The Benefits and Risks of Policymakers' Use of Smart City Technology

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Abstract

The term *smart cities* refers to the intersection of connected devices (also known as the Internet of Things), big data, the urban environment, and city dwellers. Smart city innovations have been widely lauded for their potential to improve government services and government transparency. Sensor technology creates the potential for congestion pricing, which could make government services more efficient. Access to big data can give policymakers the information they need to improve infrastructure maintenance. However, smart city innovations also carry considerable risk, including expansion of the surveillance state. Risks to citizens' rights are greatest when law enforcement agencies use smart city tools. Using a public choice framework, I explore the potential for smart cities to improve urban life and analyze the potential risks these technologies carry to violate citizens' rights.

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The term *smart cities* refers to the intersection of connected devices (also known as the *Internet of Things*), big data, the urban environment, and city dwellers.[1] Smart city products in use in American cities include bike-share networks, sensors that allow for variable parking prices, and apps that rely on publicly provided data. In an effort to make their city competitive with other jurisdictions, some city policymakers have engaged in public–private partnerships to implement these new tools with the stated goal of improving urban services. Beyond improving existing programs, some city leaders have plans to make more revolutionary changes to city government with smart city data.[2] Their ideas include thwarting terrorist attacks, reducing crime, and improving traffic flow.

These new policies have been both successes and failures. In some cases, smart city innovations have improved services in urban jurisdictions by increasing transparency. The Internet of Things has allowed city policymakers to introduce prices to manage demand for transportation services rather than rely on queuing. However, in many other cases, new technology has provided an opportunity for government agencies to create the illusion of improving services without implementing real reforms. In cases where agencies fail to achieve their goals because of poor incentives, additional data collection with smart city technology has not demonstrated the potential to improve outcomes. In some cases, smart city projects have tempted city agencies to the increase the scope of their efforts. This temptation presents the opportunity for waste when governments try

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[1] This definition follows the work of Doug Washburn and Usman Sindhu, "Helping CIOs Understand 'Smart City' Initiatives: Defining the Smart City, Its Drivers, and the Role of the CIO" (Cambridge, MA: Forrester Research, 2010).
[2] For an overview of the history of smart city tools and their use in municipalities, see Anthony M. Townsend, *Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia* (New York: Norton, 2013).

to take on services that would be better provided by the private sector. More dangerously, the availability of data on residents has increased the potential for government surveillance and has expanded the tools available to law enforcement agencies.

In this paper, I first provide an analysis of the actors who have been involved in implementing smart city tools and the incentives they face. Second, I analyze the benefits that smart city innovations have provided by improving the quality and cost-effectiveness of public services. Third, I explore the costs of smart city tools and the risks they present for civil rights. I conclude with general principles for maximizing the benefits of smart city tools while avoiding programs that carry the highest risks.

Smart Cities without Romance

In the vein of James Buchanan's "politics without romance,"[3] this paper examines the actual outcomes of smart city programs and the incentives that policymakers face in implementing them, rather than elected officials' claims about what can be achieved with new technologies. Much of the literature on smart city innovations focuses on the leadership of politicians who have spearheaded smart city policies, assuming that these leaders have the singular motivation of making life better for their constituents.[4] Developing an understanding of why smart city innovations succeed or fail requires studying the incentives of the people who put these policies in place and incorporating the assumption of self-interest to identify cases where technology will likely improve government outcomes and where it will likely make them worse.

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[3] James Buchanan, "Politics without Romance: A Sketch of Positive Public Choice Theory and Its Normative Implications," in *The Collected Works of James M. Buchanan*, vol. 1 (Indianapolis, IN: Liberty Fund, 1999).
[4] See, for example, Stephen Goldsmith and Susan Crawford, *The Responsive City: Engaging Communities through Data-Smart Governance* (San Francisco: Jossey-Bass,2014). For a critique of smart city research published by the industry, see Rob Kitchin, "The Real-Time City? Big Data and Smart Urbanism," *GeoJournal* 79, no. 1 (2014): 1–14.

