Street smart
Putting the citizen at the center of smart city initiatives
"A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness while ensuring that it meets the needs of present and future generations with respect to economic, social, cultural, and environmental aspects."

The UNECE–ITU Smart Sustainable Cities Indicators.
The challenges of urban living today

Urban life poses multiple challenges for citizens – from public security to transport, cultural issues to concerns about sustainability. In fact, nearly one third of the citizens we surveyed say they may leave their city due to the challenges they face living there.

Smart city initiatives deliver value and earn loyalty

Across major urban services, smart city initiatives have demonstrated their value across the world. Ranging from transport and parking management to flood management, smart city initiatives have benefitted multiple cities. Citizens also believe that the smart city will lead to more sustainability (58%) and better urban services (57%). Cities that deliver these gains can prevent the drain that occurs when citizens and businesses move to other smart cities that offer better prospects. This migration of people and business may become more pronounced as remote working becomes more commonplace during the global health pandemic, with remote workers able to more easily migrate to communities that they feel offer a better lifestyle.

Smart city programs should focus on key use cases

Citizens recognize the value of smart cities and are willing to use a range of use cases that span a number of urban services. To ensure authorities direct resources to the highest-potential use cases, we analyzed a long list of 44 use cases (see Appendix for full list) and assessed them against two criteria: whether citizens are likely to use the solution and whether they are willing to pay more for the solution:

- Transport and mobility – as well as utilities (electricity and water) – are seen as particularly attractive areas that citizens are eager to use.
- Over a third (36%) are willing to pay more for using smart city initiatives. This figure is higher for Millennials (44%), Gen Z (41%) and citizens in the higher income bracket of $80,000+ (43%).

Progress on smart cities is slow and a number of factors are critical to accelerating momentum

Our research finds that only a small minority of city officials (9%) are in advanced stages of smart city implementations, with 22% having just begun implementing a handful of initiatives. Accelerating implementation requires close collaboration between key stakeholders – city officials, citizens, and external parties, such as startups, academic institutes, or venture capital funds. It also requires a focus on three drivers: trust, innovation and data. We suggest three key development areas:

1. Creating a compelling smart city vision with sustainability and resilience as its cornerstones.
2. Empowering city officials to act as entrepreneurs while ensuring that data protection and trust are built into how citizen data is gathered and used.
3. Building a culture of innovation and collaboration with citizens and external entities.

Executive Summary – Key takeaways
Introduction

Many of us city dwellers face a dichotomy. Whether at home or at work, we are connected to an always-on digital highway characterized by a universe of apps, seamless video communication and online delivery. Yet, our city experience lacks a digital touch, from how cities are governed to how secure they are. Citizens also find challenges such as pollution (42%) and of lack of sustainability initiatives (36%) a major concern, and may leave their city as a result.

Smart city initiatives are critical to addressing these issues and also key to developing resilience to challenges such as COVID-19. This means developing a compelling smart city vision and delivery plan, with technology a key enabler. To frame this journey, we need to first understand what undermines cities today, what citizens want from a smart city, and how municipalities can accelerate smart city initiatives – overcoming the many challenges that stand in the way and creating measurable value.

To probe these areas, we undertook this global research study, which spanned 10 countries and sought views from both sides of the smart city fence:

1. **The citizen view**: We surveyed 10,000 citizens in April 2020, looking at everything from the challenges they face today to their willingness to use smart city initiatives.

2. **The city official view**: We surveyed 300 city officials in April 2020 to get their view on smart city initiatives and the challenges of implementation. We also conducted one-on-one interviews with a number of senior city officials to get their perspectives and understand their first-hand experience of smart city implementation.

