston, for example, is expanding a deal with Lyft to subsidize up to \$15 for paratransit trips. The expansion was motivated by the significant cost savings both for riders, who saved an average of 34 minutes per trip, and for the Massachusetts Bay Transit Authority, which cut the cost of each trip 71 percent and saved 6 percent on the operation costs of the program overall.<sup>53</sup>

Ridesharing can also provide a viable alternative for people working nontraditional hours (such as night shifts) because public transportation in many cities often stops running at night, or for people who work or live in more remote locations. For example, the Kings County Area Public Transit Agency in California operates 110 van pools to serve customers who live in less dense areas for which the government cannot justify providing other modes of transit (Transportation Research Board 2012).

Autonomous vehicles also present an opportunity to expand mobility options for people with disabilities. Waymo (the driverless car subsidiary of Google's parent company, Alphabet) is testing accessibility features as it pilots its first fleet of autonomous vehicles for ride hailing. Waymo's vehicles use accessibility features on passengers' smartphones that turn visual controls into speech controls, have buttons labeled with braille, and provide guiding sounds that can help visually impaired passengers locate their rides.<sup>54</sup>

## Challenges

Several challenges arise in implementing shared mobility options equitably. Implementation threatens to perpetuate discrimination as these options are rolled out, exacerbate uneven access to public transit, and fail to address the barriers to using these technologies that excluded groups face.

## Perpetuating Race- or Gender-Based Discrimination

Concerns over apparent race- and gender-based discrimination in ridesharing arose almost immediately after the new technology took hold in cities. According to a working paper from the National Bureau of Economic Research, the race- and gender-based discrimination can happen in four main ways: drivers may choose not to drive in or around certain neighborhoods; drivers can decline certain riders or could cancel immediately after accepting; drivers can rate riders with certain qualities poorly; or drivers can take riders on longer routes, thus increasing travel times or costs. Research has found that black male riders face longer wait times and higher cancellation rates. These disparities are drastic: cancellation rates were three times higher for black male riders of Uber than for white male riders in the same city, for example (Ge et al. 2016). Women also faced discrimination, primarily in the length of their rides (and thus their costs). Though Uber and Lyft have taken steps to become aware of the potential for discrimination across their services (such as by meeting with the researchers who conducted the study, sharing the study's findings with their drivers, and staying abreast of their available metrics on ride cancellations), the companies have yet to pursue more concrete solutions such as those suggested in the study—they say that removing the names and photos of passengers and drivers could reduce rider and driver safety.<sup>55</sup> The companies are still exploring other possibilities for addressing the discrimination the study identifies.

Another concern is that the arrival of shared-mobility options such as bikeshares and electric scooters will further accelerate gentrification and displacement. Residents in many cities such as the District of Columbia and Chicago believe that soon after the arrival of bike lanes, bikesharing services, and other shared-mobility modes in their neighborhoods, housing prices will go up and they will eventually be displaced.<sup>56</sup> This concern has led to some neighborhoods blocking shared-mobility options from entering as residents protest the technology's presence and assert their desire to stay where they live.<sup>57</sup> Involving residents in communities facing gentrification or displacement pressures in the design of shared-mobility programs can help mitigate these challenges. Although shared-mobility programs tend to be designed for entire cities, surveying different types of communities can also help uncover “local mobility culture” and ensure programs are rolled out in a way that does not threaten residential or cultural displacement (Biehl et al. 2017).

## Encouraging Disinvestment in Transit and Exacerbating Segregation

The growth of the shared-mobility industry indicates that this technological innovation is here to stay, but an overreliance on private mobility providers creates equity concerns regarding how cities invest in public transit. Although little research has examined the effects of ridesharing on reconnecting

historically segregated urban areas to city centers, some speculate that the expansion of ridesharing will lead to disinvestment in public transit systems and reinforce patterns of segregation (Allen 2018). Even when partnership opportunities arise between private ridesharing options and public systems, cities must guard against the possibility of new forms of inequity emerging. For example, though the expansion of paratransit systems through ride-hailing companies has been widely lauded for its cost-saving effects, cities will need to invest in outfitting more cars with accommodations for people who use wheelchairs (Cohen and Shiraz 2017). Otherwise, a two-tiered system could emerge that privileges people who can ride in traditional cars over people who are unable to use them.<sup>58</sup> This risk is lessened in cities that provide their own paratransit, because most vehicles cities use can accommodate both types of users.

Though bikeshare systems can expand transit options for underserved neighborhoods, the inverse is also possible: transit-rich areas of cities may be targeted for innovation because of higher existing demand, thus exacerbating the lack of mobility in cities' transit deserts. The distribution of bikeshare stations, for example, raises concerns about segregation: in the trade-off between bike density in urban cores or greater coverage across cities, many cities have tried to strike an appropriate balance, to varied effect. New York City's system is the largest and has opted for extreme density in Manhattan; the systems in Chicago and Washington, DC, fall closely behind in size and aim for slightly less density in the core to have a wider reach. But they still fail to provide enough bikes in the South Side of Chicago or east of the Anacostia River in the District, which are both historically segregated and primarily black areas.<sup>59</sup>

Some of these challenges can be overcome through intentional design and dedicated resources. For example, Philadelphia's Indego system prioritizes outreach to lower-income and nonwhite residents, and its outreach coordinators credit this effort for Indego's more equitable ridership: its rider base is 55 percent white and 19 percent black, whereas ridership for Capital Bikeshare in Washington, DC, is 80 percent white and only 4 percent black (LDA Consulting 2017).<sup>60</sup> Moreover, Philadelphia created courses for diverse residents to learn more about the Indego system and city biking in general (and paired it with digital skills education) to ensure that the system was accessible to new riders.<sup>61</sup>

## **Reinforcing Barriers for Low-Income Residents and Other Underserved Groups**

Although shared mobility can reduce transportation barriers if implemented in an inclusive manner, it can also reinforce existing barriers that disadvantage people from underserved groups. For example, payment structures for shared mobility technologies can present several barriers to equity. Ride-, car-, and bikesharing systems often require credit cards for payment, which precludes use by unbanked riders, who are often from low-income households (Shaheen and Cohen 2018). Payment structures that



require deposits up front may also exclude lower-income users who cannot afford such investments. People dealing with financial hardships are especially affected.

Companies could consider different pricing plans that would be more attractive to users with varying financial health. Philadelphia's Indego system again provides one viable model: the service offers monthly memberships at a 70 percent discount for people receiving Supplemental Nutrition Assistance Program (SNAP) benefits or other cash assistance and does not require traditional credit cards to claim the voucher.<sup>62</sup> Arlington County in Virginia allows residents to pay Capital Bikeshare membership and user fees with cash.<sup>63</sup>

## Looking Ahead

The shared mobility space has evolved quickly, and continued evolution is likely as new technologies, providers, and systems arise and disrupt our current understanding of urban mobility. However, the introduction and implementation of this innovation must be carefully planned and consider potential uses from all demographics to produce the most equitable and inclusive outcomes for residents in urban areas. Innovation in autonomous vehicles, especially for shared use, is likely to shape shared mobility significantly in the coming years, and transit agencies, which are already piloting autonomous trains and rapid bus routes in some states, are likely to be among the first adopters of autonomous vehicle technology (DuPuis, Stahl, and Rainwater 2017). But as shared-mobility options expand in cities, users must be able to access the tools required to use them. These tools, such as a smartphone and direct access to digital payments, are not available to everyone. The digital gap needs to be fully closed for shared mobility to expand equitably and inclusively. Although the timeline for widespread adoption of autonomous vehicles is unclear, the potential ripple effects that widespread use could have on public infrastructure are coming into focus: the need for sensors across street lights, roads, and parking spaces suggests that the public sector must be involved in both financing and coordinating such a large-scale effort.<sup>64</sup>

Likewise, technological changes might affect the physical form of cities: one study suggests that less demand for parking in dense downtown areas could lead to increased economic activity and land rents, and lower transportation costs from wider use of autonomous vehicles could induce sprawl (Zakharenko 2016). Black and Latinx families are more likely than white families to live near highways and therefore be more exposed to on-road air pollution (Pratt et al. 2015). Autonomous vehicles could significantly increase the number of cars on the road if current land-use planning patterns are

maintained. If autonomous vehicles are powered by internal combustion engines, they could increase congestion and harmful emissions in these communities (Ezike et al. 2019).