Public-sector transactions cannot be made using dollars, but nonetheless politicians and bureaucrats engage in trades to pursue their goals. Policymakers may engage in trades with other government officials and with private-sector actors. Although these trades are not denominated in dollars, the benefits that policymakers receive can still be considered profit.[5] This profit may come in the form of a campaign contribution, a future job opportunity, or a boost in reputation. Private firms that transact with governments face incentives to gain policymakers' personal favor because profits and losses do not drive contracting decisions as they would in a deal between two private-sector firms. City policymakers may claim they are implementing smart city tools to improve city services, but their direct incentive is to improve their own standing rather than improving the well-being of the residents they serve.[6] This incentive structure may lead policymakers to implement new technologies without making real changes in the quality of service delivery.

Rio de Janeiro has been a leader in adopting smart city technologies. In 2010, the city became the first to open an IBM operations center designed to monitor weather, traffic, and crime. An IBM employee on the project stated: "We thought that this was going to be about ROI [return-on-investment] models, and the efficiency that we can produce. To some degree it is, but it's economic development and competitiveness [that are] at the heart of it."[7] The IBM team gained insight into the differences between public-sector and private-sector profit. Rather than operating in a market in which customers have clear information about whether a firm's service is meeting their needs, policymakers are in an environment in which rhetoric and posturing play an important role in achieving their goals.

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[5] Marta Podemska-Mikluch and Richard E. Wagner, "Economic Coordination within a Mixed Ecology of Enterprises: Erasing a Theoretical Antinomy" (Working Paper 15-01, Department of Economics, George Mason University, Fairfax, VA, January 2015).

[6] Richard E. Wagner, "Systems Theory and the Public Policy Shell Game" (Working Paper 14-22, Department of Economics, George Mason University, Fairfax, VA, July 2014).

[7] Townsend, *Smart Cities*, 68.

Localities typically implement smart city services through public–private partnerships, in which city governments pay private firms to provide the infrastructure funded by tax revenues.[8] A private transaction between an individual and a firm is a dyadic transaction in which the entity purchasing a good or service is also the entity paying for it. The customer always has the option not to purchase the good.[9] In contrast, public transactions, including public–private partnerships, are triadic relationships. The taxpayers who pay for the smart city goods do not have the option to abstain from the transaction.[10] In a public–private transaction, firms face different incentives than they would in a purely private transaction. The taxpayers liable for these deals do not have the option of refusing to pay for them. The triadic transaction structures dampen the rigors of competition that facilitate continuous improvements to the products available to consumers in the private sector.

A few firms currently dominate smart city technology, including Microsoft and IBM with sensor technology[11] and Motivate with contracts for the majority of bike-share systems in the United States.[12] These firms have an incentive to promote their products to cities regardless of whether the products are well tailored to a specific city's needs.[13] Some firms have used such tactics as providing the funding and technical assistance for contests for app developers who use city data.[14] These strategies help the firms gain access to policymakers who may then purchase their services. Although these marketing strategies are an accepted part of public-sector

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[8] Taylor Shelton, Matthew Zook, and Alan Wiig, "The 'Actually Existing Smart City,'" *Cambridge Journal of Regions, Economy and Society* 8, no. 1 (2014): 13–25.

[9] Richard Wagner and Deema Yazigi, "Form vs. Substance in Selection through Competition: Elections, Markets, and Political Economy," *Public Choice* 159, no. 3 (2014): 503–14.

[10] Ibid.

[11] Martijn de Waal, *The City as Interface: How New Media Are Changing the City* (Rotterdam: nai010 Publishers, 2014).

[12] For more information about Motivate, see the company's website at http://www.motivateco.com/.

[13] Shelton, Zook, and Wiig, "'Actually Existing Smart City.'"

[14] For an example of such a competition, see http://bigapps.nyc/p/partners/.

transactions, firms that spend tens of millions of dollars to gain access to city policymakers put themselves in an advantageous position for making deals with policymakers, even if the deals are not in residents' best interest.

