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Funding and financing smart cities

About

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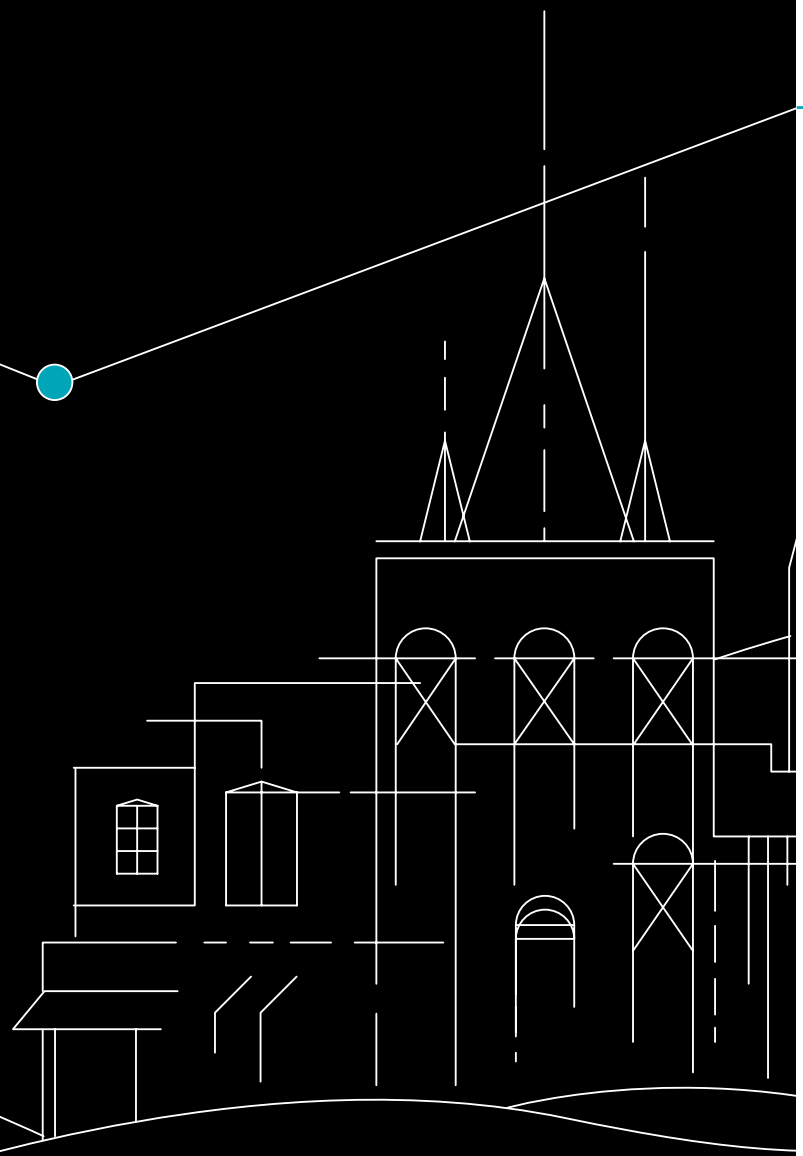
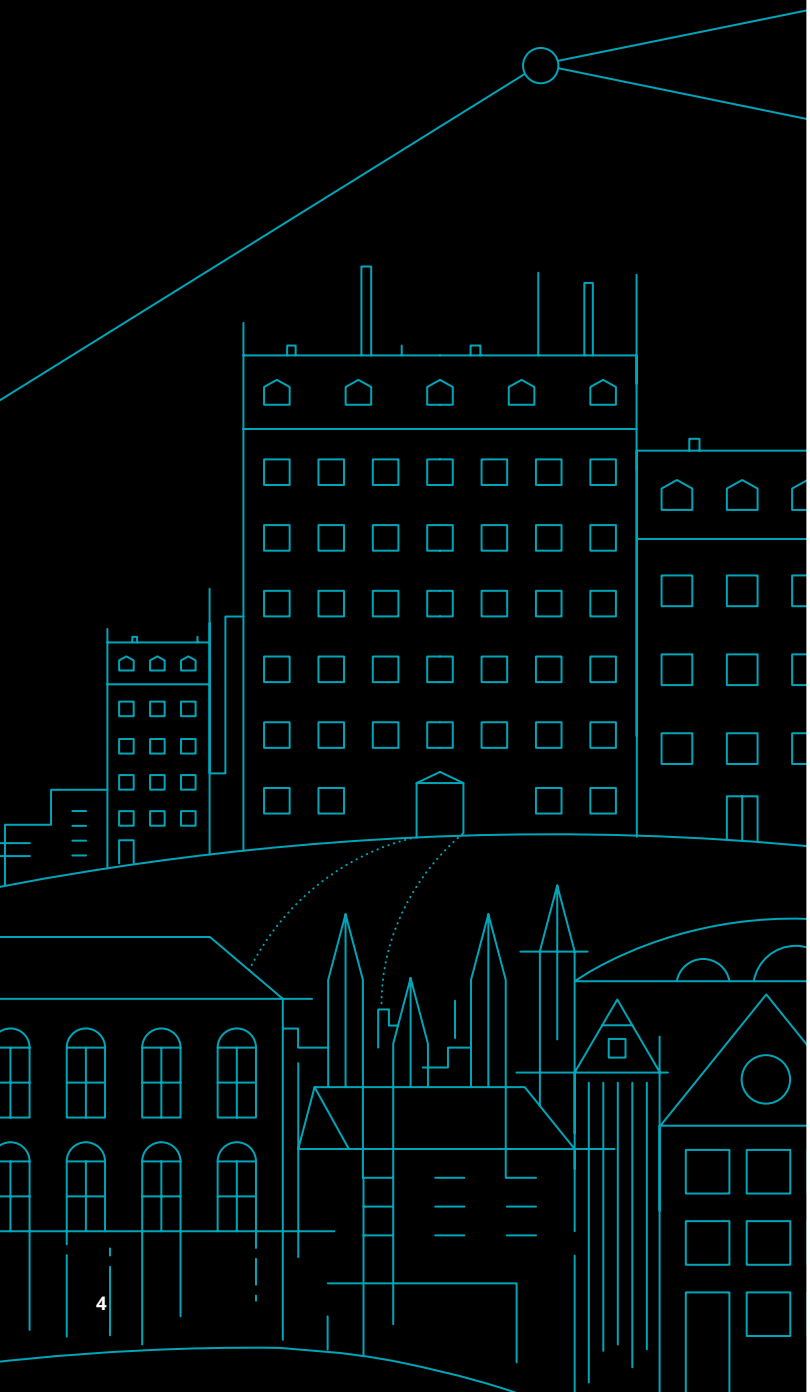