To adjust to and prepare for the many unknowns of this frequently changing landscape, cities should explicitly address equity and inclusion in their plans for modernizing mobility options and prioritize frequent consultation with diverse residents as they plan. They should plan for several scenarios regarding the adoption of shared mobility and understand how to promote equitable outcomes with major effects on land-use patterns, workforce development, sustainability, and more. Not all cities are designed the same, and they have not all developed similarly. Cities such as New York and Chicago are dense and well-served by public transit; other cities, such as Houston and Detroit, are sprawling, and a larger share of their residents rely on cars. City leaders need to account for existing land-use patterns and transportation options as they integrate shared mobility to fill transportation gaps, especially outside of urban cores.

# Civic Technology

Many local governments have taken advantage of civic technology (“civic tech”) to become more transparent, accessible, efficient, and accountable. Given recent technological advances, an increase in smartphone adoption, the emergence of government open-data portals, and the growth of citizen programming groups, civic tech has the potential to drive inclusive growth in cities. Some prominent, recent examples of civic tech include 311 applications that allow residents to report local issues, online applications that connect residents to public benefits, and government services or communication platforms that enable residents to weigh in on government decisions.<sup>65</sup>

Although civic tech has many definitions, we adopt in this report a definition used by the Civic Tech and Data Collaborative: “technology involving intentional collaboration between technologists, government, and/or nonprofits to engage the public or solve civic problems” (Reynoso, Pettit, and Whitaker 2018, 5).<sup>66</sup> More specific definitions, such as one by *Government Technology* magazine, include common applications of civic tech: “technology that enables greater participation in government or otherwise assists government in delivering citizen services and strengthening ties with the public.”<sup>67</sup>

In this report, we emphasize civic tech’s facilitation of direct interactions between residents and governments.<sup>68</sup> We include both technologies developed by the government and by outside developers in partnership with the government. Innovative civic tech practitioners include volunteer-based governmental organizations such as Code for America, a national nonprofit civic tech and design organization, and DataKind, a network of civic technologists who use data science to tackle complex cross-sector social issues, as well as publicly minded firms in the private sector and city agencies that apply innovation and technology to improve interactions between constituents and government.<sup>69</sup>

Although many local civic tech practitioners focus on developing new applications to improve government efficiency, relatively less attention has been paid to the equity implications of such efforts. However, conversations around the lasting implications and outcomes of technology are increasingly centering issues of access and equity, especially as government service delivery and communication platforms increasingly use new technology.

## Opportunities

For marginalized communities, integrating technology into government systems to improve civic engagement can help improve transparency, reduce information gaps, facilitate communication, and

foster more efficient service provision. But to harness these opportunities, governments need to carefully consider and implement strategies to overcome structural barriers to using civic tech applications.

## **Increasing Transparency and Accountability in Public Decisionmaking**

Increased access to government data enables civic tech organizations to use these data to create clear, user-friendly, accessible tools that can reach residents who are underserved in existing systems. Government data published and made accessible for download is known as “open data” and exemplifies the idea that public information should be accessible and available.<sup>70</sup> With access to open government data, civic technologists can create tools such as applications or websites that improve government transparency and accountability, enabling all constituents to track government actions that affect them and their families. For example, the Cleveland Healthy Home Data Collaborative created an online tool that allows renters to look up the risk of lead and other health hazards based on combined city datasets.<sup>71</sup>

Leading nonprofits such as the Sunlight Foundation champion open data as the bedrock for building complete, equitable, and effective government systems and civic participation (Sunlight Foundation 2014). As the open-data movement has evolved, leaders emphasize that open data need to be contextualized with outreach and engagement. In 2017, the Sunlight Foundation produced a Tactical Data Engagement Framework for data providers to encourage community use of information and open data (Sunlight Foundation 2017). This framework moves beyond just publishing data and helps data providers spur meaningful use of them. For example, Western Pennsylvania Regional Data Center in Pittsburgh created data user groups to bring together data providers, users, and data intermediaries around a specific data challenge or question. More recently, the organization built on that work by producing guidance on “Community Data Dialogues,” events held to share open data to community members and foster conversation on specific topics; one example highlighted was Data Days Cleveland (Sunlight Foundation 2019).

Once government data are made publicly available, civic technologists can use those data to reduce disparities in how services are provided or how laws are enforced. For example, as described in box 5, civic leaders, technologists and public officials worked together in St. Louis County, Missouri, to improve how residents interact with the municipal court system and to reduce racial disparities in traffic-related warrants and incarceration.

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## BOX 5

### Reducing Racial Disparities in St. Louis Civil Courts

The [Civic Tech and Data Collaborative](#), a partnership between Living Cities, Code for America, and the National Neighborhood Indicators Partnership at the Urban Institute, fostered local civic tech and data partnerships in three cities with the explicit goal of bettering the lives of low-income residents (Reynoso, Pettit, and Whitaker 2018). In St. Louis, Missouri, the team (CivTech St. Louis) created a web-based tool to help mitigate the harm from the disparity in warrants for nonviolent traffic offenses between residents of color and white residents (Arena and Pettit 2018). Residents who received traffic tickets in one of the roughly 90 jurisdictions within St. Louis County were left struggling to find court information in disparate systems.

Residents bore the burden of tracking their information through traditional means in the criminal justice system. Before the tool was created, residents had to manually and individually contact municipalities in St. Louis County to receive information on their ticket and court date.<sup>a</sup> In St. Louis County, this burdensome process disproportionately disadvantaged communities without flexibility, knowledge of the system, and access to resources. YourSTLCourts consolidated court data in St. Louis County through an application programming interface into a digital portal that allows residents to access their traffic ticket information and opt to receive text message notifications with court information. YourSTLCourts is an example of technology created for a more transparent and centralized system for connecting residents with their own court data.<sup>b</sup> To sustain the technology, the team established a nonprofit, CivTechSTL, to continue educating residents, finding champions within county government, and encouraging use of the tool.

<sup>a</sup> “YourSTLCourts,” CivTech St. Louis, accessed November 12, 2019, <http://www.civtechstl.com/projects/yourstl-courts/>.

<sup>b</sup> John Cruz and Laura Kinsell-Baer, “Court Data in St. Louis County: Sharing Sensitively,” Living Cities blog, May 4, 2017, <https://www.livingcities.org/blog/1196-court-data-in-st-louis-county-sharing-sensitively>.

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Although having access to government data is an important step toward transparency and accountability, creating change for residents requires pulling that information into usable tools. An evaluation of 34 US municipal open-data portals found that more needs to be done to “improve user interaction and engagement, especially regarding trust, understanding data, integrating data, and user involvement and participation” (Zhu and Freeman 2018). Data need translators or “mediators” to “support access and overcome barriers for those who might otherwise be excluded from the societal (and economic) benefits of open data” (Zhu and Freeman 2018). Open-data portals alone are not enough to increase equity. To democratize data, information should be pulled from portals, compiled, and presented in an accessible format. Data should be contextualized for users. Local data intermediaries can work with community leaders or practitioners to use data in a way that helps them achieve their goals.<sup>72</sup>

Public agencies can also bring data to communities and provide opportunities to learn about data use. For example, the City of Los Angeles's Department of Neighborhood Empowerment, EmpowerLA, launched the Open Data Literacy Program with the goal of educating community leaders in all 99 Neighborhood Councils in Los Angeles to use open data to "gain a deeper understanding of the makeup of their neighborhoods to solve their unique neighborhood needs."<sup>73</sup> From November 2017 through September 2018, EmpowerLA hosted eight data trainings reaching over 300 residents and used the USC Price Center for Social Innovation's Neighborhood Data for Social Change platform to explore neighborhood-level census data. The training aimed to encourage residents to use a data-driven approach to identifying and solving community challenges.<sup>74</sup>

## Improving Fair Access to Public Services

Governments can now use websites and mobile applications powered by real-time data to communicate with residents to notify them of service changes or disruption, and residents can similarly use these applications to provide timely feedback to help improve government services in their neighborhoods. Where once people needed to take time off of work to visit government offices or spend time navigating several government websites, they can now report local issues and apply for or manage government benefits from any connected device.

Civic tech organizations are building applications to help residents better access government services and information. Eligible applicants may be deterred from applying for benefits because of the initial resources required or may become frustrated with cumbersome processes. Some applications focus on making these initial processes more accessible, while others help users manage benefits. Perhaps the most well-known example of the first concept is GetCalFresh, a Code for America application and website built to access CalFresh, California's implementation of SNAP. The designers' goal was to simplify the application process for SNAP benefits for eligible applicants, who have limited economic resources.<sup>75</sup> Ultimately, the portal was able to reduce a lengthy, complex application process down to 10 minutes, increasing the likelihood that busy adults apply for the program and recertify in a timely manner.<sup>76</sup> The tool allows users to apply for SNAP, ask questions through a chat system, upload required documents as a photo, and receive text reminders for appointments.