The mixed incentives that policymakers face could lead one to believe that no good can come from the adoption of smart city innovations. The following section explores some of the smart city innovations that have, in fact, improved life for city dwellers and the potential incentive structures that have allowed for these successes. Notable smart city successes include increased local government transparency, improved efficiency of city agencies, facilitation of private-sector innovations, and demand-based pricing for congested urban services.

Benefits of the Smart City

One key benefit of the smart city trend has been the increase in constituent access to government data. Transparency improves government services by reducing information asymmetries between government officials and their constituents. Because public-sector employees typically have secure jobs in which their productivity is not rigorously measured, they may not have the incentive to provide the best-possible service.[15] To improve employees' incentives, Boston's Office of New Urban Mechanics implemented a customer relationship management system to centralize citizen complaints. The system includes iPhone and Android apps for citizens to log issues with city services, such as a need for snow removal or a problem with a streetlight. Users can then follow the progress on resolving their issue, ultimately receiving a photo of the repair in successful cases. The transparency of giving residents access to the mechanics of city operations improves employees' incentives to complete their tasks efficiently.

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[15] Jerry Brito and Drew Perraut, "Transparency and Performance in Government," *North Carolina Journal of Law and Technology* 11 (2010): 161–94.

Some cities are taking advantage of the ease of sharing data to make information on their programs available to the public. For example, Dublinked provides 250 open datasets from agencies in Dublin, Ireland.[16] In Chicago, not a city known for a focus on transparency, Mayor Rahm Emanuel spearheaded the creation of the Department of Innovation and Technology. The department's website includes a portal with links to data from each city department. The mayor has required that each department identify a staff member in charge of open data who has the responsibility of providing usable data for the portal to be made available to the media and the public. This top-down requirement for transparency makes Chicago's system more effective than leaving the option for transparency up to individual agencies, which cannot be trusted to police themselves.[17]

Transparency is not an end goal for opening government data; rather it is a tool for achieving accountability.[18] The potential for accountability has led some public officials to oppose increased access to data, even if such access could make their agencies more effective. The former chief analytics officer for New York City, Mike Flowers, points to the opposition to intelligence access from a city law enforcement agency. Flowers worked to implement data sharing across agencies to improve emergency services. He cites an example of a law enforcement agency that did not want access to other agencies' data because that access could point to its own failures and make those failures visible outside the agency.[19]

Because individual agencies do not face any rewards for increasing transparency on their activities, open-government requirements work best when implemented by politicians who can

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[16] For more information about this initiative, see the Dublinked website at http://dublinked.ie/.
[17] Jerry Brito, "Hack, Mash, and Peer: Crowdsourcing Government Transparency," *Columbia Science and Technology Law Review* 9 (2008): 119–57.
[18] Ibid.
[19] Goldsmith and Crawford, *The Responsive City*, 132.

campaign on strengthening transparency requirements. In cases where chief information officers have succeeded in opening up data across agencies, some have achieved measurable improvements. In another New York City example, the Office of Citywide Emergency Communications began sharing information between the police and fire departments to improve emergency services response times.[20] In addition to opening up their data to the public, some cities have used data from the Internet of Things to improve services. Boston's Office of New Urban Mechanics has implemented Street Bump, a system for identifying needed road repairs. When residents download the app, the accelerometers in their phones catalog road bumps, alerting the city to potholes. Street Bump has helped the city find and repair over a thousand sunken manholes.[21] Street Bump has also improved repairs overall in the city by providing the information needed to make specific repairs, thus addressing a legitimate need for data.

The open data that facilitate government transparency also create opportunities for new private-sector services. For example, many cities have made their transit data public, adding GPS sensors to trains and buses and making the data available to the public. This effort has created the opportunity for the development of apps that enable commuters to know when the next train or bus will arrive, which makes transit use more convenient and time effective by showing riders the fastest route to their destination.[22] Apps that bring together multiple data sources, known as *mashups*, provide the potential for city data to be combined with weather and traffic data to help transit users decide whether a bike-share, bus, or train choice is their best option on a given day.

In addition to increasing transparency and data access, smart city tools introduce the ability to adjust pricing for congested urban goods. Some cities have begun relying on the

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[20] Ibid., 135.
[21] Hiawatha Bray, "Northeastern Engineers Go Looking for Potholes." *Boston Globe*, March 17, 2015.
[22] Goldsmith and Crawford, *The Responsive City*, 80.