About the Deloitte Center for Government Insights

The Deloitte Center for Government Insights shares inspiring stories of government innovation, looking at what's behind the adoption of new technologies and management practices. We produce cutting-edge research that guides public officials without burying them in jargon and minutiae, crystalizing essential insights in an easy-to-absorb format. Through research, forums, and immersive workshops, our goal is to provide public officials, policy professionals, and members of the media with fresh insights that advance an understanding of what is possible in government transformation.

Introduction

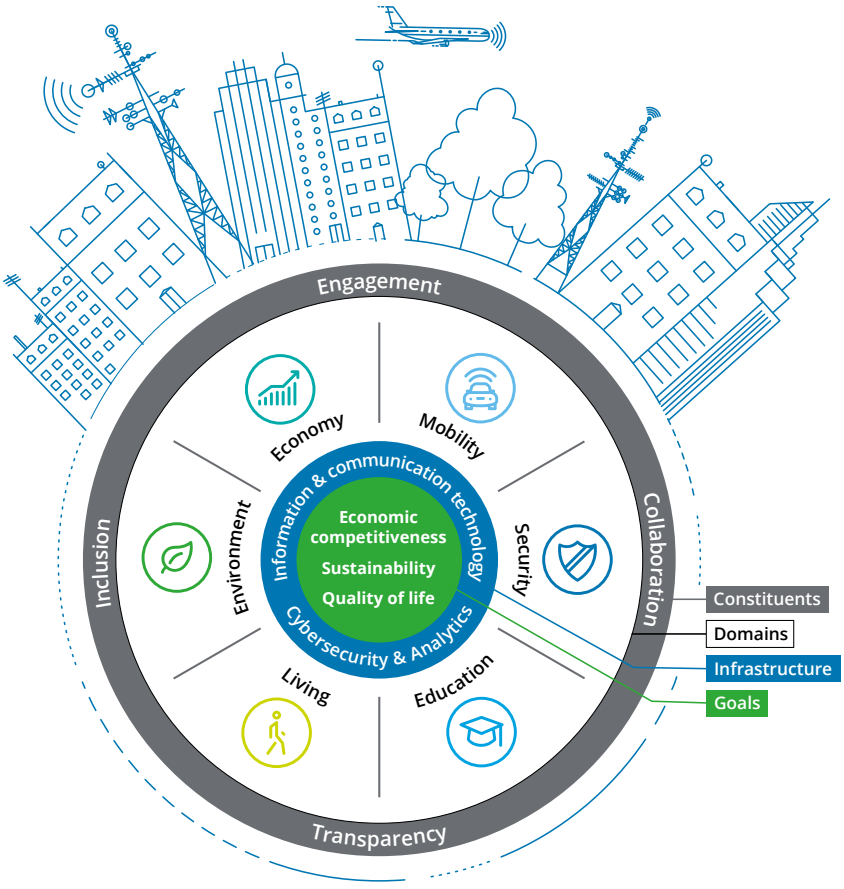


Government leaders, citizens, and business professionals across the United States understand that our infrastructure needs major reinvestment and modernization. As is most visibly apparent in our cities, these needs typically surpass the municipal capacity to fund them. This forces city governments to carefully consider the cost benefit of pursuing a particular project or suite of projects, as well as new models for funding and financing infrastructure programs.

Government financial officers can play a key role in enabling city reinvestment and modernization using fiscal policy, public-private partnerships (PPPs), and performance-based revenue models as important levers to catalyze economically impactful capital investments that create long-term value for citizens, businesses, and the city as a whole. Not only is the safety and security of our citizens and businesses at risk as infrastructure assets age and fall into disrepair, but so too is the broader economic well-being and global competitiveness of our cities and our country.