Propel, another free mobile application, enables SNAP recipients to more easily manage their benefits. Propel allows users to check their balance on the application rather than through a phone call, saving them time and making it more likely they manage balances more consistently. Understanding that SNAP recipients often have limited economic resources, the application provides coupons,

connections to services, and job opportunities. According to Propel CEO Jimmy Chen, CalFresh recipients have applied for over 60,000 jobs through the app.<sup>77</sup> The application modernizes an outdated aspect of service delivery through better design and by harnessing more current technologies and flexible resources not as available to the public sector.<sup>78</sup> In the future, improved technology could also increase the uptake of benefits by integrating eligibility across several programs, reducing the time and energy required to apply for benefits.

## Supporting Civic Engagement and Inclusive Design

As many in the civic tech space note, better civic tech is not just about building usable technology; it is also a process of cross-sector collaboration that engages experts, technologists, and users.<sup>79</sup> Implemented correctly, civic tech is built hand-in-hand with the residents it serves, a philosophy known as “build with, not for.”<sup>80</sup> The shift from top-down creation and implementation to a more individual- and community-centered approach to creating government tools can help increase equitable and inclusive engagement. Laurenellen McCann of the Johns Hopkins University Center for Government Excellence writes:

What distinguishes community-driven civic tech from ‘civic tech’ more generally is the extent to which the real people that a tool is intended to serve guide the lifecycle of that tool.

Community-driven technologies are built at the speed of inclusion—the pace necessary not just to create a tool but to do so with in-depth communal input and stewardship—and directly respond to the needs, ideas, and wants of those they’re intended to benefit.<sup>81</sup>

McCann also developed “5 Modes of Civic Engagement in Civic Tech,” which provides strategies based on successful community-driven tech projects to guide “bottom up” innovation (McCann 2015). Human- or user-centered design provides an avenue for residents to sculpt tools best designed to fit their needs. In interviews, experts in the civic tech field emphasized that civic tech should revolve around the specific goals of a community, feedback from users, and increased accountability of those in power to those they serve. One example of the “build with, not for” concept is the InnoMaytion hackathon, described in more detail in box 6.

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## BOX 6

### Deliberate Inclusion in Tech Development

Civic tech gives cities an opportunity to bring new voices into government, fostering inclusive processes. For example, the District of Columbia government organizes the [InnoMAYtion hackathon](#) annually. In 2017, the hackathon organizers focused on “the advancement of women and youth in entrepreneurship” and STEM through the creation of civic tech applications using open data and web development technology. The government invited a diverse group of programmers, entrepreneurs, students, nonprofit leaders, and community members to participate. The project focused on empowering women of color, increasing opportunities for boys and young men of color, improving policy and outcomes for youth and families, improving school scorecards, and providing a tool to inform affordable housing discussions. The hackathon also included educational workshops for participants of all ages and skill levels.<sup>a</sup> The InnoMAYtion hackathon is an example of an inclusive, city-initiated process that provides marginalized groups the opportunity to participate in the development of new technology. In 2018, InnoMAYtion included a month of 34 events dedicated to increasing underrepresented communities’ participation in technology development and highlighting government use of technology.<sup>b</sup>

<sup>a</sup>“InnoMAYtion Hackathon for Women and Youth in STEM & Entrepreneurship,” Washington, DC Office of the Deputy Mayor for Planning and Economic Development and the Washington Post, accessed November 12, 2019, <https://nvite.com/innoMAYtion/4wy9dv>.

<sup>b</sup>To see the full list of InnoMAYtion events, visit <https://innomaytion.org/events/>.

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Online platforms for civic engagement are one way constituents can participate in government. Issue-specific forums allow residents to electronically access information, track legislation, and comment, similar to how they might participate in a town hall meeting. In-person participation in traditional community engagement forums can be difficult for people with limited time or resources to spend navigating complex bureaucratic systems. As described by a Data Smart City Solutions blog, traditional methods of community engagement “cannot meaningfully capture citizen input” because these feedback mechanisms are not accessible to all.<sup>82</sup> Further, with time and resource constraints in government, a lack of engagement can misallocate resources. Creating digital options for civic engagement, such as [SpeakUpAustin!](#), an online feedback platform for the City of Austin, can help increase opportunities to participate in local politics by diversifying the ways residents can provide feedback or weigh in on government decisions (box 7).



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## BOX 7

### Speaking Up in Austin, Texas

SpeakUp Austin! is an online forum that allows Austin residents to follow current local issues, submit feedback, publicly post personal stories, and monitor legislation and reports (Rumbul and Shaw 2017). In February 2018, the City of Austin decided to leverage the platform after the city council voted to mandate paid sick leave for all nongovernment employers. Prior to the decision, SpeakUp Austin! posted questions on a digital forum, such as “Who should be covered under a policy that requires employers to provide paid sick days?” and encouraged Austin residents to post stories of how paid sick leave would affect them to better capture engagement.<sup>a</sup> Individual forum questions garnered anywhere from 83 to 521 responses, and according to the City’s Paid Sick Leave Stakeholder Process Report, “more than 183 Austinites provided a total of nearly 900 comments online via SpeakUpAustin.org” on the issue (Schooler 2017). Residents could also send input via text message. To ensure that all residents were able to weigh in regardless of digital access, the city still used traditional public conversations to garner feedback. The website includes contact information for a relevant staff member, a timeline of deliverables to the City of Austin, and links to the reports compiled from feedback.<sup>b</sup> These features encourage government accountability and transparency and help close the feedback loop between residents and their elected officials.<sup>c</sup> The current 2020 Budget Engagement board includes links to the proposed budget, a schedule of town hall meetings, forum recordings with specific community members, information videos, a survey in multiple languages, and an updated schedule of the budget process.<sup>d</sup>

<sup>a</sup> “Paid Sick Days for Austinites,” *SpeakUp Austin!*, accessed November 12, 2019, <https://www.speakupaustin.org/paid-sick-days-for-austinites>.

<sup>b</sup> “Paid Sick Days for Austinites,” *SpeakUp Austin!*.

<sup>c</sup> Visit the SpeakUp Austin! website to see the format for online discussion, the tracker for collected feedback, and the contact information for relevant city employees by issue area. See “Paid Sick Days for Austinites,” *SpeakUp Austin!*.

<sup>d</sup> To view the current 2020 Budget Engagement platform, visit [https://www.speakupaustin.org/budget-2020?tool=survey\\_tool&tool\\_id=2020-budget-engagement-spanish#tool\\_tab](https://www.speakupaustin.org/budget-2020?tool=survey_tool&tool_id=2020-budget-engagement-spanish#tool_tab).

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## Challenges

Although advocates for civic tech have long touted the potential gains of a more technologically advanced civic infrastructure, realizing these opportunities requires overcoming existing structural challenges: exclusion of residents with limited internet access or comfort, disparate power dynamics, and a lack of institutionalization of new technology. Within government, civic tech alone will not achieve equity and inclusion. Technology must be coupled with a political agenda to address structural inequities created by past policy decisions. Without an explicit commitment to equity or intentionality in design, inequities may be amplified by technology instead of diminished. Rather than promoting

inclusivity, technology can reinforce and potentially exacerbate barriers that have long excluded socially and economically marginalized communities.

## **Excluding Residents Who Lack Access to Key Technology and Information**

Without deliberate efforts to design for all people, all technology, including civic technology, can perpetuate inequality. Alissa Black, investment director at Luminate, pointed out that technology as a tool for civic engagement may remove barriers—such as time and distance for in-person meetings—while simultaneously introducing new ones, such as access to technology. According to Black, “[Technology] empowers those who already feel empowered. If you were never going to show up to a city hall meeting, moving that forum online doesn’t necessarily empower people who have felt marginalized in the past.”

Civic tech tools often rely on digital access (i.e., through social media or smart phones), which is much less common in lower-income communities. In February 2019, 95 percent of US adults making less than \$30,000 a year had a cell phone, but only 71 percent owned a smartphone (compared with 81 percent of all adults). Further, because of limited broadband access, people of color and low-income households may rely on smartphones as their only connection to the internet.<sup>83</sup> Twenty-six percent of Americans making below \$30,000 a year relied exclusively on smartphones to access the Internet compared with 6 percent of those making \$75,000,<sup>84</sup> and the same pattern is true for internet access for people of color compared with white Americans: 25 percent of Hispanic people rely on smartphones for internet access, 23 percent of black people rely on them, and 12 percent of white people rely on them. Smartphone applications that allow constituents to communicate directly with governments may provide another channel for the same higher-income and more-educated share of the population to access government officials, further perpetuating existing inequalities in participation and access. Without a smart phone or reliable internet access, residents may not have equitable access to information.