Internet of Things to improve demand-based pricing for city street parking. Sensors in street parking spots allow a network of city computers to identify how many spots on each block are being used. In response, parking meter prices are adjusted to maintain availability on each block. This approach reduces the problem of so-called cruising, when people waste time and increase congestion while driving around looking for parking.[23] By providing real-time information about the demand for street parking, sensors enable this publicly provided good to be allocated according to drivers' willingness to pay.

San Francisco has been a world leader in implementing smart parking with its SFpark program. Roughly 8,200 of the city's curbside parking spots each have a sensor that indicates whether the spot is occupied. Using the sensor data, the San Francisco Municipal Transportation Agency adjusts meter prices with the goal of maintaining a 15 percent vacancy rate so as to eliminate the need for drivers to cruise around looking for an available spot.[24] The move to demand-based pricing involves bureaucrats giving up some control over pricing to allow demand to determine the prices for public services.[25] Congestion pricing is an area of opportunity for policymakers to explore because it allows them to implement smart city tools without significant budget outlays. Smart parking systems increase both compliance and enforcement efficiency, so the systems typically pay for themselves.[26] The potential to use the Internet of Things to price congested public services does not mean that city policymakers will easily cede control to this technology, but the San Francisco case demonstrates that reform is possible.

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[23] Donald Shoup, *The High Cost of Free Parking* (Chicago: American Planning Association, 2005).
[24] Shoup estimates that in downtown areas up to 30 percent of traffic is the result of drivers who are merely searching for a parking spot. See Donald Shoup, "Cruising for Parking," *Access* 30, Spring 2007.
[25] Richard E. Wagner. *Fiscal Sociology and the Theory of Public Finance: An Exploratory Essay* (Cheltenham, UK: Edward Elgar, 2007).
[26] Federal Highway Administration, *Contemporary Approaches to Parking Pricing: A Primer* (Washington, DC: US Department of Transportation, 2012).

Parking policy demonstrates the complex relationships between actors in the public and private sectors. In *The High Cost of Free Parking*, Donald Shoup examines the enormous influence that minimum parking requirements have on private-sector decisions in real estate development. Public demand for minimum parking requirements increases when street parking is underpriced. People who live near business districts often object to business patrons parking on residential streets.[27] By pricing street parking according to demand, municipal policymakers could make it politically feasible to reduce or eliminate minimum parking requirements. Price adjustments maintain availability for parking on commercial streets, thus reducing the parking burden in adjacent residential neighborhoods.

Over time, congestion pricing for parking creates the potential for the public square to shrink relative to the market square if property owners are given the option to choose the amount of parking they want to build. Although parking experts view SFpark as both a technical and a political success,[28] politics has prevented the program from achieving its full potential for congestion reduction because bureaucrats have chosen to retain price controls at the cost of efficiency. With the flip of a switch, the city could use the existing sensors to implement real-time price changes to maintain the optimum parking availability of one spot per block. Instead, it has chosen to implement caps on hourly rates and price fluctuations.[29] During peak demand, the price is still too low to eliminate queuing. Even with price controls limiting its effectiveness, SFpark's pilot program achieved optimum parking availability 31 percent more often than did prior pricing schemes.[30]

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[27] Shoup, *High Cost of Free Parking*.
[28] Aaron Bialick, "Shoup: SFpark Yields Promising Results, Lessons for Demand-Based Pricing," *Streetsblog SF*, August 7, 2013.
[29] SFpark, "Pricing," http://sfpark.org/how-it-works/pricing/.
[30] Aaron Bialick, "SFpark Releases Pilot Report, Considers Giving Revenue to Local Streets," *Streetsblog SF*, June 20, 2014.

Risks of the Smart City

Smart city tools could worsen city governance in three important ways: (a) they can encourage bureaucrats and politicians to increase the scope of government programs, (b) they can allow bad actors to victimize the public more efficiently, and (c) they can provide cover for ineffective reforms. Smart city tools may worsen governance in these areas when they provide data that the public sector does not have the right incentives to put to use. At worst, such tools can compound poor incentives or make bad behavior easier for bad actors.