Undertaking a broad-based smart city reinvestment and modernization program will help reduce costs, maximize revenue potential, and improve citizen well-being through the deployment of cutting-edge, technology-enabled infrastructure that is more environmentally friendly and resilient.

According to the American Society of Civil Engineers' 2013 Report Card for America's Infrastructure, our near-failing grade (D+) will require an estimated investment of $3.6 trillion by 2020.[1] In September 2016, former US Treasury Secretary Lawrence Summers wrote: "The case for infrastructure investment has been strong for a long time, but it gets stronger with each passing year as government borrowing costs decline and ongoing neglect raises the return on incremental spending increases."[2] Summers is a leading voice on the need for major infrastructure reinvestment and modernization in the US, which can not only improve the quality and condition of our infrastructure, but also produce positive economic returns for society.



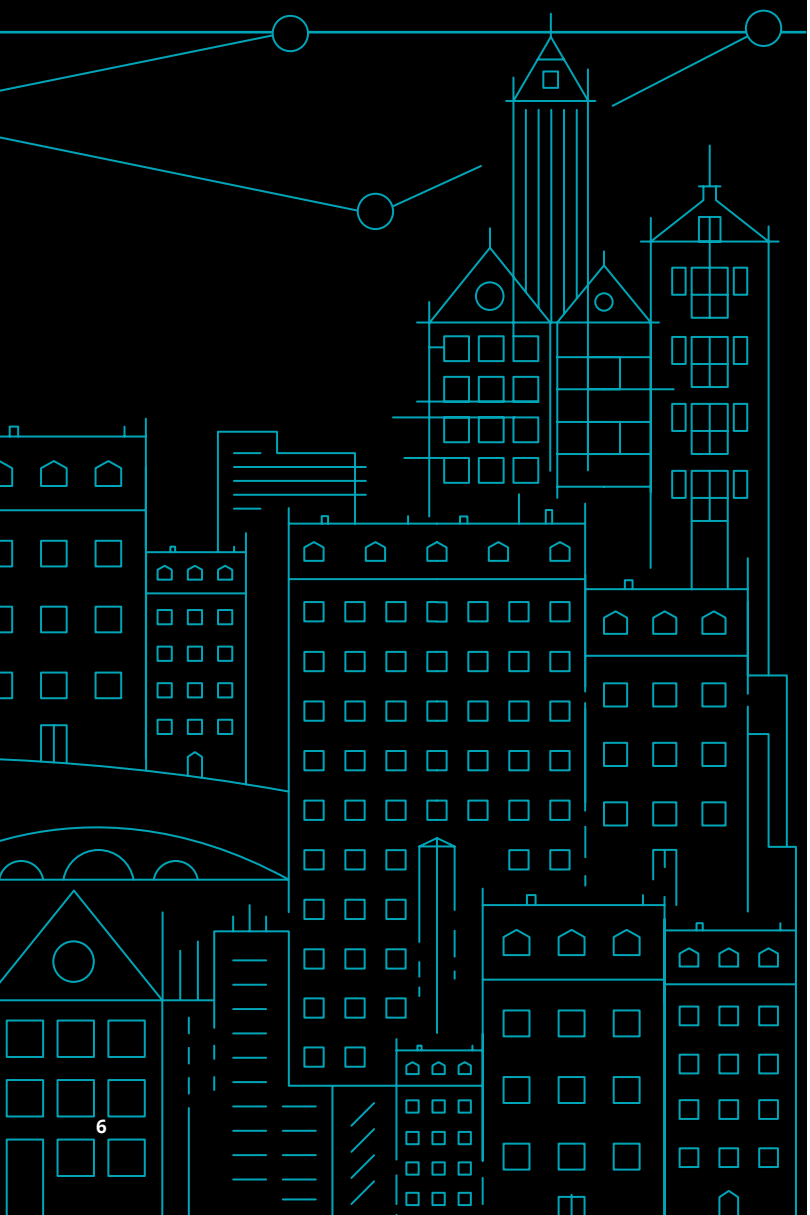
The country's deferred maintenance challenges coexist with disruptive technologies that are reconfiguring how we live, work, and interact with our cities: automated/autonomous vehicles; ride-sharing services; cloud-based management services for improving municipal services delivery; Internet of Things (IoT); and road, water, and lighting systems with embedded sensors. These technologies force city managers, planners, and financial and accounting managers to consider or rethink issues such as citizen data capture/management, revenue models, cybersecurity, urban density, transportation networks, and land-use allocation. "Smart cities" consist of investments in human and social capital, traditional infrastructure, and disruptive technologies that fuel sustainable economic growth and a high quality of life with the wise management of natural resources through participatory governance.