The challenge of technology accessibility is much broader than smartphone ownership or access to broadband: digital comfort is also required to expand civic participation. On top of internet access, residents must have the knowledge necessary to decipher the language used in government materials.<sup>85</sup> When mySociety analyzed survey responses submitted by users of web-based government tools, they found “only people who were inherently comfortable using digital government services and speaking often opaque bureaucratic language were accessing city department services through the tool” (Rumbul and Shaw 2017). To mitigate barriers brought about because of language and comfort with city

processes, civic tech experts we interviewed emphasized that governments need to couple technology with offline engagement. Although civic tech is necessary to promote increased access to government, it alone is not enough to reach all residents. To combat disparities in digital literacy and comfort using digital resources, unequal access to internet, and historical patterns of exclusion from political processes, local governments need an explicit commitment to equity and inclusion to fully implement, integrate, and publicize technology within marginalized communities.

## **Failing to Sustain Innovations and Improvements over Time**

A persistent challenge for civic technologists is the sustainable political and financial integration and maintenance of tools. Even the most successful civic tech projects can fail because of a lack of adequate funding or buy-in from government departments. Without plans for longevity, civic tech solutions can be shortsighted and lack the support needed to provide long-term change. As Rumbul and Shaw (2017, 2) point out, “The greatest risk to the success of civic tech is a lack of full institutional absorption of tech tools into structural and budgetary systems.” Even with enough funding, resources may be diverted to build an application that may not meet the needs of the community or that falls short of its original equity goals. Candace Faber, the former Civic Tech Advocate for the City of Seattle, explained in an interview that working toward government solutions does not end with the creation of a tool: “Often times, people want to implement the tool and be done, but you’re not necessarily going to fix longstanding problems with technology alone. What you can do is implement something in a new way so that it meets people’s needs.” But even when a tool is implemented well, according to Faber, there may be “no funding model available to support this technology over time.”

Research conducted by the Knight Foundation and the Rita Allen Foundation finds that “few civic tech startups have developed repeatable and reliable revenue to cover their costs and grow their operations—indeed, many startups in the field launch without an anticipated business model” (Sotsky and Kartt 2017). Given the fast pace of technological advancement, governments must dedicate resources to integrating technology into its processes, ensuring those technologies’ upkeep, and updating the data and technology. They must also commit resources for ongoing funding outreach and engagement. Otherwise, the technology may be working, but people will be unaware of the resource and the project will not have any constituency to advocate for its continuation.

Adoption of civic tech is also susceptible to changes in political will. Programs or policies that integrate technology in government in one administration may not receive continued support after that administration leaves office. Commenting on the challenge of civic tech sustainability, ST Mayer, Code for America’s chief program officer, told us, “Often it is less about sustaining the technology, and more about sustaining government interest when people retire, change jobs, or the administration changes.

Sustainability is often about ensuring you have a diversity of relationships within government so that you institutionalize the interest [in the application].” In its survey, mySociety found that an ongoing challenge to civic tech leaders is institutionalizing tools, and if digital tools appear temporary or do not lead to definite changes, residents are not likely to adopt these new technologies or behaviors (Rumbul and Shaw 2017).

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#### BOX 8

##### **Building Internal Capacity to Innovate within Government**

When cities commit to embedding technology in an intentional and sustainable way, they can focus on more efficiently and effectively delivering services to residents. The City of Boston’s Department of Innovation and Technology works with city departments to design applications that serve city residents. For example, the Department of Innovation and Technology developed BOS: 311, a brand that includes an app, website, and Twitter strategy that allows residents to report nonemergency issues.<sup>a</sup> They also created more specific applications that eliminate the need to call 311 or pay tickets by mail: Trashday, an app to set reminders for recycling and trash collection, and PayTix, which lets residents pay parking tickets. Boston’s citywide Resilience Strategy focused on addressing racial equity. As part of the strategy and Boston 2030 plan, the city is investing in infrastructure, training programs, and services, in addition to working with private companies, to “enhance digital equity by increasing access to technology tools, computers, and the Internet” (City of Boston 2017). A component of these initiatives includes expanding broadband access to narrow the equity gap in accessing city services through civic tech (City of Boston 2017).

<sup>a</sup> BOS:311 is a brand to signal to residents a single unified strategy and place for all of Boston’s non-emergency issues. To read more about the strategy, read the digital team case study on branding and design: <https://www.boston.gov/departments/innovation-and-technology/apps>.

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Starting with a successful model and creating teams dedicated to innovation in technology within government can help institutionalize civic technology applications. Internal technology and design teams, such as the New York City Mayor’s Office for Economic Opportunity, can provide opportunities to digitize government systems and ensure human-centered design is incorporated into civic technology processes. Working within government, these teams can help champion and socialize successful projects to other departments in the city. For example, mySociety’s civic tech survey found that in many cities, a successful civic tech tool made internal government officials more likely to envision expanding or integrating technology throughout the city (Rumbul and Shaw 2017). And according to Alissa Black, the dedicated innovation offices and chief data officer positions act as channels to harness technology to serve residents. The City of Boston’s Department of Innovation and

Technology is an example of a dedicated city agency that has been able to integrate technology capacity across government functions with the explicit goal of better service delivery (box 8).

Some civic tech applications achieve sustainability by relying on outside organizations to support the technology. Candace Faber noted that innovative civic tech often does not require that government processes change. Rather, outside actors create technology that helps residents better navigate existing government systems and processes. For example, Clear My Record, a portal launched by Code for America's Safety and Justice Team in 2016, helps Californians expunge their criminal records. Now known as Clear My Record (Classic), the application allows people with eligible convictions to begin the process of clearing their criminal record. Applicants enter information and are connected with an attorney to handle their case. The tool synchronizes this information across 14 participating California counties, which is helpful given that 43 percent of people who apply have convictions in several counties. The information is sent to an attorney to determine program eligibility, and within a month applicants receive information on their results and next steps.<sup>86</sup> The app requires only 10 minutes to complete, staff members are available for support throughout the process, and the average time to be connected with an attorney has decreased from three months to within a week.<sup>87</sup> Code for America also developed a pilot in five California counties in 2018 that helps the government quickly evaluate eligibility for record remediation relief under Proposition 64, which legalized marijuana in the state.<sup>88</sup> The pilot is expected to lead to the dismissal or reduction of 75,000 cannabis convictions, and the program has been expanded to every county in California.<sup>89</sup>

## Looking Ahead

Although civic tech alone cannot solve longstanding structural inequities, integrating technology into government systems and processes will likely become a necessary step in improving the relationship between government and its constituents. As the field continues to develop, more opportunities for coordination and mobilization on platforms that enable civic participation will emerge. Governments, even in smaller localities, will likely follow the direction of cities such as Boston and New York and dedicate time and resources to deploying technology to reach and serve residents. Bloomberg Philanthropies began investing in innovation teams ("i-teams") in five cities in 2012 and today funds 20 i-teams in cities around the globe.<sup>90</sup> However, because technology is becoming increasingly integrated into public-sector processes, more research needs to be conducted on its effectiveness.<sup>91</sup> One step is to understand if and how civic technology can significantly improve not just transparency and service delivery but also equity. Cities must begin to recognize the role of technology in furthering equity while still furthering policies that address systemic inequity head-on.

# Technology-Enhanced Data Analytics

Technological advances have provided cities with access to a constellation of new, frequently updated datasets and an array of advanced analytic techniques for processing both preexisting and new data. Cities such as New York are now analyzing large volumes of 311 data in ways that were previously impossible because of time and technological constraints, allowing leaders to prioritize and respond to issues in real time.

New data sources produced by smart city technologies, shared-mobility services, and civic tech applications, paired with data science methods capable of processing nearly unlimited quantities of data, can also provide city leaders with a more accurate and useful understanding of everything from resident well-being to the built environment. For example, cities can collect data from traffic sensors and smartphones to better understand “transportation deserts” (areas without adequate public transit for a population that needs it) and access to basic services.

These new datasets and analytical tools also give city leaders an opportunity to better understand and address equity challenges and to evaluate ongoing interventions using timely information. To date, most applied data analytics projects in cities aim to improve efficiency, according to several experts we interviewed. Although these analytics projects often have indirect equity implications, key stakeholders both inside and outside of government are increasingly focusing on the equity opportunities and challenges inherent in data analytics and using this frame to guide important conversations around the use of data to inform decisions.

