



Beyond smart cities—to future-ready cities

The city of the future will need to be not just 'smart' but also resilient in the face of unpredictable events. Here are six ways cities can fulfill their future-ready vision, according to our recent research.



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Executive summary

Examples abound of cities around the world doing something clever with technology—installing thousands of sensors, hundreds of solar panels or dozens of rooftop farms—and putting a “smart city” label on it. While some of these initiatives have achieved a degree of success, most haven’t lived up to the hype.

With the alarming acceleration in catastrophic weather events, natural disasters and global health emergencies, there’s no question cities need what some might call “more smarts.” From their sheer density to their often aging infrastructures, cities’ vulnerabilities are plentiful and must be addressed.

The increasingly widespread availability of 5G has made the concept of a smart city more of a reality than ever before. But while cities are called to deliver what smart city visionaries have long promised—economic opportunity, high-quality education and healthcare, clean air, safe streets, a rich cultural life and an efficient transportation system—they must do so while considering not just today’s challenges and opportunities but also those of tomorrow.

Beyond being smart, then, cities [need to be future-ready](#). Becoming a future-ready

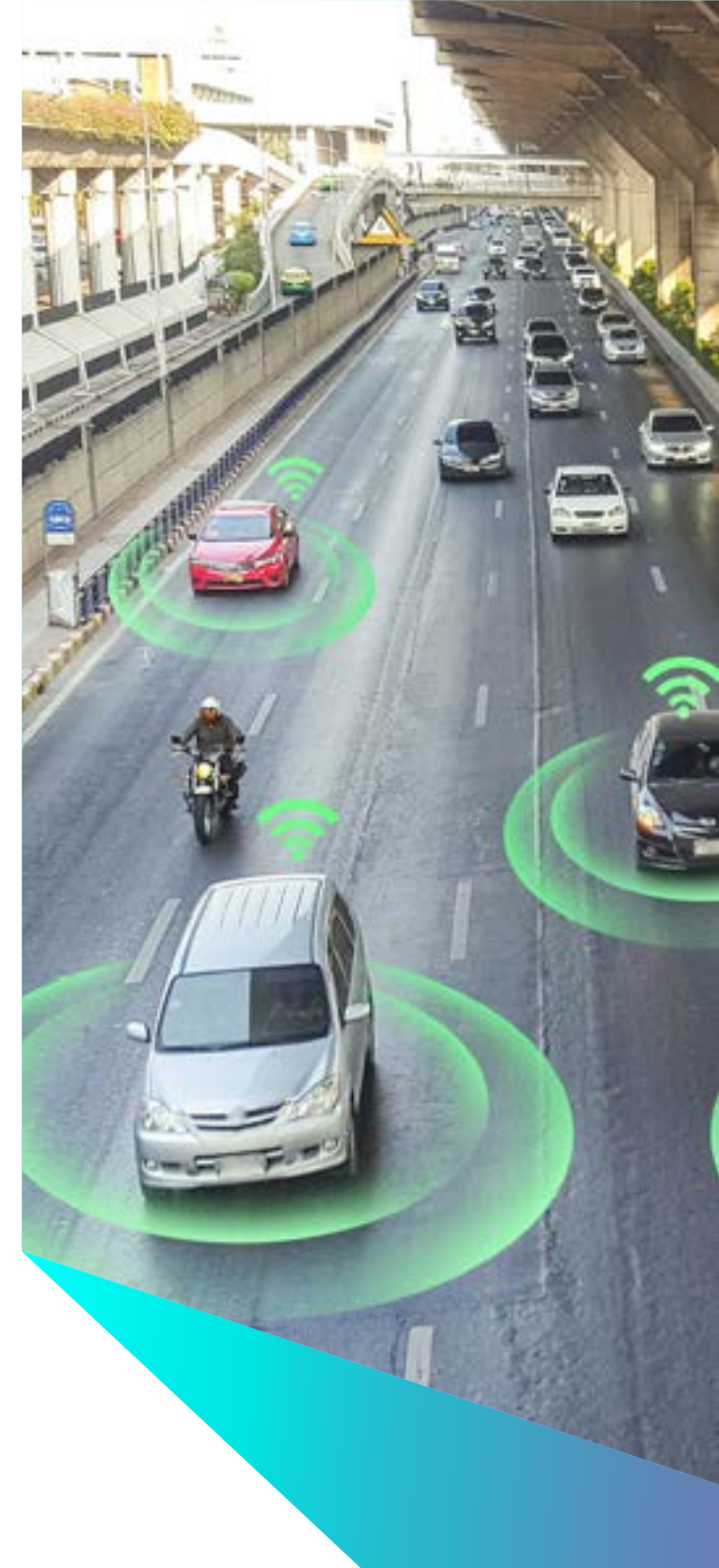
city requires building the foundation to [be resilient](#) in the face of both predictable and unpredictable challenges and [adapting to fast-changing social and economic situations](#).

[5G will play a big role](#) in achieving a future-ready vision. This technology’s ultra-low latency, blazing speeds, extra-large bandwidth and fail-proof reliability promise to breathe new life into the technology capabilities cities now rely on and deliver enormous improvements in quality of life.

But while making the best use of technology is essential, it’s not enough. In recent research co-sponsored by Cognizant, we found the city of the future will need more than 5G and a wide range of other technologies. It will require strong ecosystems of local governments, infrastructure providers (telcos) and integrators (tech partners).

The study also found, however, that today, well-functioning ecosystems are few and far between. Also lacking are sophisticated capabilities to not just create high-quality data but also to manage, share, protect and make that data actionable. Survey respondents are feeling the brunt of these shortcomings.

The study, conducted by ThoughtLab, surveyed 200 city officials from around the world. It also included a series of interviews with policymakers, business executives and other experts, to understand where cities stand in terms of their future-preparedness, what challenges they are encountering and what solutions they are exploring. For more study details, see our methodology, page 22.