According to Technavio, the smart cities market—interrelated domains that impact urban living—is projected to reach $1.2 trillion by 2019.[3] These domains include industry automation, smart grid, security, education, home and building, healthcare, transport, and water and waste. For federal, state, and local leaders—including those in financial and accounting roles—looking to transform our cities, there are two important questions:

01. What combination of existing and new approaches exist to fund/finance smart cities?

02. What does the new partnership model look like as you embark upon a smart cities program—how can different levels of government, industry, and other non-governmental entities work together to create smart cities—and will old procurement models need to be updated to new realities?

What is a smart city?



The convergence of technology and infrastructure provides a workable construct for smart cities that forms the basis of this discussion. This construct places the smart city at the center of traditional infrastructure. Its connection to and augmentation by IoT technology allows for process optimization and automation to occur, thereby making it "smarter." Smart infrastructure can be segmented into six domains, governed by a nuanced framework, in which the city and its citizens are simultaneously users and enablers of the system, incorporating shared objectives. Figure 1 illustrates this schematic.

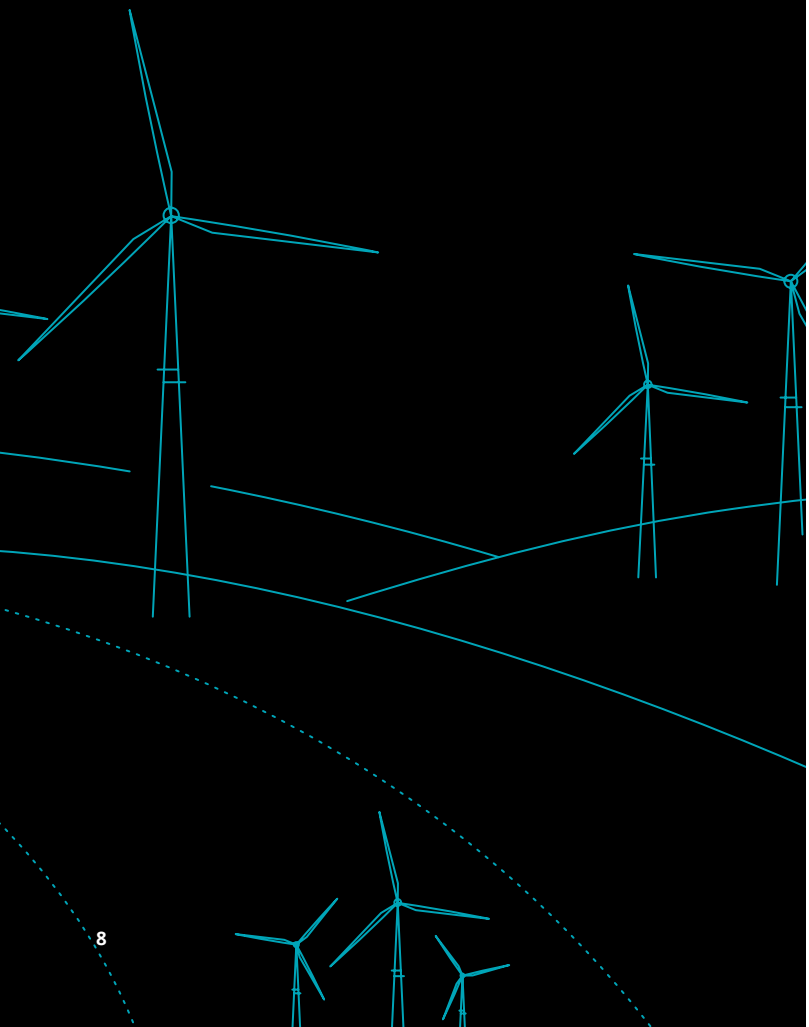
How are the federal, state, local government, and private sector currently involved in smart cities?