## Opportunities

Analyzing new and existing data allows city leaders to uncover pressing issues they were previously unaware of, more effectively address equity challenges within time and resource constraints, and spark new conversations around equity and opportunity.

### Uncovering Equity Challenges

Analyzing existing city datasets can provide a more precise understanding of the longstanding challenges residents face and how government resources have historically been distributed to address

them. Local governments collect a variety of administrative data across departments, such as building inspection procedures, crime rates, and resident complaints. Many of these data include demographic information on people who interact with city services, allowing cities to understand who is already served by their programs and where gaps exist. Although analyzing these data has historically been difficult because of fragmented collection procedures and inadequate technology, more powerful computing capacity and new analytical tools have made it substantially easier to connect, manipulate, and analyze multiple datasets in less time.

Cities around the country are beginning to harness the power of existing administrative data to better understand local issues. City leaders in New Orleans, for example, were concerned that many residents did not have adequate smoke alarm systems in their homes. To better understand the extent of this problem, the city's Office of Accountability linked local fire department data with the American Housing Survey and American Community Survey to identify low-income neighborhoods that faced a high risk for fires and which households might not have the money to install fire alarms (City of New Orleans 2015). And in Philadelphia, the Department of Licenses and Inspections is analyzing how to address 311 calls more equitably (box 9).

New analytical tools also allow local governments to link datasets from across departments to gain a more comprehensive understanding of how different challenges intersect to affect residents' well-being. For example, Oakland's [Equity Intelligence Platform](#) is using analytic techniques to reduce the burden of combining local administrative datasets, allowing city agencies to create a standardized process for analyzing and displaying cross-departmental data to city leaders.<sup>92</sup> Oakland's new system will allow officials to assess who is being served by different city services and how outcomes and needs differ by neighborhood.

Cities are also analyzing data from new smart infrastructure projects to better understand and target service delivery to historically underserved or excluded populations. Data from smart technologies can reveal any number of insights about city life, such as how residents interact with the built environment and how much they use public services. Sensors and internet-enabled devices can capture data automatically and in more frequent intervals, making them more useful to city leaders and analysts looking to use data that are timelier and that have fewer human entry errors and biases in judgment.

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## BOX 9

### Improving Racial Equity in Philadelphia's 311 System

The City of Philadelphia is working actively to dismantle institutional racism and improve racial equity within the city. As part of the Racial Equity Here Cohort, a Living Cities initiative that supports cities committed to advancing racial equity, city leaders analyzed how racial segregation of neighborhoods and inequitable government policies have led to unequal opportunity for residents.<sup>a</sup> To help reverse the legacy of racial inequity in their city, local government officials analyzed differences in how 311 complaints are addressed based on race, income, and housing tenure.

The City's Department of Licenses & Inspections, which oversees city building permits and inspections, worked with the city's 311 system to analyze 311 requests using a racial equity lens. First, the department measured the time elapsed between the submission of a complaint and the time the problem was resolved and found that two complaint types had especially long wait times: "maintenance residential complaints," which include structural problems such as a leaky roof, and "vacant property" complaints. Focusing on these two areas, they then analyzed how wait times vary by neighborhood based on race, homeownership, crime rate, and poverty rate. They found that the census tracts with longer wait times tended to have a higher share of minority residents, a higher share of renters, higher crime rates, and higher poverty rates.<sup>b</sup>

Based on these findings, the department and Philadelphia's 311 system are working to change city policy. Specifically, they are focusing on refining how they allocate staff time to certain neighborhoods and where they locate their field offices throughout the city.<sup>c</sup> They are hiring new inspectors and reallocating the number of officers devoted to certain neighborhoods based on their research findings. They also continue to analyze the data to better understand why these disparities exist.

<sup>a</sup> Local and Regional Government Alliance on Race & Equity, "Philadelphia Finalizes Racial Equity Action Plan to Drive Equity Efforts," *Racialequityalliance.org* blog, July 21, 2017, <https://www.racialequityalliance.org/2017/07/21/philadelphia-finalizes-racial-equity-action-plan-drive-equity-efforts/>; Ben Hecht, "Announcing Racial Equity Here," *Living Cities* blog, May 25, 2016, <https://www.livingcities.org/blog/1071-announcing-racial-equity-here>.

<sup>b</sup> Rebecca Swanson and Nefertiri Sickout, "Equity in Government Services: How the City of Philadelphia Utilized a Racial Equity Analysis to Inform Internal Resource Allocation and Drive External Outcomes," *RacialEquityAlliance.org* blog, November 15, 2017, <https://www.racialequityalliance.org/2017/11/15/equity-government-services-city-philadelphia-utilized-racial-equity-analysis-inform-internal-resource-allocation-drive-external-outcomes/>.

<sup>c</sup> Local and Regional Government Alliance on Race & Equity, "Philadelphia Finalizes Racial Equity Action Plan to Drive Equity Efforts."

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In Louisville, Kentucky, for example, the local government analyzed data from a "smart infrastructure" project that tracks asthma inhaler usage by embedding a sensor into the inhalers of over 1,000 residents. The data from these sensors provided information on where and when asthma inhalers were used and the quantity of the medication released by the inhaler during each usage period. The local government, in collaboration with the technology company Propeller Health, used these data to



analyze asthma risk and prevalence for each neighborhood in the city and identify specific environmental hazards that exacerbate asthma.<sup>93</sup> The new sensor-generated data allowed Louisville to understand the landscape of asthma prevalence, asthma triggers, and health outcomes in a way previously inaccessible to them. Analysis of the data from the asthma sensors highlighted the concentration of air quality issues in areas with high shares of low-income and black residents. These findings motivated the city of Louisville to review zoning regulations to better separate neighborhoods from pollutants and target interventions in specific communities that were disproportionately struggling with asthma.<sup>94</sup>

## Designing More Effective and Evidence-Based Interventions

Data analytics can provide local leaders with the tools necessary to design effective interventions for underserved populations. As discussed in the previous section, New Orleans fire department employees analyzed fire inspections and survey data to target communities especially prone to fires and home to a large share of low-income residents.<sup>95</sup> This initiative was seen as such a success that Enigma, the analytics company that partnered with the city to analyze the data, scaled their predictive model for fire risks to more than 170 cities<sup>96</sup> so that communities across the country, such as Syracuse, New York, could use the technology to design more effective interventions.<sup>97</sup> Similarly, in New York City, the Center for Innovation through Data Intelligence partnered with a local academic institution to use data analytics to design a more effective service delivery system that targets individuals at risk of homelessness (box 10).

Local governments can also use analytical tools to track the effect an initiative has on its target population, allowing city governments to understand success in real time and adjust programs accordingly. Further, if an initiative shows promising results in its infancy, governments may be more inclined to provide additional resources to build upon the work. In Louisville's case, the city government used findings from its asthma inhaler data to design policies and practices that target environmental toxins associated with severe asthma.<sup>98</sup> After a year, they used the same inhaler data to analyze results. They found an average 82 percent reduction in asthma inhaler use for emergency situations and that participants experienced more than double the number of symptom-free days.<sup>99</sup>

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## BOX 10

### Predicting Homelessness in New York City

The New York City Department of Homelessness Services (DHS) provides case management services to homeless people and people at risk of homelessness across the city through their Homebase program. Over the past decade, DHS has worked with local partners to harness the power of data-driven decisionmaking tools to increase the efficiency of their program and improve their processes for identifying people at risk of homelessness.<sup>a</sup>

DHS partnered with researchers to develop a risk assessment process that used data analytics to guide case managers' decisions. The researchers applied a risk factor model based on past DHS Homebase administrative records and linked this information to shelter entry data to identify the individual-level traits that are most predictive of shelter entry. They then identified the most important factors associated with shelter entry, such as threat of eviction or pregnancy. Ultimately, the model developed through this process was more efficient and effective than the previous system at predicting the risk of homelessness. This increases the effectiveness of funding and services for homelessness and highlights the ability of predictive modeling to support case management efforts (Shinn et al. 2013).

Building off the momentum from this project, the city's Center for Innovation through Data Intelligence continued to explore ways to more effectively identify and deliver services to people at risk of homelessness. The group worked with the New York University Furman Center for Real Estate and Urban Policy to apply machine learning tools to identify building-level characteristics that predicted higher rates of shelter entry, with the goal of better streamlining outreach efforts to families at risk of homelessness (Collinson et al. 2015; Hendey 2016).