Six key imperatives derived from the study include:

01

Develop three-part ecosystems to support and execute on the vision. Cities need to collaborate with infrastructure providers and tech integrators to pull together the ideas, capabilities, technologies and funding to realize their future-ready vision. However, fewer than half of survey respondents (46%) believe their cities have made strong progress in developing these partnerships. Respondents are feeling the pain in the form of skills and expertise shortages.

02

Design ecosystems with the right dynamics. The challenge is to not just form these ecosystems but to also design them to foster mutually beneficial relationships and allow for ample experimentation.

03

Create individual solutions with a shared foundation in mind. It may be tempting to roll out an integrated solution of services and products that supports a wide range of city sectors. But while a holistic vision is needed, a more successful approach is to focus on individual initiatives that leverage the foundation of previous solutions.

04

Embolden tech choices, supported by ecosystem partners. Study respondents name a wide array of technologies they believe will be key to realizing their future-ready goals, from artificial intelligence (AI) to mobile technologies. 5G will only further the value of these technologies by enabling real-time connectivity and lightning-fast processing of high volumes of data without delay. Buoyed by this, and with the support of a strong ecosystem, cities can embrace emerging, high-impact technologies, like digital twins, that can serve as a foundation for future-ready endeavors.

05

Share data by default. High-quality data is a requirement for successful collaborative ecosystems. But this data needs to be made available to multiple stakeholders—siloed data will result in missed opportunities to improve public services, economic development and, ultimately, citizens' lives. However, respondents voice widespread frustration about their ability to use data to reach their future-ready goals.

06

Take security and privacy concerns to heart. Concern about cybersecurity [and the potential for citizen surveillance](#) is increasingly widespread. Ecosystem partners must acknowledge and respond to these concerns. While nearly three-quarters of survey respondents plan to increase their focus on data security in the next few years, just one-third said privacy concerns are slowing their efforts to collect and use citizen data.

Our report explores the key challenges local authorities and businesses face to prepare cities for the future, and how these can be overcome with an ecosystem-driven strategy.

**Develop three-
part ecosystems to
support and execute
on the vision**



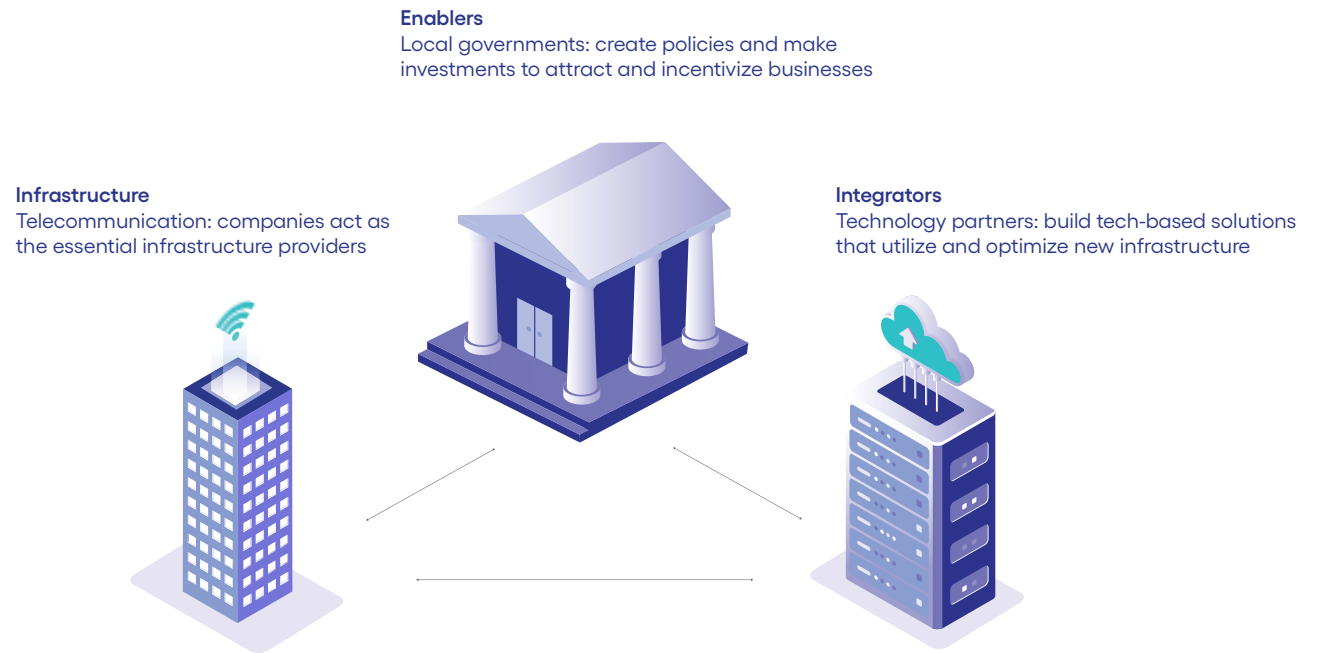
No city can become future-ready on its own; instead, future readiness requires thriving collaborative ecosystems between the public and private sectors.

“Ecosystems of partnerships will be crucial in driving progress, pooling resources and knowledge, sharing or copying best practices, and educating and helping scale technology,” says Jeremy Kelly, City Futures Global Research Director at Jones Lang LaSalle, a global provider of real estate and investment management services.¹

Partnerships are essential to not only give cities the necessary talent and technology capabilities needed to achieve their future-ready goals, but also to address the funding gap that has undermined previous initiatives.

The three-part future-ready ecosystem

Collaborative ecosystems should consist of three key groups: local governments, telecommunication companies and technology partners.



¹ "Future-Ready Cities: A Roadmap for Urban Leaders," ThoughtLab, Sept. 12, 2022. <https://thoughtlabgroup.com/roadmap-for-urban-leaders/>.