The increased availability of data on residents gives governments new opportunities to implement paternalistic policies. For example, Children's Optimal Health, a nonprofit organization, worked with the Austin Independent School District to create a dataset showing the home addresses of overweight and obese children.[31] The organization then mapped the data, along with fast food restaurants and outdoor play space, to investigate the environmental factors that shape childhood health. The insights gained from these data led the Austin school district to expand its physical education program. Although this policy change may prove worthwhile, the data-sharing collaboration highlights the potential for cities to invade residents' personal lives. Government efforts to reduce obesity through public policy tend to be ineffective.[32] When governments try to reduce access to unhealthy food in a specific neighborhood, they may inadvertently reduce access to food in general, leaving residents with fewer healthy choices than they had before the intervention.[33] Although open data on government activities carries the benefit of increased accountability between government and

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[31] Goldsmith and Crawford, *Responsive City*, 47.
[32] See, for example, Robert Scharff and Sherzod Abdukadirov, "FDA Misses the Mark with Food Labeling Rules," *Regulation*, Fall 2014.
[33] Adam Hoffer et al., "Regressive Effects: Causes and Consequences of Selective Consumption Taxation" (Mercatus Working Paper, Mercatus Center at George Mason University, Arlington, VA, March 2015).

citizens, open data on individuals carries the risk of new paternalistic policies and thus unintended negative consequences.

Open-data efforts to improve policy outcomes may carry their own privacy risks. Several American cities and states have implemented data-sharing systems in their health and human services departments.[34] Such data sharing has been lauded as a way to prevent tragedies, such as cases of abused children whom city workers fail to remove from their parents. Although such data sharing may improve certain outcomes by coordinating the work of agencies, officials must recognize the associated risks that increased access to sensitive data present to the most vulnerable populations. A 2014–2015 cybersecurity data breach at the US Office of Personnel Management resulted in 21.5 million personnel records being stolen. Relative to local governments, the federal government has huge cybersecurity resources, yet it was unable to keep online data safe from hackers. Such data breaches demonstrate the possibility that smart city programs could put residents' personal data at risk. Even in the absence of a cybersecurity breach, cities and states are gathering increasingly valuable data on their residents that could be used without those residents' consent. Some cities are already selling contact information gleaned from business permits, and in some cases there are no privacy policies in place to let people know what to expect when they share personal information with city agencies.[35] Although people are free to avoid using private companies' services that violate their privacy preferences, there are few alternatives when they want to opt out of providing governments with personal data.

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[34] See, for example, the description of the State of Indiana Interoperability and Integration Project on the website of the Administration for Children and Families at http://www.acf.hhs.gov/state-of-indiana-interoperability-and -integration-project.

[35] Kalev Leetaru, "Do Smart Cities Pose Data Dangers? When Governments See Value in Data," *Forbes*, May 14, 2016.

In addition to cybersecurity concerns, the Internet of Things allows for a massive increase in surveillance. In Brazil, Rio de Janeiro's IBM intelligent operations center demonstrates the available technology for city officials to watch residents on camera and to gain information about their habits through sensors. Such technology presents huge concerns for civil rights and privacy. The IBM center, which monitors a network of sensors and cameras, was ostensibly designed to improve traffic and better manage emergencies. According to Anthony Townsend, implementation of the IBM system encouraged Rio de Janeiro's officials to use smart city tools for mass surveillance and increase the scope of city management:

> What began as a tool to predict rain and manage flood response morphed into a high-precision control panel for the entire city. . . . Urban security experts with whom I have spoken are skeptical that it will dramatically improve the effectiveness of law enforcement, and technology experts point out that beyond the video streams there has been little investment in new sensor infrastructure to feed real-time data to the center.[36]

The IBM system has demonstrated the ability for city government to surveil residents' activities in both public and private spaces. The policymakers behind the Rio de Janeiro program are operating as if sufficient data about urban environments will solve residents' problems, but all city governments face knowledge and incentive problems in implementing policies that will improve residents' lives; access to more data will not improve outcomes without changes to the incentives of people in the public sector.[37]