In 2014, DHS also partnered with the SumAll Foundation to create a model that anticipated which upcoming evictions would likely lead to a person or family becoming homeless. This project linked administrative data on eviction cases in housing court with shelter entry data to understand the geospatial relationship between the two. Using this analysis, they developed a map for their Homebase workers to better target outreach in certain areas with higher rates of evictions and shelter entries. Outreach efforts included a mobile services van, which has been deployed to the identified high-risk areas.<sup>b</sup>

<sup>a</sup> "Predicting Homeless Shelter Entry." NYC.gov, accessed November 12, 2019, <http://www1.nyc.gov/site/cidi/projects/predicting-homeless-shelter-entry.page>.

<sup>b</sup> Lyell Sakaue, "Data-Driven Strategies for Reducing Homelessness," Harvard Ash Center for Democratic Governance and Innovation, August 6, 2014, <https://datasmart.ash.harvard.edu/news/article/data-driven-strategies-for-reducing-homelessness-516>; Kathleen Hickey, "City Mines Eviction Filings to Slow Homelessness," GCN (Government Computer News), February 13, 2014, <https://gcn.com/articles/2014/02/13/new-york-homeless-data.aspx>; Liz Enbysk, "Hard Data and Warm Hearts: A Formula for Ending Homelessness," Smart Cities Council, October 4, 2016, <https://cc.smartcitiescouncil.com/article/hard-data-and-warm-hearts-formula-ending-homelessness>.

## Sparking New Conversations about Equity and Inclusion

Using data analytics to inform decisions can spark conversations around equity and inclusion that are grounded in evidence. To design predictive models effectively, city leaders must be explicit about their assumptions and goals, which can lead to productive conversations around biases in the data and structural barriers more generally (Metro Lab Network 2017). And according to Joy Bonaguro, former chief data officer for the City and County of San Francisco, “cities need to be accountable for the decisions they make.” Analyzing data related to city services holds the city accountable to the effectiveness of their programs and prevents cities from relying on anecdotal evidence or biased assumptions regarding their performance.

Data analytics can also spark conversations beyond the confines of city government, encouraging other stakeholders to think concretely about equity and inclusion. In Boston, for example, the launch of an open-data portal that tracks the “health” of the city on a variety of dimensions is starting conversations among stakeholders about which issues the city government should prioritize.<sup>100</sup> Using data as a democratizing force to start equity-related conversations is essential to involving the diverse coalition of stakeholders necessary to combat the structural forces that create and perpetuate disparities.

## Challenges

### Reinforcing Biases in Data and Algorithms

If algorithms are designed without scrutiny and a comprehensive understanding of the data, they can create a biased understanding of residents’ needs, in turn biasing the resource allocations and interventions to address them. Flawed interventions based on biased data can exacerbate the problems they aim to address and can often create an entirely new set of challenges.<sup>101</sup> Although algorithms are often thought of as objective instruments, they rely on data that may be rooted in biased human behavior, which will likely lead to biased results. For example, the COMPAS software used by courts nationwide to predict the likelihood of a defendant reoffending was the subject of a ProPublica investigation that found that when the software was incorrect, it often assigned higher risk scores to black offenders than to their white counterparts.<sup>102</sup>

The use of historical data to predict future problems poses unique challenges for data analysts. Data reflect past trends in service delivery, but they often do not address the structural forces that shaped them. And these structural forces, including biases in historical data, often shape who appears in the

data and how they are categorized. As mathematician and author of *Weapons of Math Destruction*, Cathy O'Neil (2017), stated, "Algorithms don't make things fair. They repeat our past patterns. They automate the status quo."

Further, a lack of transparency around how predictive models work can catalyze distrust among the public and diminish accountability. According to Tashira Halyard, senior associate at the Center for the Study of Social Policy, "If used incorrectly these [analytical] tools can let people off the hook—to not have to attend to the assumptions they bring to the table about families that come from a certain socioeconomic background or are of a particular race or ethnicity" (Metro Lab Network 2017).

The field of predictive policing illustrates these risks. Predictive policing uses historical arrest or conviction data to predict future criminal activity and is a practice that has garnered significant scrutiny in recent years. Crime data is not always collected uniformly, and they often reflect the deeply entrenched biases of police department policies and practices and of society as a whole. Biased targeting and arrest patterns can lead to flawed historical datasets where, regardless of the underlying crime rate, crimes are overreported in low-income neighborhoods or neighborhoods with high shares of people of color.<sup>103</sup>

Given the history of racial segregation and criminalization of black men in the US, predictive policing models that pinpoint neighborhoods with high levels of crime can lead to an increased focus on certain income classes or racial groups, leading in turn to a heightened police presence in areas with populations that already experience high rates of criminalization, further exacerbating these issues (DuPuis et al. 2017). Much of the debate around predictive policing has centered on CompStat, a process through which police departments analyze historical spikes in crime rates and use this information to target police activity. Critics of this analysis tool argue that the predictive model fails to address the structural racism and budgetary issues, such as limited resources that confine where officers patrol, that created these differences in crime rates in the first place.<sup>104</sup>

Moreover, new technologies are often unequally distributed across the city or used by a nonrepresentative sample of the population. Therefore, any data used to make decisions may not represent the full population and can produce biased findings. For example, smart city technologies embedded into public transportation will capture the information of those who use public transit, which might exclude populations who live in transit deserts or cannot afford to use transit frequently. In using these data, a city might mistake a steady stream of usage data by a group or neighborhood as a sign that there is no issue with the city's service delivery process, when in fact a significant portion of the community may prefer a different transit configuration.<sup>105</sup>

## Exceeding Local Capacity to Address Equity and Efficiency Simultaneously

Government technology efforts are often underfunded, and procurement processes leave little room for innovative responses from smaller, less well-established competitors, leaving innovative staff at local governments stuck with insufficient legacy systems.<sup>106</sup> If the government manages to procure more modern technology, it may struggle to recruit employees whose technical skills allow them to take advantage of these new systems in a competitive job market for technical talent.<sup>107</sup> A lack of technical talent also means that a city may struggle to translate policy goals into technical requirements for skilled technology vendors. This skill gap can leave governments with subpar analytics projects that are fraught with biases or misguided information.

Moreover, using data-intensive applications without enough support or budget can lead to biased systems that seem cheaper and more equitable but that actually obscure the inequalities they create. Without sufficient funds for qualified data analysts, for example, cities may use 311 calls to represent the actual need for service in the city, but 311 calls typically offer a poor representation of the need for service in lower-income neighborhoods.<sup>108</sup> Joy Bonaguro, former chief data officer for the City and County of San Francisco, describes how cities face two barriers to increasing analytics adoption: “asking good questions” and finding “sufficiently skilled people to answer these questions.”<sup>109</sup>

## Suggesting Short-Term Solutions to Enduring Problems

Relying on data to identify issues and address them can produce programs that focus on short-term solutions rather than on long-term or structural changes. Because changes are monitored in real time, performance management criteria are focused on short-term gains, driving public agencies and service providers to make decisions that might have positive results in the short run but more negative outcomes over time. For example, some argue that predictive policing strategies encourage police officers to focus on potentially harmful intervention-oriented practices rather than on strategies that emphasize trust building and community interaction, which may be more effective in the long run (DuPuis, Stahl, and Rainwater 2017; Ferguson 2017). In other cases, officials may prioritize “gaming” performance metrics, and at times this may be at the expense of the overall goal the metrics seek to measure. For example, teachers famously “taught to the test” to improve test scores following the 2001 No Child Left Behind Act, and police officers have been known to underreport or downgrade incidents to improve crime metrics.<sup>110</sup>

# Looking Ahead

The ongoing adoption of new technologies, such as body-worn cameras and autonomous vehicles, suggests that opportunities are growing to apply data analytics to equity issues and generate new sources of data that can be used in real time, to address equity challenges. Further, ongoing technological advancements in natural language processing and machine learning will continue to allow cities to understand and address equity concerns using already-available data currently locked in inaccessible text formats or nontraditional formats such as audio and video.

Acknowledging both the opportunities and challenges inherent in applying data analytics to equity issues, stakeholders are beginning to develop tools and frameworks to help practitioners in the field better use data analytics to drive equitable outcomes. For example, the University of Chicago Center for Data Science and Public Policy recently launched Aequitas, a toolkit that allows practitioners and policymakers to audit machine learning models for biases and discrimination (Saleiro et al. 2018). And the Institute for Ethical AI & Machine Learning's Responsible Machine Learning Principles outlines a framework of eight principles to support the "ethical and conscious development of AI projects across all industries."<sup>111</sup>

As technologies continue to advance and the conversation around data analytics for equity expands, city leaders should adopt an explicit equity focus in their processes and address the key challenges associated with applying analytics to equity to achieve positive results for their constituents.