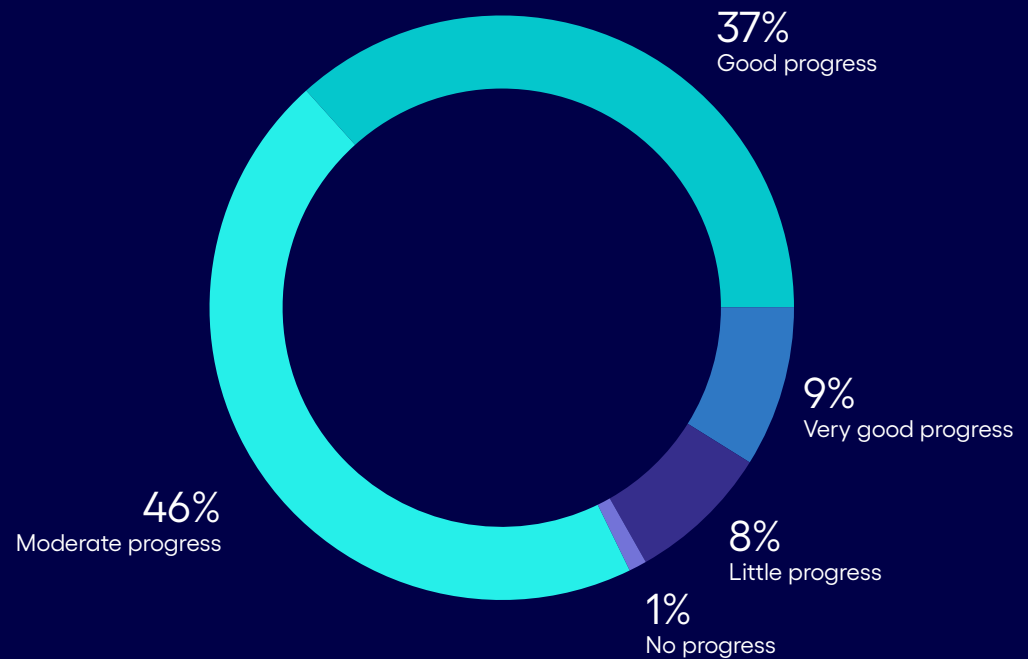
In many cities today, however, these ecosystems are underdeveloped. In our study, less than half of respondents (46%) said they've made good or very good progress in developing an ecosystem of enablers, infrastructure providers and integrators (see Figure 1).

In fact, a key challenge for 65% of respondents was finding the right technology suppliers, partners or consultants to achieve their future-ready plans. Half cited a shortage of the required skills and expertise, and 44% pointed to an insufficient understanding of technology among decision-makers.

Figure 1

Underdeveloped collaboration ecosystems

Q: How would you rate the progress your city has made in developing an ecosystem of collaboration for future readiness?



Percentages may not add to 100% due to rounding
Source: Cognizant/ThoughtLab
Base: 200 city officials

**Design
ecosystems
with the right
dynamics**



To develop a thriving ecosystem, municipal leaders need to ensure these partnerships emphasize two key characteristics:

01

Mutually beneficial relationships.

All three parties need to realize a share of the benefits from the collaborative effort. This can be difficult when incentives are not naturally aligned or there are disputes over issues such as data monetization.

To create alignment, ecosystem partners should define a wide array of possible benefits. These must include more than immediate financial returns and improved public services and should emphasize outcomes like heightened economic activity, and a greater ability to attract talent and investment.

Take the case of Peachtree Corners, a suburb of Atlanta with a population of some 45,000. The city grew around the technology park created in the late 1960s to attract high-tech business and employ the skills of graduates of nearby universities such as the Georgia Institute of Technology.²

With its partners Cisco, T-Mobile, Georgia Power and Bosch, Peachtree Corners has built on this major advantage to create Curiosity Lab, a three-mile autonomous vehicle test track

equipped with 5G and optical fiber networks, connected streetlights, sensors and traffic lights able to communicate with the vehicles and with each other. The street is owned by the city, which allows driverless vehicles to operate on the two outside lanes, and designates the middle lane exclusively for human drivers. This creates a rare real-life (i.e., uncontrolled) testing environment for autonomous vehicles, while protecting people.

The city recovers its investment through business taxes and its reputation as a cutting-edge tech hub, which enables it to attract more investment and jobs.

02

Room for experimentation. Although a key aspect of becoming future-ready is to minimize errors and delays in public-service delivery, cities need the freedom to undergo trial-and-error along the way to realizing their vision. Future-readiness requires cities and their partners to design urban “sandboxes”—safe spaces for experimental efforts that could fail to deliver the expected outcomes but could also lead to outstanding (sometimes unpredictable) results.

A case in point is an initiative at La Défense, a large business district in the greater Paris region. Its pilot program is creating opportunities for companies to explore how ultrafast connectivity can transform an area

whose hundreds of offices, restaurants, shopping malls and other attractions receive millions of visitors every year.³

Paris La Défense’s administration has partnered with Cellnex, a Spanish wireless telecommunications infrastructure and services company, to run a trial encouraging applications of 5G mmWave (waves whose bands have low coverage ranges but extremely high speeds). The idea is to turn this vast area “into a unique playground and experimental area for companies wishing to test new use cases for 5G,” explains Thomas Bertrand, Deputy General Manager at Cellnex France.⁴