Smart city stakeholders are evolving with different levels of focus and involvement at the federal, state, and local levels. The market is diverse and complex given the cross-cutting needs of cities. The private sector, foundations, and non-governmental organizations are involved as service providers, financiers, and industry collaborators, and are also defining standards. Figure 2 provides examples of stakeholders, roles, and programs.

Figure 2

Actor	Federal	State	Local	Private sector/other
Current status/ involvement	• President [Obama]'s Council of Advisors on Science and Technology released a report (February 2016) encouraging the adoption of smart cities and suggesting tens of millions in funding[4] • Policy environment is evolving under President Trump	• States can channel debt and grant funding for urban infrastructure projects that have significant regional impact using financing facilities such as state revolving funds	• Cities such as Pittsburgh and Atlanta have appointed chief information officers responsible for leading municipal-level strategies for smart technology	• Management consulting firms • Architecture/ engineering firms • Technology firms • Financial institutions • Smart Cities Council • National Institute of Standards and Testing
Potential role	• Encourage the enabling environment through federal legislation—grants and funding provisions for smart cities • Support development of an infrastructure bank with specific investment and lending programs for smart cities technology adoption	• Expand project eligibility criteria to receive funding from financing facilities specifically for inclusion of smart cities projects that may have cross-cutting features spanning traditional sectors such as energy, transport, and water	• Support infrastructure bonds that include a focus on smart city technology adoption • Coordinate efforts between private sector and federal/state offices to drive implementation of smart city strategy	• Collaborate with federal, state, and local government counterparts to provide industry insights and leading practices during the planning and design phases • Implement and deliver smart infrastructure in support of government mandates
Program examples (real and potential)	• US Department of Transportation Smart City Challenge • US Department of Housing and Urban Development—Community Development Block Grant Program, Section 108 Loan Guarantee Program	• Property Assessed Clean Energy Financing in Maryland provides low-cost financing for eligible clean tech and energy efficiency projects, which are key components of smart city infrastructure	• Atlanta smart city initiatives driven by a citizen-approved infrastructure bond of $250 million	• AECOM Brilliant Cities • IBM Smarter Cities • AT&T Smart Cities • Siemens Intelligent Infrastructure Solutions • Black & Veatch Smart Integrated Infrastructure • Atkins Future Proofing Cities

Existing and new approaches to fund and finance smart cities



Cities can adopt a variety of approaches to fund/finance smart city projects. It is important to distinguish between these two terms, which are often used interchangeably. Financing refers to the time-shifting of costs through which a borrower (for example, a city) can defer costs incurred for capital projects until a future point in time (such as the loan maturity date). Funding refers to the means by which project costs are repaid by the city through mechanisms such as property taxes. Financing and funding are used to pay for and generate revenue to service costs related to traditional infrastructure development (see figure 3).

Addressing the challenge of investing in smart cities programs requires creative thinking that departs from traditional models of infrastructure finance. Under traditional models, infrastructure projects are paid using debt instruments (financing) whereby the city secures capital from financing sources (such as commercial or development banks) in the form of municipal bonds. The capital is used to pay for the cost of construction, and there is usually a grace period during which the borrower is exempt from repayment until construction is completed. Once the infrastructure asset is operational and earning a revenue stream (funding), the proceeds are used to repay the principal and interest on the bond.

This process assumes the project is of a certain scale (for example, $100 million or more), that it falls within core sectors—such as water, transport, energy, and information and communications technology (ICT)—and that proceeds from its asset revenue stream can be solely dedicated to service the debt (more applicable to project bonds than general obligation bonds). This model is particularly relevant for a growing segment of the $3.7 trillion US municipal bond market: green bonds. Similar to traditional municipal bonds, these notes generate proceeds used to finance infrastructure projects in climate-aligned sectors such as water or transport. Green bonds have grown in popularity in recent years, with notable examples including Washington, DC ($350 million) and Seattle ($923 million).[5]

Smart cities, on the other hand, are more than traditional physical infrastructure. While some may argue that smart technology falls under ICT because of the inclusion of fiber-optic networks, it functions laterally across sectors because its core attribute is inter-connectivity between infrastructure systems. Smart city infrastructure, therefore, can comprise multiple sectors and be adapted for use beyond the realm of traditional infrastructure functions. This inherent flexibility presents both opportunities and challenges for cities from a funding/financing perspective. This can be demonstrated by analyzing one example of smart city technology—smart street lighting.