# Key Lessons

In our research, we found four lessons that surfaced across each area of technological innovation we studied, which we describe in this section:

1. Technology can provide new insights on equity.
2. Technology does not erase structural barriers.
3. Embedding equity in technology requires up-front investments.
4. Inclusive processes are more likely to lead to inclusive outcomes.

## Cities Can Use Technology to Generate New Insights on Equity

Data generated by new technologies and analytical tools can reveal additional detail on disparities in access to opportunity in ways that were previously difficult to measure. New technologies are generating unprecedented volumes of data about cities that can be used by policymakers to understand disparities. However, having data alone is insufficient. As summarized by Rayid Ghani, Distinguished Career Professor at Carnegie Mellon University, “Data are the artifacts, but not the goal. The question we need to be asking is how do we use the data—and what tools and analysis can be done—to deliver services that increase access to opportunity and equitable outcomes?”

Fortunately, new technologies have made it easier than ever to distill data into actionable insights that can promote equity. For example, analytical tools such as natural language processing, otherwise known as text analysis, can extract information on names, people, locations, and sentiment from citizen feedback and input to allow decisionmakers to better understand and summarize a large volume of public responses. Grade.DC.gov in Washington, DC, for example, uses text analysis to mine citizen feedback on their website and social media to produce monthly grades for the District’s government agencies.<sup>112</sup> Big data systems can process billions of points of traffic data generated by sensors across the city in seconds to better understand and target bottlenecks in real time (Syafudin et al. 2018).

From an equity standpoint, city leaders use these analytics systems to better understand the issues faced by low-income residents, such as the prevalence of adequate smoke alarm systems in New Orleans or the extent of asthma risk in Louisville, and target solutions for those communities (City of New Orleans 2015).<sup>113</sup> In the smart infrastructure space, efforts such as Smart Chicago’s Array of

Things will regularly measure activity such as pollution, sound, and pedestrian and vehicle traffic and help city leaders better understand the disparities in access to clean air and efficient street networks between neighborhoods.<sup>114</sup> In the civic tech space, technologies such as Code for America's Clear My Record, which streamlines the process for people to complete the forms to clear their criminal records online, can illuminate opportunities for government intervention to remove barriers for marginalized populations.<sup>115</sup> As city officials use these new data sources to generate insights on equity, they must implement measures to transparently engage communities about the data collected and safeguard resident privacy, particularly as the surveillance concerns of these new technologies disproportionately affect the poor (Eubanks 2018).

## Technology Does Not Erase Structural Barriers

Issues such as racial discrimination, residential segregation, financial exclusion, and disparate access to broadband and computing technology are crucial to consider when adopting technological solutions. For example, lower-income, black, and Latinx residents are less likely to own a computer, have broadband at home, and own a smartphone. And although libraries provide an alternative means of access, black and Latinx residents are much more likely to report that they need training to increase their confidence in using the internet.<sup>116</sup> Consequently, when a city uses a website or application to provide a service traditionally performed by paper or in a government office, people from these historically disadvantaged groups are less likely to be able to take advantage of the benefits digitization provide. For example, in the civic tech space, many tools such as #VizLou, a civic communications tool in Louisville, Kentucky, rely on smartphones or social media.<sup>117</sup> Candace Faber, the former Civic Tech Advocate for the City of Seattle, noted, "when the city doesn't think about what the process will look like to the end user, the application will require privilege to use, and as a result you'll only receive feedback from a small number of engaged power users."

Moreover, forces of discrimination, or past patterns of discrimination captured by city data, perpetuate these structural barriers. In data analytics, programs such as CompStat use historical data to predict future crime patterns, but the historical data may be based on discriminatory behavior, so the predictions will perpetuate these stereotypes.<sup>118</sup> And in the shared mobility space, researchers have found that black users wait longer and face higher cancellation rates for services like Uber (Brown 2018).



# Embedding Equity in Technology Requires Up-Front Investments

Many cities lack the capacity and resources necessary to harness technological innovation to advance equity and prioritize users who are historically excluded. According to Aaron Rieke at Upturn, “many cities struggle to hire people with sufficient technical expertise to build new systems.” As cities try to do more with less, technology can help reduce costs, but up-front investments are necessary to ensure equitable outcomes: if equity and user experience are not explicit parts of these technology decisions, cost, vendor biases, and vendor lock-in will take precedence.

For example, in the data analytics and civic tech space, city governments are often tempted to use 311 calls to represent calls for service in the city. However, these calls may do a poor job representing service requests from people in lower-income areas, who are less likely to use the app to report issues (Narayanan and MacDonald 2019). Local governments need staff with data analytics capacity to ensure the data are used appropriately to advance inclusion. Programs such as the Bloomberg Philanthropies What Works Cities project are responding to this need by investing in building city data analytics capacity and providing a valuable peer learning network for staff in 100 cities.<sup>119</sup> They may also need to dedicate resources to outreach and education in communities that are less likely to use 311. Although the city may save money from hiring fewer call operators, it may need to spend some of those savings to hire analytics talent and coordinate targeted outreach efforts.

In civic tech, implementing new technologies, such as mobile apps, takes intensive investment to build the tool and conduct platform and version updates, but they are much easier for people with smartphones to access and use. If equity is not explicitly included as part of the project, however, cities may not have enough money remaining after app development is complete to conduct targeted outreach to communities with low smartphone usage or to develop a web version this group can access.<sup>120</sup>

In general, city leaders are at times confronted with the challenge of repurposing technology originally built to maximize profit, instead using it to solve a specific social problem. In the smart infrastructure space, technologies are often repurposed from the needs of big businesses and built by engineers in technology companies geared toward solving problems for business clients (Adelberg et al. 2018).<sup>121</sup> As Nigel Jacob, the cofounder of the Boston Mayor’s Office of New Urban Mechanics, said in an interview, smart cities’ technologies “are not often built with insights into cities and the role of people, and assume the problems of a city are optimization, which is sometimes appropriate but often not.”

# Inclusive Processes Are More Likely to Lead to Inclusive Outcomes

Design research has shown that inclusive design processes yield programs and products that are better quality and more usable for all people (PwC Australia 2019).<sup>122</sup> However, without explicit planning for codesign and participation, groups that lack access to power may be shut out of the processes of building and implementing new technologies. In other words, shaping technology products without input from historically excluded groups is likely to reinforce exclusion. In civic tech, for example, many technologies may inevitably reinforce existing patterns of civic participation even despite good intentions. A mySociety survey of five “successful” civic tech applications in five US cities found that the applications’ users were very similar demographically to people who already participated in government in person through traditional means, such as showing up to government forums to speak in city council sessions (Rumbul 2015). In other words, many applications of civic tech may not be expanding access to people who face barriers to participation in government.

Cities also need to proactively ensure that diverse perspectives are included from the outset to reap the benefits of inclusive design. As Amber Woodburn McNair, Assistant Professor of City and Regional Planning at the Ohio State University, observed, “If you’re going to lead with racial or economic equity, you need more than just the IT people and engineers at the table. For example, you need public health specialists and public service providers who understand government planning processes and can advocate for people, not just technology.”<sup>123</sup>

When cities implement more inclusive processes, they can seemingly achieve more equitable results. For example, the inclusive process championed by the Washington, DC, InnoMAYtion Hackathon has led to the design and creation of websites and applications for women, youth, and people of color.<sup>124</sup> KC Digital Drive’s Paint the Town Green campaign helped ensure that Google Fiber access was equitably shared in Kansas City, Missouri, by bringing outreach efforts to lower-income neighborhoods, contributing to the citywide goal that 90 percent of neighborhoods would be eligible for Google Fiber.<sup>125</sup> Although these examples are promising, more rigorous evaluation is needed that demonstrates more inclusive processes deliver more equitable outcomes.

# Paths Forward

This section sets out four principles to address the challenges and accelerate the opportunities surfaced in the previous section:

1. Combine technological innovation with structural solutions.
2. Hardwire equity goals into project development and implementation.
3. “Build with, not for,” traditionally excluded communities.
4. Leverage technology to track equity goals.

## Combine Technological Innovation with Structural Solutions

To effectively combat discrimination, segregation, and the digital divide, actors implementing technology innovations should combine investments in technology with investments in the enabling environment for equity, such as policy supports and approaches to address structural issues.

Governments must not use technology in place of structural change; technology alone cannot overcome larger political and economic challenges (Arena and Pettit 2018).