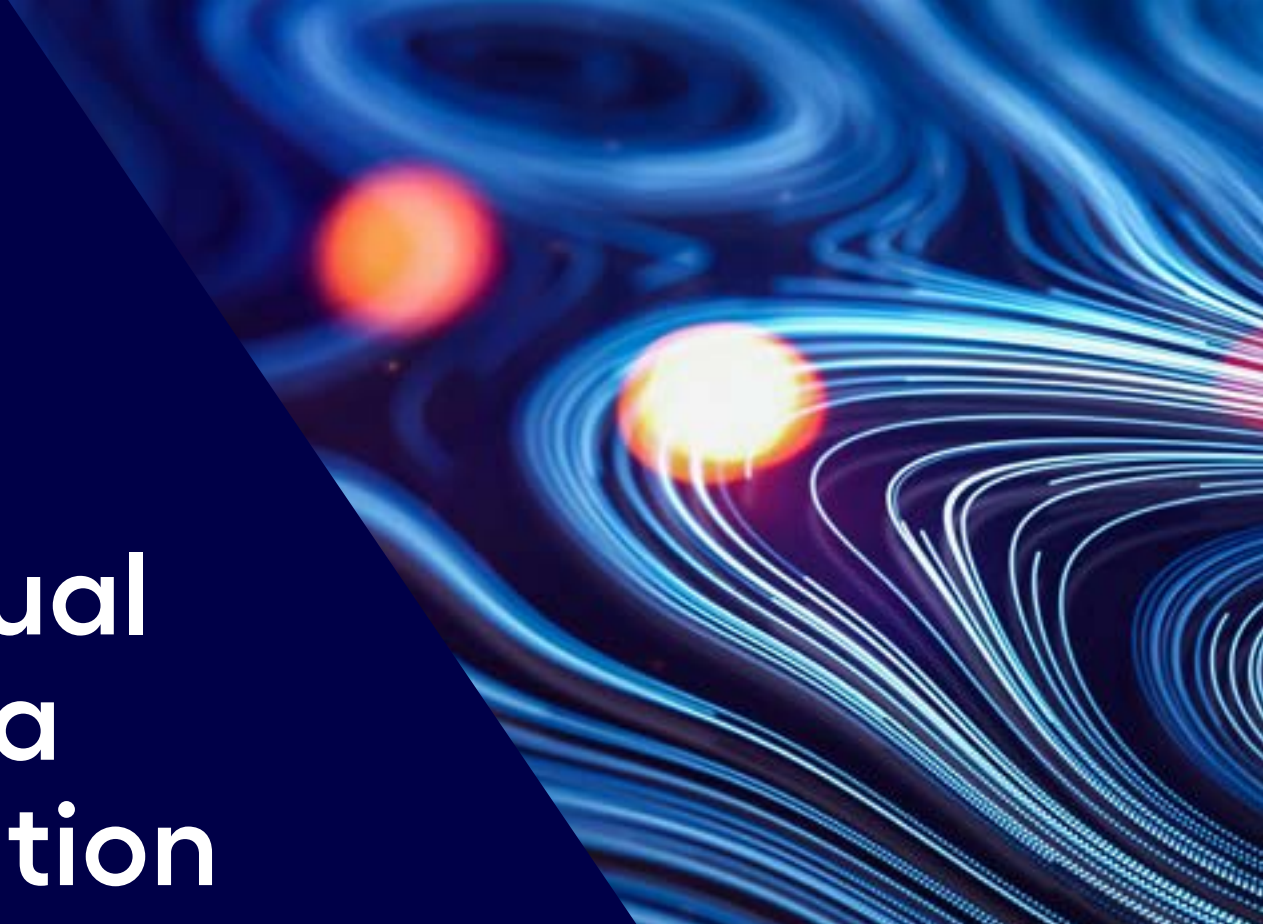


²“Peachtree Corners, Georgia: Innovation Lab of the Future,” ThoughtLab, Jan. 4, 2023, https://thoughtlabgroup.com/wp-content/uploads/2023/01/City-profiles_Spotlight-on-urban-strategies.pdf

³ Paris La Défense website: <https://parisladefense.com/fr/decouvrir/>

⁴“5G mmWave Is Reinventing Business Districts—Here’s How,” Qualcomm/Financial Times, <https://qualcomm.ft.com/article/5g-mmWave-reinventing-business-districts>

**Create individual
solutions with a
shared foundation
in mind**



It's essential, of course, to establish a full-fledged, holistic future-ready vision. After all, that's what informs the planning process and serves as a continuous reminder to all stakeholders—including citizens and successive governments—of what they are working to achieve.