The city governments of London, Dubai, and New York also have implemented networked surveillance systems with the stated goal of thwarting crime and terrorist attacks. Cameras track people on both public and private property. In New York City, according to a police spokesman, surveillance occurs in "areas where there's no expectation of privacy."[38]

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[36] Townsend, *Smart Cities*, 67–68.
[37] Kitchin, "Real-Time City?"
[38] Cara Buckley, "New York Plans Surveillance Veil for Downtown," *New York Times*, July 9, 2007.

However, critics argue that American courts have not recognized that these surveillance systems violate citizens' Fourth Amendment protections against unreasonable search, the Fifth Amendment right to due process, or the First Amendment right to anonymity.[39] Sensor technology that makes bike-share systems and congestion pricing possible also can be used to invade privacy, often without users being aware of the data gathered on them. New York State has installed a system of microwave sensors that measure drivers' speeds and travel times using their E-ZPass transponder in an effort to gather information about traffic congestion even when the car is not passing through a toll plaza. Data that are not gathered at toll plazas are made anonymous, but they are collected without users' knowledge.[40]

The use of the data management tool CompStat by police departments has demonstrated that smart city technologies can be abused by public officials in agencies with poor incentive structures.[41] CompStat is a geographic database of crime and arrest statistics. It has received extensive praise, with some analysts attributing New York City's historic drop in crime to improved data collection.[42] The city's police department implemented the system in 1994. Hundreds of other cities have since followed suit. However, CompStat is not an unambiguous benefit for public safety. It has garnered criticism from those who suggest that statistics-based policing has fostered institutional racism among police officers under pressure to meet arrest quotas.[43]

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[39] David Cole and John W. Whitehead, "I Think We're Being Watched," *Legal Times* 30, no. 35 (August 2007).

[40] Kashmir Hill, "E-ZPasses Get Read All over New York (Not Just at Toll Booths)," *Forbes*, September 12, 2013.

[41] For an overview of CompStat, see David Weisburd et al., "Growth of CompStat in American Policing" (report, Police Foundation, Washington, DC, April 2004).

[42] See, for example, Mark H. Moore and Anthony Braga, "Measuring and Improving Police Performance: The Lessons of CompStat and Its Progeny," *Policing* 26, no. 3 (2003): 439–53.

[43] Several states, including New York, have passed laws that ban arrest quotas, defined as rules that require officers to make a certain number of arrests in a given time period. However, Nathaniel Bronstein points out that the New York City Police Department has circumvented the antiquota law by treating enforcement numbers as the currency that officers use to get promotions, overtime, days off, and desired assignments. See Nathaniel Bronstein, "Police Management and Quotas: Governance in the CompStat Era," *Columbia Journal of Law and Social Problems* 48, no. 4 (2015): 543–51.

A 2012 *New York Times* poll found that 64 percent of New Yorkers think that city police have a favorable bias toward white residents.[44] In interviews with a legal scholar, some retired police officers attributed poor relationships with minorities to changes made to officer performance evaluations stemming from the introduction of CompStat. For example, previously officers were encouraged to play with children in high-crime neighborhoods to develop relationships with them and build goodwill in the neighborhood. Having positive relationships with community members in high-crime neighborhoods helps police officers find witnesses who are willing to help with investigations into serious crimes. In the CompStat era, supervisors punish police officers for spending time doing anything that is not quantifiable by withholding opportunities to work overtime and denying requests for days off and requests for tour changes.[45] Anthropologist Avram Bornstein explains that data-driven measurement of police performance encourages police officers to position themselves in high-crime neighborhoods where they can make frequent arrests for relatively minor crimes.[46] This strategy makes them appear "productive" to their superiors, although it may result in relatively little attention being paid to the most serious crimes, which take more time to investigate.