The digital divide remains a critical structural issue that must be addressed to create an enabling environment that ensures the benefits of technological innovation are equitably shared. For example, Kansas City’s plan to expand public Wi-Fi access and smart kiosks focused on previously disinvested neighborhoods in the downtown area and used technology to promote digital inclusion and reduce the digital divide. The city first acknowledged the existing level of disinvestment in these communities and then acted to ensure more equitable outcomes in access to the internet. The city plans to leverage this investment to ensure that residents will also be able to benefit from other smart infrastructure investments and online government services. The city of Charlotte took a similar approach. The Charlotte Digital Inclusion Alliance developed a Digital Inclusion Playbook, which identifies strategies to ensure that the 20 percent of Charlottesville residents without in-home internet access could fully participate in the digital economy. The city paired programs providing access to broadband and low-cost devices with digital and media literacy training (Dorsey and Martin 2017).

In the shared-mobility space, inequities in access to credit or debit cards and smartphone data are critical structural issues that may preclude the 15 percent of US consumers who are underbanked or

unbanked from benefitting from shared-mobility technologies that often require payment through a credit or debit card or a smartphone app (Hackenbracht et al. 2016; US Department of Transportation 2017). The payment barrier has equity concerns, considering that most underbanked or unbanked consumers have an annual household income under \$25,000. Some shared mobility programs are seeking to remove this barrier by enabling cash payments, such as Philadelphia's Indego bikeshare program.<sup>126</sup> Such efforts should also be paired with structural investments to reduce the existing disparities in access to credit and smartphones, which would expand access to shared mobility.

## Hardwire Equity Goals into Project Development and Implementation

To ensure equity goals are met, leaders must build them into the planning, scoping, and evaluation of technology projects. Efforts can take the form of targeting a specific disinvested area, an equity plan, reforming business processes and procedures, or otherwise explicitly linking tech to equity in official city actions. Many cities are adopting explicit equity commitments and toolkits to help city departments adopt a racial equity lens in all programs and practices, and their technological efforts should align their equity goals and processes with these broader citywide initiatives.<sup>127</sup>

Alissa Black explained that cities need to start with the “why” of adopting new technology. According to Black, “Technology inherently advantages people who have access to the technology. So, you need to ask a city official “why” they are implementing the technology. The city needs to understand the purpose of deploying civic tech, and if that purpose improves equitable distribution or access, the technology is much more likely to achieve that goal.”

Too often, city technology projects are led by the technologists within the city or partner technology companies rather than by city policy staff. In such cases, the primary goal of the project may often be efficiency, not equity. According to Nigel Jacob, many smart cities projects aim to “make society better, faster, and cheaper, and while sometimes that’s appropriate, sometimes it may not be.” Instead, Jacob recommends that cities “put people at the center of what they do,” which forces leaders to come up with “a more flexible and creative approach” to the problem.

Three cities leading the way in this regard are New Orleans; New York; and Portland, Oregon. New Orleans targeted homes in lower-income neighborhoods at high risk of fire for intervention, ensuring that these disadvantaged neighborhoods received services as part of the process. LinkNYC targeted disconnected areas of the Bronx to receive new broadband hotspots. Portland's [Smart Cities PDX](#)

**Priorities Framework** requires that smart city projects engage underrepresented communities during design, and it defines criteria for support that mandates all projects must “address an inequity/disparity.”<sup>128</sup>

In the data analytics space, Aaron Rieke at Upturn says that cities should ask basic questions to ensure equity goals are met, such as “Who is doing the work? What is their stated goal? How are they doing? And have you measured their progress?” For example, Philadelphia recently analyzed its 311 data with a racial equity lens. The city is consequently revising its policies on the allocation of staff time and the location of field offices in the Department of Licenses and Inspections to support equitable service delivery to all communities.

In general, many experts noted that cities should “lead with values,” or ensure that technology decisions are driven by the city’s agenda and outreach to shape a public consensus. For example, Brooks Rainwater of the National League of Cities stated that, “technology should align with the values of the city and what its constituents want. Public engagement is key in starting to think about innovation.”

## “Build With, Not For,” Traditionally Excluded Communities

Simply planning for equity considerations is not enough: cities should also ensure that decisionmakers are representative of the entire city. In the smart infrastructure space, Boston—the creator of the Smart City Playbook,<sup>129</sup> a resource a strategy for developing people-centered sensor technologies—has created a citywide equity strategy, called Resilient Boston, that establishes collaborative, proactive governance as one its four pillars. The focus of the pillar is to create “an inclusive and collaborative city government culture that offers residents a meaningful role in decision-making processes,” and one of its primary goals is to increase employment equity and representation in government.

To ensure that marginalized groups are included, the civic tech field has pioneered the phrase “build with, not for,” a concept that complements hardwiring equity goals by promoting equitable processes for identifying these goals and designing technology solutions to meet them. Cities should work in partnership with local organizations with established community relationships to create an inclusive process that may need to go beyond consultation with communities and include resident empowerment and codesign. Technology can help create these processes. As Code for America’s ST Mayer notes, “Local governments can use technology to facilitate people who have historically been excluded to have

a voice in shaping their community and their future. Creating these opportunities is a core challenge of government, but government and technology leaders must be intentional about making it happen.”

Human-centered design plays a big role in the idea of “build with, not for,” because it prioritizes the input and value of the technology to users throughout the build process. Candace Faber, the former Civic Tech Advocate at the City of Seattle, believes that technology projects should build “an ethos around human centered design and user experience” into the process to achieve more equitable results. Events such as the civic tech InnoMAYtion hackathon in Washington, DC, are a great example of human-centered design because they intentionally bring together both the groups affected by the technology and the groups building the technology to create a solution.

## Leverage Technology to Track Progress

Cities and companies can accelerate the use of technology and analytics tools to track equity outcomes across a range of programs and services. Some cities have developed the capacity to perform advanced data analytics to better target households for lead inspections or to better predict who might become homeless and provide support services. Yet according to experts, even in larger, well-resourced cities, many of these analytics projects are one-time endeavors, they don’t always meet residents’ needs, and most are not focused on measuring equity.

Cities should continue to invest in applied data analytics talent and develop frameworks, processes, and best practices for measuring progress on equity goals. In civic tech, programmers and city officials can go beyond the InnoMAYtion hackathon approach and build monitors into the applications themselves, with user permission, to better understand the disparities in who uses the tools that are created. Cities and companies can use the analytics embedded in smart infrastructure and shared mobility applications to understand the geographic disparities in the infrastructure location and user demographics to track progress toward equity.

For any agency, doing this well requires a commitment to equity concerns and data transparency. City open-data platforms and dashboards with up-to-date measures of progress can be a key resource to operationalize this commitment to transparency and give community groups the information they need to hold government accountable. For example, the city of Louisville, Kentucky, incorporated racial equity indicators into their LouieStat online measurement and performance system to openly track progress toward their racial equity commitments.<sup>130</sup>

In the data analytics space, researchers and technology companies have begun to develop technology tools to integrate equity measurement into city data efforts. For example, applications have been built to evaluate spatial equity in data (such as the distribution of public parks or police arrests) as well as to audit machine learning models for bias and discrimination (Narayanan and MacDonald 2019; Sailer et al. 2018). And companies such as Microsoft,<sup>131</sup> Google,<sup>132</sup> and IBM,<sup>133</sup> have created and made publicly available code, papers, examples, and demonstrations for detecting and adjusting for bias in algorithms.

# Conclusion

The digital revolution is changing the way people move, work, and engage in cities. As cities implement new technologies, some residents are at risk of being left behind, further exacerbating inequalities. City leaders can leverage new technologies to advance inclusion by creating systems that have greater reach and ensure that benefits and services are accessible and available to all residents who need them. However, this will require that city leaders design new systems and ways of doing business that foreground equity and inclusion. And it will require input from and codesign with residents as well as rigorous approaches to evaluating progress.

Too often, we consider the opportunities and challenges that new technologies present in silos: What are the privacy threats posed by big data analytics? Can new mobility platforms help connect underserved communities? Will smart infrastructure widen or narrow the digital divide? In this report, we grappled with these narrow (though critical) questions, but we also identified how they relate and what larger lessons and principles they point toward that can guide efforts to harness technology to improve equity in cities. Many of these lessons and principles will be familiar to those already working at the intersection of technology and equity. For others, we hope these insights can help spark new conversations and approaches.

Important questions remain about how and where new technologies can help close divides in equity and inclusion, without recreating structural disparities of the past. With support from the Mastercard Center for Inclusive Growth, the Urban Institute will help equip city and community leaders with insights and measurement tools to better understand how technology can improve all residents' quality of life. As part of this collaboration, we will conduct research and analysis on how leaders from the public, private, and nonprofit sectors can work together to drive inclusive growth and harness technology to improve equity in cities. As we pursue this work, we will build upon the insights from this research, and we will test and apply the principles identified here across a broader range of areas.



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