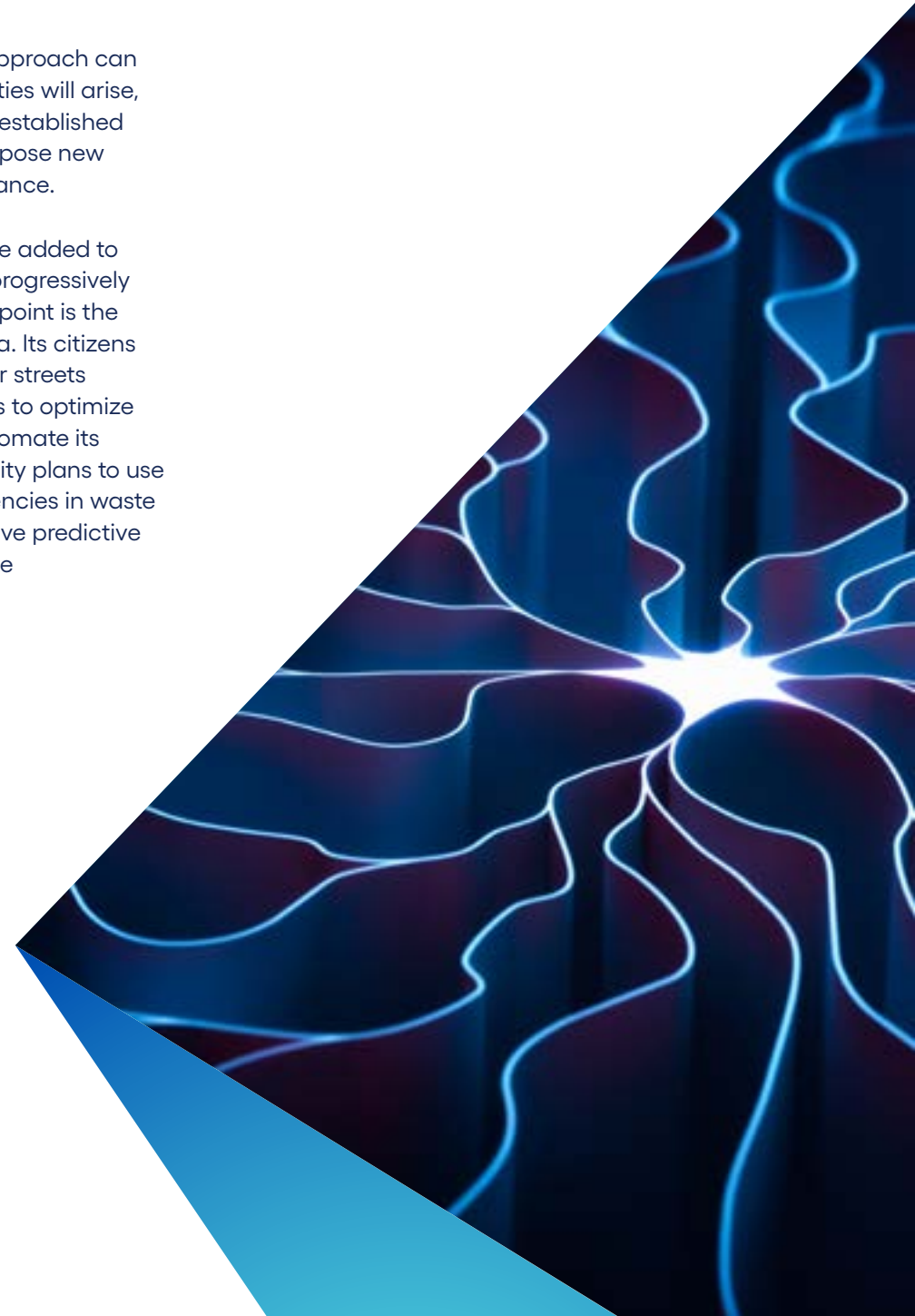
But it's just as important to let the vision unfold piece by interconnected piece. Cities will realize more success by taking it one step at a time—focusing, for instance, on a single area like transportation or waste management—than trying to adopt a “whole package” of measures for large sectors.

A gradual approach delivers more immediate tangible benefits for the population, which helps sustain buy-in. By reducing the costs that need to be covered in each step, it minimizes the chances that projects will be abandoned, therefore increasing the likelihood that, in time, more ambitious objectives will be fulfilled.

Moreover, because a staged approach can signal where further opportunities will arise, it can incentivize startups and established companies to develop and propose new solutions as city initiatives advance.

With time, new solutions can be added to the initial initiative, leading to progressively improved outcomes. A case in point is the Colombia city of Bucaramanga. Its citizens are now enjoying much cleaner streets thanks to the use of IoT sensors to optimize trash collection routes and automate its management. Over time, the city plans to use AI to discover additional efficiencies in waste management, as well as creative predictive models to forecast and mitigate natural disasters.⁵

⁵ Bucaramanga, Colombia: How an Unplanned City Is Preparing for the Future,” ThoughtLab, Jan. 4, 2023. <https://thoughtlabgroup.com/bucaramanga-colombia-unplanned-city-preparing-for-the-future/>.



**Embolden tech
choices, supported
by ecosystem
partners**



Study respondents named a wide array of technologies they believe will be key to realizing their future-ready goals (see Figure 2).

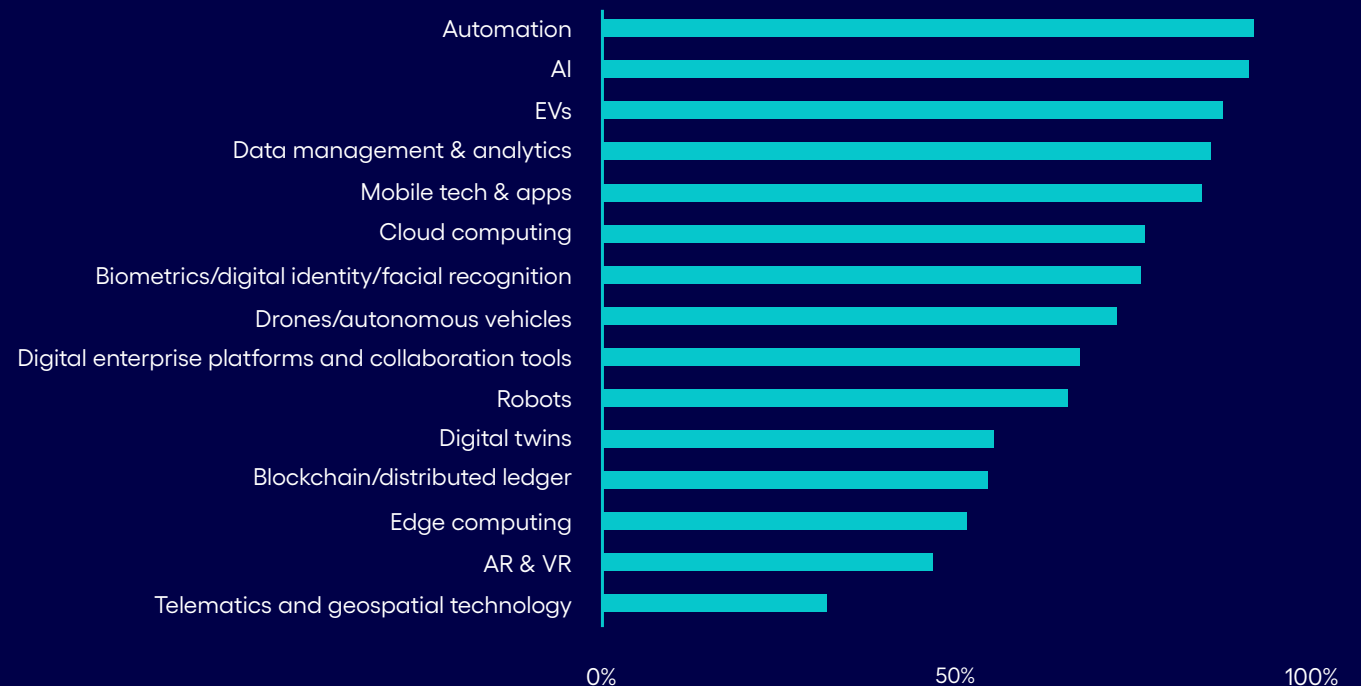
Many of these technologies—including automation, AI, electric vehicles, data analytics, mobile technologies and cloud computing—have long been considered core to any smart city endeavor. 5G will only further the value of these technologies, with its ultra-low latency, blazing speeds, extra-large bandwidth and fail-proof reliability.