Because predominantly minority neighborhoods in major cities tend to have higher numbers of easy-to-prosecute misdemeanors, CompStat's incentives have led to higher prosecution rates for those demographics.[47] David Simon drew attention to the side effects of statistics-driven policing in his HBO series, *The Wire*. As portrayed in the series, a police force that is rewarded for high productivity numbers faces incentives to forgo pursuing cases that

[44] Michael M. Grynbaum and Marjorie Connelly, "Majority in City See Police as Favoring Whites, Poll Finds," *New York Times*, August 20, 2012.
[45] Bronstein, "Police Management and Quotas."
[46] Avram Bornstein, "Institutional Racism, Numbers Management, and Zero-Tolerance Policing in New York City," *Open Anthropology* 18, no. 2 (2015).
[47] Ibid.

would require extensive investigation in favor of making easy arrests. This system results in officers arresting low-level drug dealers rather than pursuing the arrests of higher-level criminals who may have a greater impact on community safety.[48] More recently, the incentives that CompStat creates have been a focus of the Black Lives Matter movement.[49] Data can be manipulated, which gives police chiefs the opportunity to present an empirical case that they are making their cities safer without actually doing so.[50] As legal scholar Nathaniel Bronstein writes, "This focus on the quantification of enforcement activity is more than just an aggregate management tactic; it appears to be an obsession that is tied directly to CompStat."[51] Before CompStat, police officer performance evaluations were based on supervisors' and colleagues' evaluations of the officers' work in sometimes dangerous and subjective situations. The narrative-style evaluation was replaced with purely numerical evaluations.

A review committee established by then–New York City Police Commissioner Raymond Kelly found that CompStat created incentives for manipulating crime statistics:

> The theory . . . is that precinct commanders exert pressure on their immediate subordinates to take actions that serve to manipulate crime statistics. The precinct commanders interviewed by the Committee denied that patrol officers or their superiors had any incentive to follow such orders, a sentiment also expressed by other officers who spoke with the Committee. Despite these statements, the fact of an order is its own incentive in a hierarchical organization, and the Committee is of the view that the risk exists and, as indicated, there have been substantiated reports of manipulation in the past. Indeed, in the investigative reports reviewed by the Committee, the vast majority of officers implicated in downgrading and suppression were patrol officers, sergeants, and lieutenants. In one instance, a group of detectives was implicated. Nevertheless, officers rarely admitted to facing pressure to downgrade or suppress complaint reports—even when admitting to having done so.[52]

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[48] Bronstein, "Police Management and Quotas."
[49] Michael Daly, "Eric Garner Was Just a Number to Them," *Daily Beast*, December 5, 2014.
[50] Radley Balko, "The Other Broken Windows Fallacy," *Reason.com*, March 8, 2010.
[51] Bronstein, "Police Management and Quotas," 565.
[52] David N. Kelley and Sharon L. McCarthy, "The Report of the Crime Reporting Review Committee to Commissioner Raymond W. Kelly Concerning CompStat Auditing," April 8, 2013, 18.

The committee's findings indicate that CompStat's abuses come from systemic incentives rather than a few bad actors.

In addition to the serious threats to liberty outlined herein, implementing Web 2.0 programs can be a tool for governments to use to appear to be improving constituent services through transparency without actually making any substantial reforms. In 2012, Washington, DC, for example, spent $500,000 to implement, for the city's agencies, Grade DC, which is a ranking algorithm most commonly used for restaurant chains to gauge their performance. The algorithm provides grades based on constituent feedback.[53] Although then–Mayor Vincent Gray touted the program as a tool to improve city services, the *Washington Post* criticized it for doling out an "A+" to the city's scandal-ridden fire and emergency medical services department.[54] The greatest success attributed to the program is that of moving Department of Motor Vehicles employees who rated poorly in customer service to positions in which they no longer interact with constituents.[55] In most cases, Grade DC has given the illusion that reforms have been made while policymakers have actively avoided making real changes. Data on customer experience may be helpful for managing restaurants in a profit-based environment, but without a profit incentive, increased access to data may not meaningfully change decision making.[56] In the case of Boston's Street Bump program, discussed in the first section of this paper, city officials had the correct incentive to put increased access to data to use. Without a profit incentive, however, data on constituent experiences with city employees is unlikely to lead to any meaningful improvement in services.