**Drawing on that research**, this report explores five key themes:

1. What challenges are undermining today’s city experience for citizens?
2. Why do smart cities hold the key to improving urban life?
3. What do citizens hope for and want from a smart city?
4. What challenges stand in the way of success?
5. How can cities accelerate implementation?
Smart city definition

For this research, we use the United Nations Economic Commission for Europe definition of a smart city (i):

“A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness while ensuring that it meets the needs of present and future generations with respect to economic, social, cultural, and environmental aspects”

Throughout the report, as Figure 1 shows, we have explored and examined smart city initiatives across a range of areas, and which include emergency services (medical, police, and fire-fighting services), healthcare, public transportation, public assets (such as roads, parks, museums, etc.), waste management, public administration (inclusive of permits and licenses) and utility networks (such as water, gas and electricity supply networks). We have also considered smart city initiatives for sustainable development.

Figure 1. Areas considered for smart cities initiatives

Broken cities: the challenges undermining today’s citizen experience

Megacities are an established phenomenon today as urbanization accelerates. Nearly 55% of the world’s population lives in cities now (two-thirds are expected to by 2050) and we may have 43 megacities with a population of more than 10 million by 2030 (up from 33 in 2018).

But many of today’s major cities emerged during the industrial revolution and fall short of what people now expect in this digital age. Smaller cities are also struggling to provide high quality public services. In fact, we found that 54% of citizens feel technology firms would be better able to provide urban services than their current city’s authorities.

Many citizens are frustrated with their city experience and will vote with their feet: leaving their current base to move to what they see as a more advanced city

Citizens face multiple challenges in their current city of residence

In our research, we found that many citizens are unhappy with where they currently live, pointing to health and wellbeing issues, lack of professional growth and underwhelming sustainability initiatives. This dissatisfaction is a global phenomenon:

- More than one in three citizens across the world (35%) are unhappy with a lack of community life and cultural activities:
  - This reaches 42% in Washington, DC (making it highest in all American cities surveyed) and 39% in London (highest in all European cities).
- 42% of citizens across the world, and 63% of citizens in Milan, say they will leave their city due to increased pollution.
- 41% of citizens overall, and 57% of citizens in Rome, say they may leave because good job opportunities and economic growth are limited

Traditional, systemic challenges are also a major factor: 45% of citizens across the world suffer from high commute time due to poor transport infrastructure/traffic.

Key pain points that can lead to citizens to leaving a city

Transport and mobility issues

- The large amount of time I spent in commute

Cultural and personal issues

- Lack of a community life
- Not feeling belonged in the city

Financial issues

- Lack of good job opportunities and economic growth
- High cost of living

Sustainability issues

- High level of pollution
- Lack of sustainability initiatives

Public security issues

- Lack of public security

I may leave my city in future due to...

Source: Capgemini Research Institute, Smart Cities Survey, April 2020 (n=10,000 citizens),

Although public security and financial issues emerge as key challenges, there are nuances at a city-specific level. For instance, transport and mobility emerges as the biggest concern for citizens in multiple European cities.
Figure 2.1. Major pain points differ by cities

<table>
<thead>
<tr>
<th>France</th>
<th>UK</th>
<th>Germany</th>
<th>Netherlands</th>
<th>Italy</th>
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</thead>
<tbody>
<tr>
<td>Paris</td>
<td>London</td>
<td>Berlin</td>
<td>Amsterdams</td>
<td>Rome</td>
</tr>
<tr>
<td>Toulouse</td>
<td>Manchester</td>
<td>Munich</td>
<td>Rotterdam</td>
<td>Milan</td>
</tr>
<tr>
<td>Marseille</td>
<td>Bristol</td>
<td>Dusseldorf</td>
<td>The Hague</td>
<td>Florence</td>
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<tr>
<td>Lille</td>
<td>Birmingham</td>
<td>Frankfurt</td>
<td>Utrecht</td>
<td>Turin</td>
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<tr>
<td>Lyon</td>
<td>Leeds</td>
<td>Hamburg</td>
<td>Eindhoven</td>
<td>Naples</td>
</tr>
</tbody>
</table>