Other technologies, like digital twins and blockchain, while less used, can serve as a solid foundation for future-ready endeavors.

Figure 2

Key technologies for future plans

Q: Which of the following technologies will be most important to help your city achieve its future-ready plans?
(Percent of respondents naming each as important)



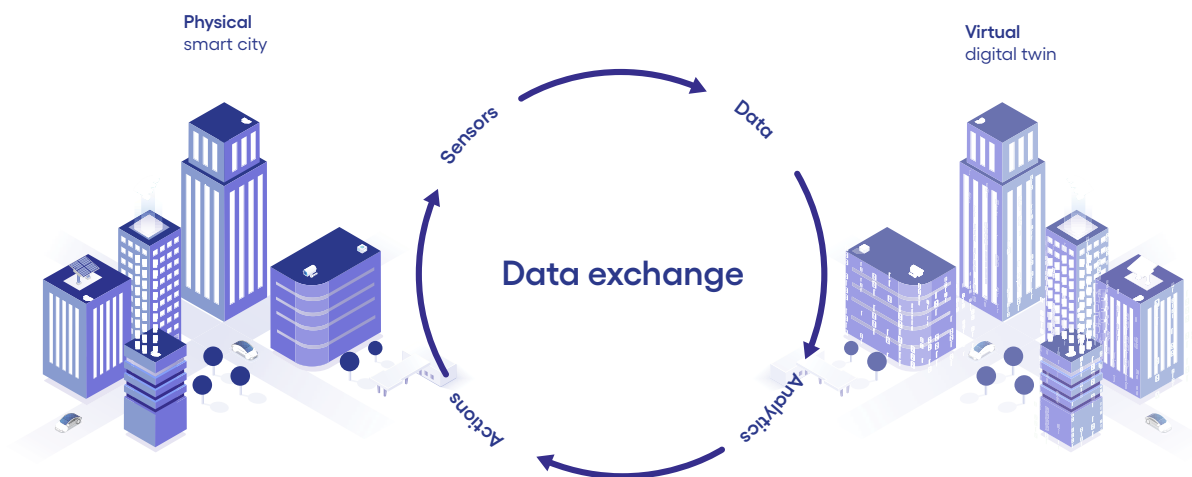
Source: Cognizant/ThoughtLab
Base: 200 city officials

Digital twins—virtual replicas of the physical world updated in real time—can be a key integration tool for initiatives that build on and complement the previous layer of solutions adopted. So far, over one-third (37%) of cities included in the survey are currently using a digital twin, and more than half believe the technology will play a key role in achieving their future-ready plans.

An example of the effective use of digital twins can be found in the city of Seoul. The South Korean capital built on its already robust smart-city infrastructure and solutions to launch a metaverse version of itself.⁶ In addition to enabling citizens to access public services and leisure options, the metaverse space allows Seoul officials to proactively diagnose urban issues and possibly develop solutions, according to the city’s vice mayor, Dong Cho. “This helps reduce costs that may otherwise be required for diagnosis and unexpected accidents and ensure the safety of our citizens,” Cho says.⁷

Digital twins also allow businesses and cities to model scenarios and identify the potential direct and indirect consequences of alternative decisions in a range of areas.

For instance, in Singapore, the world’s first country-scale digital twin will be used to identify the best locations to install solar panels in the city-state, helping it achieve its goals of deploying at least two gigawatt-peak solar energy by 2030 (equivalent to the amount of electricity used annually by 350,000 households).⁸



⁶ Metaverse Seoul: <https://metaverseseoul.kr/user/>

⁷ “Seoul, South Korea: Reimagining a City in the Metaverse,” ThoughtLab, 2022, https://thoughtlabgroup.com/wp-content/uploads/2023/01/City-profiles_Spotlight-on-urban-strategies.pdf

⁸ “Singapore’s Digital Twin of Entire Country,” Tomorrow’s World Today, Sept., 12, 2022, <https://www.tomorrowworldtoday.com/2022/09/12/singapores-digital-twin-of-entire-country/>

**Share data
by default**



Digital twins and other technology-based solutions at the heart of future-ready cities can only be as good as the data that feeds them. This makes the availability of high-quality data a determinant factor for generating the insights that will fuel ecosystem success.

In our study, over 70% of respondents cited a wide range of data activities they'd prioritize in the next five years to meet their future-ready goals, from analyzing, gathering and managing data, to making real-time decisions based on it (see Figure 3).