Figure 3

Financing sources
Commercial banks
Development banks/multilaterals
Municipal project bonds
Green bonds
Tax increment financing (TIFs)
Leasing and vendor finance
Credit guarantees
Funding sources
Property taxes
Business taxes
Municipal income tax
Tolls and user charges
Pay-for-performance models
Asset disposals
Federal grants

Any use of public data must be balanced with careful consideration as to the nature of the protection of user privacy and potential cybersecurity risks of the underlying infrastructure.

As detailed in figure 4, smart street lighting (also referred to as sensory light networks) are LED street lights equipped with environmental sensors used for monitoring air pollution, temperature, and parking spaces. Each sensor-enhanced lighting pole is connected to a fiber-optics network, with the aggregate system essentially serving as the central nervous system of the smart city. Not only does the system provide the city with energy-efficient street lights, it also generates rich data on environmental and social performance. The city can monetize the data by charging access fees for any third-party developers who wish to develop applications using this data (such as a parking space app). Whereas traditional street lighting project revenue streams are realized through energy cost savings alone, the revenue stream of smart street lighting projects is increased by a multiplier factor because of the economic value of the data. Any use of public data must be balanced with careful consideration as to the nature of the protection of user privacy and the potential cybersecurity risks of the underlying infrastructure.

As a further example, New York City recently began deployment of LinkNYC[6]—a $200 million project designed to replace legacy phone booths with 7,500 digital kiosks throughout the city. Each kiosk will provide citizens with free high-speed Wi-Fi, along with other features that include wayfinding services for tourists and sensors to monitor environmental data. The city has formed an innovative partnership model to finance and fund the project with the sponsor CityBridge, a consortium comprising Qualcomm, Civiq, and Intersection. Under this model, the city provides concessions to allow the consortium to install the kiosks (at no cost to taxpayers) and collect advertising revenue, which is shared with the city at an agreed-upon rate. The revenue would be used to cover the costs of installation, equipment maintenance, and digital advertising operations. The program is expected to generate $500 million in advertising revenue during its 12- year implementation period. Such funding models repurpose existing physical assets, bring in private-sector capital and expertise, and ultimately create new sources of revenue through data collection and citizen engagement.

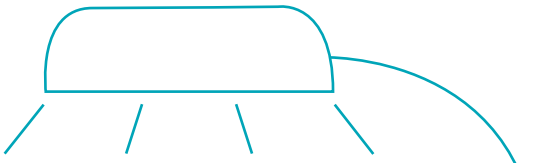


Figure 4. Smart street lighting applications

Capabilities

Dimmable LED lights CCTV cameras Intelligent signs E-V charging stations

Sensors

Moisture Ambient light Seismic activity Wind Temperature Air quality Radiation

Three layers of apps for turning smart street lighting into a profit center

Apps for lighting control and energy management

SSL vendor develops app for city/utility entity; cost is included with smart lighting

Benefit: Adjusts light using motion-based dimming, saving energy costs

Apps for security, partking, event coordination

Apps developed by third-party vendors using Sensity's APIs and tools; small fee charged

Benefit: Gunshot detection using audio sensors can help accelerate response time to violent crime

Apps for planetary data on earthquake detection, global warming, etc.

Sensity charges vendors fees to access data and develop on their own platforms

Benefit: Provides insights on weather—for example, solar energy producers are notified ahead of cloud cover events

New partnership models for smart cities

Regardless of the technology application, a cross-cutting theme in smart city infrastructure investment is the reallocation of risk and reward between the public and private sectors. Federal, state, and local leaders will increasingly encounter new partnership models for front-end investment and revenue sharing, including pay-for-performance related to service improvements or access to services. Even resource-constrained federal, state, and local entities can participate in the emerging smart cities market with the oversight of their financial, accounting, and infrastructure leaders. As in the case of the Smart Cities Challenge sponsored by the US Department of Transportation (DoT), winning city Columbus, Ohio received a $40 million DoT grant, along with $10 million in support from Vulcan Philanthropies. The private sector also stepped forward with $100 million in investment. Collectively, this investment will be used to transform how transportation is used in Columbus. One area of focus is ride sharing that can better connect lower-income communities to their city, which can result in economic benefits, citizen inclusion, and potentially better health outcomes.

The Columbus example shows that the private sector is willing to invest in pilot projects as an up-front investment or loss leader, but will expect to participate in longer-term upside and downstream implementation opportunities. In this incremental, modular development approach (in which smart city solutions are scaled to needs over time and pilot tested involving multiple partners), some of the key issues include: the nature of existing procurement rules and the legal or regulatory framework adjustments that are required to assure any conflicts of interest are managed in a manner appropriate to the new model of risk allocation; the flexibility, interoperability, and longevity of new smart city systems, (both in terms of technology platform and across departments and agencies); and a movement to managed, cloud-based services and the associated privacy and cybersecurity risk management requirements.