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[53] Marissa Evans, "District Agencies Hoping to Make the Grade with Customers," *Washington Post*, June 13, 2012.
[54] Mike DeBonis, "Just How Useful Is Grade D.C.?," *Washington Post*, April 3, 2013.
[55] Goldsmith and Crawford, *Responsive City.*
[56] Although the *Washington Post* published an article questioning the validity of Grade DC, it has also published articles lauding the program, and Goldsmith and Crawford hold up the program as an example of urban innovation and transparency.

In another case, Philadelphia won an IBM challenge to gain funding for its Digital On-Ramps program. The program has the stated goal of matching low-income residents with jobs in the information economy.[57] The city created a job application system in which residents could apply using smartphones, because access to smartphones is widespread among low-income residents.[58] Program creators failed to recognize that the low-income residents intended to be the beneficiaries of the app lived in neighborhoods far from those where the high-tech jobs are located. Even if they received job offers from the high-tech firms, the residents would not have access to transportation to get to these jobs. The program's failure to help the stated beneficiaries reflects policymakers' incentive to appear that they are taking action to help a group of residents without necessarily following through completely. One analyst observed that the program was "a promotional vehicle, highlighting the city's efforts to produce a competitive, entry-level workforce for the 21st century economy, despite achieving few meaningful results in this respect."[59] Rather, the program provided an opportunity for Philadelphia policymakers to appear that they were using technology to reduce income equality, but they lacked the incentives to identify policies that could actually help low-income residents find employment.

Bike-sharing systems, one of the most visible smart city programs, also fail to serve the vulnerable populations they purportedly help. In Washington, DC, Capital Bikeshare organizers intended to increase ridership with discounted memberships for low-income people and free memberships for homeless people.[60] Despite the discounts, the median income of riders is rising, with over 50 percent of riders making more than $100,000 annually. Just 6 percent of users had

[57] Shelton, Zook, and Wiig, "'Actually Existing Smart City.'"
[58] Sherrell Dorsey, "ePortfolio Lets Job Seekers Shine," *Next City*, May 17, 2016.
[59] Shelton, Zook, and Wiig, "'Actually Existing Smart City,'" 9.
[60] Christina Sturdivant, "Capital Bikeshare Program Expands Access with $5 Memberships, *DCist*, April 13, 2016.

household incomes of less than $35,000 in 2014, down from 12 percent in 2011.[61] Other cities

with bike-share systems, including New York City and Minneapolis, have had similar

experiences with their users' demographics being wealthier, better educated, and whiter than

their cities as a whole.[62] Although bike-share systems create an opportunity for policymakers to

cultivate a progressive image, they have not achieved their stated welfare goals.

Conclusion

Smart city innovations have improved some city services by introducing dynamic prices to

city-administered toll goods that were previously underpriced and by introducing transparency

to important programs. The ready availability of sensor technology has allowed previously

congested urban infrastructure to be managed with prices rather than with willingness to

queue. By making their data open to the public, cities have also created the opportunity for

private-sector actors to create apps that make city living more convenient by providing real-

time information on the urban environment. In cases where "big data" has improved city

services, agencies had incentives in place to put such data to use, as in the case of Boston's

Street Bump program.

Despite these nontrivial successes, smart city innovations carry with them significant

risks. In the public sector, where deals can be made to benefit officials and private firms at the

expense of taxpayers who are not parties to the transactions, smart city services often fail to live

up to the promises that they will improve the lives of constituents. New paternalistic policies

made possible with greater government access to data will likely carry unintended consequences.

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[61] LDA Consulting, "Capital Bikeshare 2014 Member Survey Report," April 3, 2015.
[62] Joseph Stromberg, "Bike Share Users Are Mostly Rich and White. Here's Why That's Hard to Change," *Vox*, May 15, 2015.

Smart city tools are most dangerous in surveillance and law enforcement, where they can create perverse incentives or facilitate rights abuses. When incentive structures allow policymakers to advance their own goals at the expense of constituents, increased access to information will not improve outcomes.