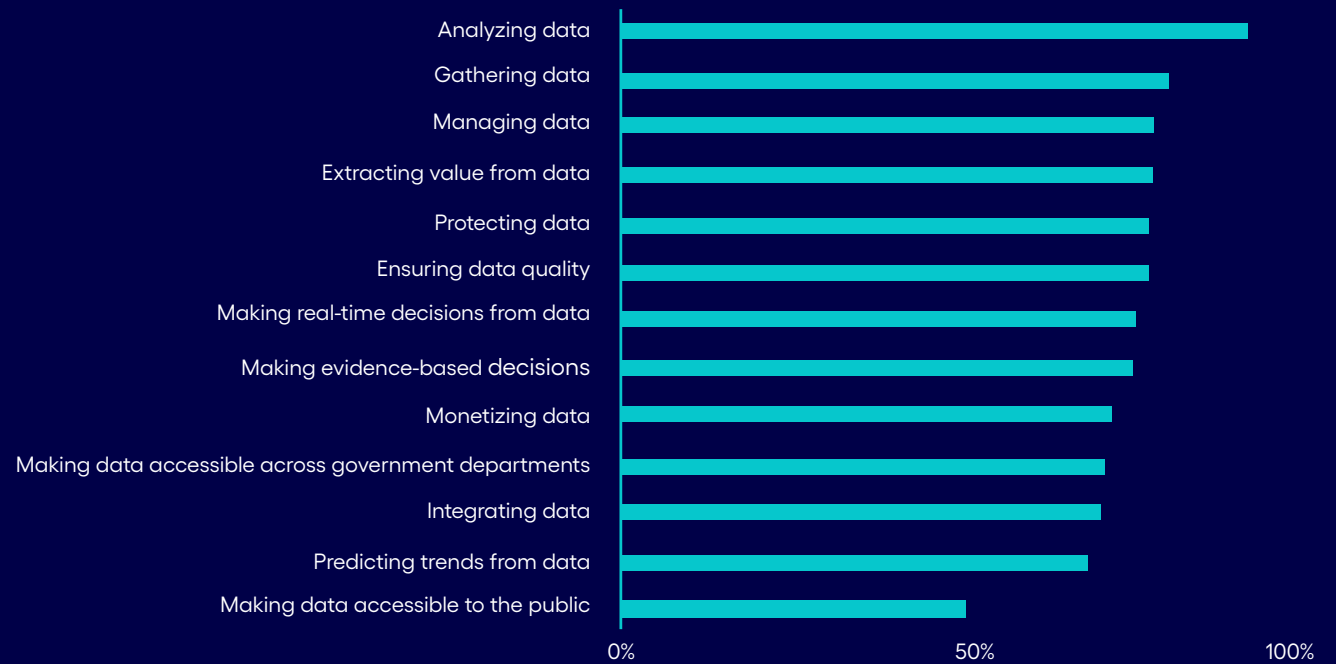
More than half said they would prioritize making data accessible government-wide (69%) and integrating data (68%). Such data sharing is essential to optimizing opportunities for improved public services, economic development and better lives for citizens.

Figure 3

Data's key role in city future-readiness

Q: Which of the following data activities will your city pursue in the next five years?

(Percent of respondents citing each activity)



Source: Cognizant/ThoughtLab
Base: 200 city officials

Perhaps the most dramatic illustration of this comes from Kyiv. The Ukrainian capital was well advanced in becoming future-ready before the start of the Russian invasion in early 2022. For example, seven in 10 adults had downloaded the Kyiv Digital app to do things like pay parking tickets or utility bills.⁹

The city had also begun developing a situation center, as well as a platform for coordinating and sharing data from various municipal entities, such as the city's emergency services units. Moreover, Kyiv's network of IoT sensors and over 7,000 video surveillance cameras were set up to provide data for advanced video analytics.

With the onset of the war, this system began generating valuable information for military and law enforcement officials. At the same time, the Kyiv Digital app added additional functionalities, such as an early warning for air raids and information provided by business owners about which shops were open and where supplies were available.

The benefits of data sharing are also visible in less tense settings. For example, to support better economic and environmental decision-making, the city council in Dublin, Ireland, has developed data partnerships with MasterCard to provide insights into consumer spending patterns, as well as with Google and delivery company DPD to create a street-by-street air-quality map, using electric vehicles embedded with pollution sensors.

⁹ "Kyiv, Ukraine: Building Resilience into Future-Ready Plans," ThoughtLab, 2022, https://thoughtlabgroup.com/wp-content/uploads/2023/01/City-profiles_Spotlight-on-urban-strategies.pdf.

¹⁰ "Dublinked: Open Data for the Dublin Region," Smart Dublin, <https://data.smartdublin.ie/>.

¹¹ "Cary, North Carolina: Pursuing Smart Initiatives through Partnerships," ThoughtLab, 2022, https://thoughtlabgroup.com/wp-content/uploads/2023/01/City-profiles_Spotlight-on-urban-strategies.pdf.

Dublin and the three other councils in its area also created an open data repository for businesses, citizens and researchers, called Dublinked, which features over 560 datasets on areas ranging from recreation and amenities to the economy and innovation.¹⁰

Data sharing often needs to go beyond a city's boundaries since a jurisdiction's activities are deeply intertwined with those of its surrounding areas. Additionally, data and lessons from one location can feed systems and contribute insights to cities elsewhere. As a result, outcomes improve when data sharing does not stop at city or even national borders.

A good example of this comes from the US state of North Carolina, where the city of Cary is working with nearby towns to monitor risks from stormwater impact. It has partnered with SAS, an AI and data management multinational, to install sensors that monitor stream water levels during storms that can act as an early warning flooding system.¹¹



Unfortunately, though, most cities are not as good as Dublin and Cary at sharing and utilizing data across jurisdictional borders. Only 35% of survey respondents believe they are proficient at doing this. Further, respondents are generally frustrated with their progress in using data to achieve their goals across a variety of activities, from sustainability to public safety and security (see Figure 4).