The smarter road ahead

Given the need for large-scale reinvestment and modernization of US cities, government financial leaders at the federal, state, and local levels are uniquely positioned to embrace and accelerate the adoption of smart cities. Realizing this vision requires embarking on a smarter road.

As a first step, this includes supporting policies such as fiscal incentives (including tax abatements), PPPs, and qualified infrastructure bonds specifically focused on smart city requirements. The public sector should encourage private-sector investment in new smart city partnership models that will reduce the near-term cost of investment in technology-enabled infrastructure (in an era of public resource constraints), while ensuring any risk and reward considerations are appropriately balanced.

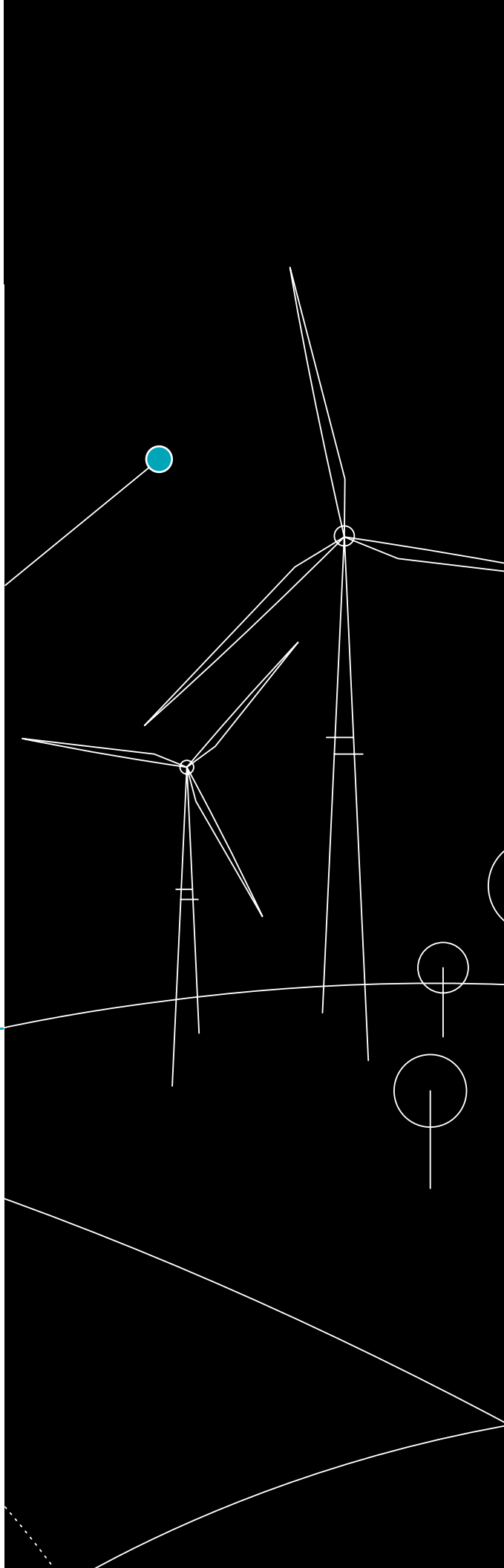
As a second step, new performance-based approaches for revenue sharing should be built into delivery models for smart city systems, whereby the public procurer of services and the private-sector investors share in the value of efficiency gains in service delivery, advertising-generated income, and revenue from value-added analytics services.