Clearly, data management and data sharing are two key areas for cities to work on, in coordination with their ecosystem partners.

Figure 4

Widespread frustration with using data to achieve goals

Q: How would you rate your city's progress in using data to achieve its goals in the following urban domains?
(Percent of respondents saying good or very good progress)



Source: Cognizant/ThoughtLab
Base: 200 city officials

**Take security and
privacy concerns
to heart**



Though crucial, data sharing can't come at the expense of cybersecurity and citizen privacy. In fact, these are two critical elements of any sound and sustainable future-preparedness strategy. Without them, mistrust undermines relationships, and the future-ready ecosystem cannot deliver.

In the absence of strong cyber defenses, citizen and other data may fall into the wrong hands, putting government services at risk of being paralyzed, with potentially serious consequences for essential services. Fortunately, most cities are increasingly aware of these risks. In the next five years, 74% of respondents intend to prioritize data protection.

Take the case of St. Catharines, in the Canadian province of Ontario. The city uses the AI-based services of UK-US cybersecurity company Darktrace. By learning the normal pattern of the city's IT systems, the AI system recognizes unusual activity that may reveal an attack. And if a serious attack does take place, it takes accurate action to stop it without affecting the rest of the city's digital operations.¹²

Poor privacy tends to be less headline-grabbing than a destructive cyberattack, but it can cause a political and legal backlash, undermining initiatives that seek to make cities more prepared for the future. Any business and local authority working in a future ready-city project should learn the lesson from Toronto in Ontario, Canada. The city is remaking its original smart city vision after concerns over privacy helped bury the ambitious plans it had developed with Sidewalk Labs, the urban innovation unit of Alphabet, for the high-tech development of the Quayside area.¹³

Concern about the increased use of sensors and the potential for citizen surveillance is increasingly widespread. As French activist group La Quadrature Du Net puts it, "The so-called Smart City is turning our future into the Technopolice: Under the guise of optimization and decision support, they transform the whole urban world into a vast surveillance project."¹⁴

Future-ready ecosystem partners must acknowledge that these concerns are real and justified. Fortunately, progress is being made. Cities such as New York and Chicago have created new positions for chief privacy officers, and the UK has instituted an "Algorithmic Transparency Recording Standard" to help public sector organizations provide clear information about the algorithmic tools they use, and why they're using them.¹⁵

AI and machine learning solutions are increasingly incorporating built-in privacy protections. For example, differential privacy systems—which, for instance, Google offers in its free and open-access TensorFlow software library—mitigate the risk of exposing sensitive data used to train ML algorithms.¹⁶


Much more needs to be done; only 30% of local officials surveyed say their city avoids collecting and using citizen data because of concerns around privacy.



¹² "A New Sheriff in Town: Why the City of St. Catharines Turned to Darktrace to Protect its Digital Assets," Darktrace, Aug. 9, 2022, <https://darktrace.com/blog/a-new-sheriff-in-town-why-the-city-of-st-catharines-turned-to-darktrace-to-protect-its-digital-assets>

¹³ "Toronto Wants to Kill the Smart City Forever," MIT Technology Review, June 29, 2022, <https://www.technologyreview.com/2022/06/29/1054005/toronto-kill-the-smart-city/>.

¹⁴ "The Technopolice Manifesto: Resisting the Total Surveillance of Our Cities and of Our Lives," La Quadrature Du Net, May 31, 2020, <https://technopolice.fr/blog/the-technopolice-manifesto-resisting-the-total-surveillance-of-our-cities-and-of-our-lives/>.



Embracing the future-ready city vision

Just as sewage systems and electricity made cities more livable and efficient over a century ago, new and emerging technologies have the potential to further boost the city's role in spurring human progress.

But to thrive in the coming decades, cities must be future-ready. Doing so has never looked more possible, as cities lay the groundwork for the next generation of 5G networking and embrace emerging technologies to support their plans.

By forming well-calibrated ecosystems and well-developed policies that make future-ready capabilities beneficial and accessible to all, cities can pave the way to a future in which they continue to play a vibrant role.



¹⁵ "Algorithmic Transparency Recording Standard Hub," UK Government Website, Jan. 5, 2023, <https://www.gov.uk/government/collections/algorithmic-transparency-recording-standard-hub>.

¹⁶ "Implementing Differential Privacy with TensorFlow Privacy," TensorFlow, https://www.tensorflow.org/responsible_ai/privacy/tutorials/classification_privacy.

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Methodology

This study is based on research conducted by ThoughtLab between May and November 2022.

ThoughtLab surveyed 200 city officials across six regions.

51
North America

25
Latin America

45
Asia Pacific

21
Sub-Saharan
Africa

40
Europe

18
Middle East and
Northern Africa

ThoughtLab also surveyed 2,000 citizens from the following 20 cities: Almaty (Kazakhstan), Amsterdam (Netherlands), Bangkok (Thailand), Belo Horizonte (Brazil), Bengaluru (India), Boston (USA), Cali (Colombia), Chengdu (China), Detroit (USA), Glasgow (UK), Johannesburg (South Africa), Melbourne (Australia), Nairobi (Kenya), Pearland (USA), San Francisco (USA), Seoul (South Korea), Stockholm (Sweden), Tallinn (Estonia), Teheran (Iran), Vancouver (Canada).

ThoughtLab also conducted in-depth interviews with city officials from the following 15 cities: Almaty (Kazakhstan), Austin (USA), Barcelona (Spain), Bucaramanga (Colombia), Cary (USA), Chengdu (China), Chicago (USA), Dublin (Ireland), Kyiv (Ukraine), New York (USA), Orlando (USA), Peachtree Corners (USA), Perth (Australia), Seoul (South Korea) and Toyota City (Japan).

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Cognizant—which was on the advisory board and one of the research project's co-sponsors—also conducted additional secondary research during the development of this and the other reports in this series.



About Cognizant

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