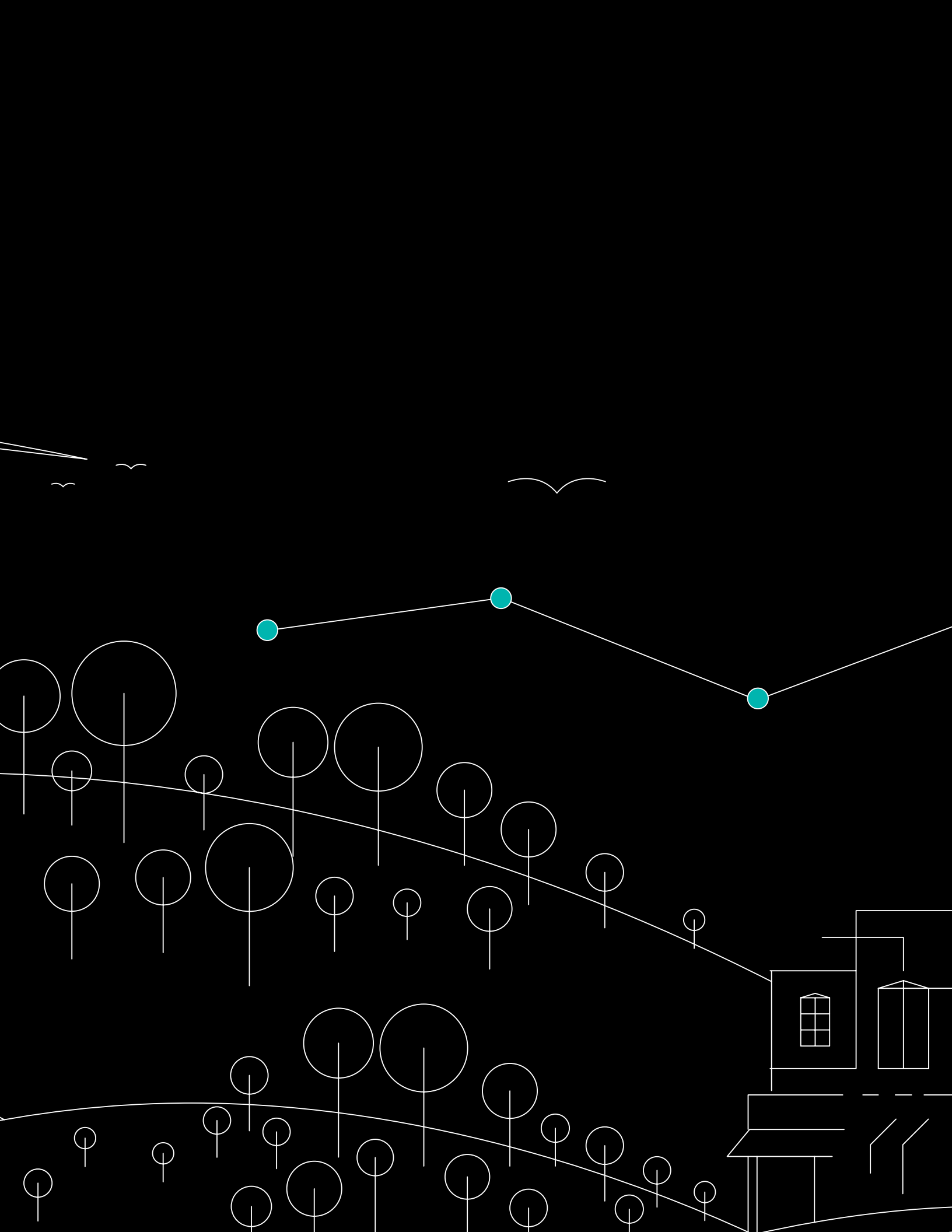
A critical third step on the road to smart cities is active federal, state, and local collaboration. This includes the potential to fund special-purpose vehicles and align on potential innovation districts within major metropolitan areas (even military bases).

These approaches are being continuously tested and refined as municipalities pursue smart city strategies, leading to valuable lessons learned and best practices that will enable the success of future adopters. By embarking upon this smarter road ahead and these first three steps, government financial leaders can help make America's cities smarter—and ultimately more secure, resilient, and globally competitive.

Endnotes

1. ASCE, www.infrastructurereportcard.org/executive-summary/; accessed Feb. 2, 2017. ASCE ranks the condition and needs of the following infrastructure categories: energy; schools; public parks and recreation; transit; roads; rail; ports; inland waterways; bridges; aviation; wastewater; solid waste; levees; hazardous waste; drinking water and dams on an A to F scale (A: EXCEPTIONAL, B: GOOD, C: MEDIOCRE, D: POOR, F: FAILING), and then develops an overall score. Each infrastructure category was evaluated based on capacity, condition, funding, future need, operation and maintenance, public safety, resilience, and innovation.
2. Lawrence Summers, larrysummers. com/2016/09/12/buildingthe-case-for-greater-infrastructureinvestment/; accessed Feb. 2, 2017.
3. Technavio, Global Smart Cities Market 2015–2019, Global Smart Waste Market 2015–2019, Global Smart Water Network Market 2015–2019, www.technavio. com/report/global-machinemachine-m2m-andconnected-devices-global- smart-citymarket-2016-2020; accessed Feb. 2, 2017.
4. PCAST Report, obamawhitehouse. archives.gov/blog/2016/02/23/pcast-releases-technology-and-futurecities-report-president
5. Brooking Institute. “Green bonds take root in the US municipal bond market.” Oct. 25, 2016.
6. LinkNYC, www.link.nyc





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