Figure 2.2. The cities where citizens are least likely to leave

<table>
<thead>
<tr>
<th>Major reasons for citizens leaving city</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainability issues</td>
</tr>
<tr>
<td>Cultural and personal issues</td>
</tr>
<tr>
<td>Transport and mobility issues</td>
</tr>
<tr>
<td>Public security issues</td>
</tr>
<tr>
<td>Financial issues</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Top five cities citizens least likely to leave</th>
</tr>
</thead>
<tbody>
<tr>
<td>City</td>
</tr>
<tr>
<td>Country</td>
</tr>
</tbody>
</table>

Please refer to the appendix for a complete list of cities.
Percentages refer to the global share of citizens who agree with the statement.

Source: Capgemini Research Institute, Smart Cities Survey, and April 2020 (n=10,000 citizens).
Why do smart cities hold the key to improving urban life?

Citizens believe smart cities will provide an elevated experience that is not limited to basic infrastructure needs. Our research found that citizens want to live in smart cities because they believe that:

• The city will be more sustainable (58%).
• The quality of urban services will improve (57%).
• There will be a better quality of life (54%).
• It will improve their efficiency at work (53%).

As Figure 3 shows, sustainability and improved urban services are seen as two of the major upsides of smart cities for citizens across the world. Toyota, for example, is planning to build a smart city in Japan that will be fully sustainable. The “Woven City” will be powered by hydrogen fuel cells and rooftop solar panels. In addition, only fully autonomous and zero-emission cars will be permitted.1

Figure 3. Sustainability and better urban services key drivers for smart cities

Source: Capgemini Research Institute, Smart Cities Citizen Survey, April 2020 (n=10,000 citizens).
Given that people are enthusiastic about the improvements that can come from a smart city, they are an attractive prospect. We found, for example, that 60% of citizens want to live in a smart city. This was particularly true for Millennials (64%) and those who earned more than $80,000 (more than two-thirds of this group want to live in a smart city). However, enthusiasm is not confined to higher earners: 56% of citizens with income less than $20,000 also want to live in smart cities.

Citizens using smart city initiatives are happier with the quality of their city life

Our research shows that citizens who use smart city initiatives are happier with their quality of life compared to those who have no experience of smart city programs. For example, as Figure 4 shows, 73% of those who have used smart city initiatives say they are happier with their quality of life in terms of health factors, such as air quality. However, this drops sharply to 56% among those who have not used a smart city initiative.

Figure 4. Citizens who use smart city initiatives are happier with the quality of their life

"I am happy with the quality of life in my city now when I think of my...."

Source: Capgemini Research Institute, Smart Cities Survey, April 2020 (n=689 citizens who have used smart city implementations in these civic services: Transport and mobility, health services, public security, and sustainability. n=3516 citizens who have not used smart city implementation in any major civic service.
We define major civic service to include transport and mobility, electric utility, waste management, health services, public security, and citizen services
Smart cities improve quality of life and the citizen experience significantly

Citizens have a strong appetite for using smart city solutions that can improve their lives and environment, showing a willingness to take part in initiatives in areas ranging from healthier living to recycling:

Healthier living: There are several use cases that directly impact healthier living for citizens. For example, air monitoring stations can help cities keep real-time tabs on air quality and take corrective measures if necessary. King’s Collage in London has developed an air pollution app that uses the GPS data and information from the “London Air Quality Network” to provide details on exposure to pollution. The app also notifies the user if air quality deteriorates beyond the limits prescribed by the World Health Organization.

Smart cities also promote healthier living by emphasizing the role of green spaces and encouraging walkable design to aid citizen health and wellbeing. Copenhagen plans to be the world’s first carbon-neutral city by 2025. It has already cut emissions by 42%, and 62% of residents commute by bike. Frank Jensen, the city’s lord mayor, has said, “I want Copenhagen to be a green leader – also in the future. So, we will certainly have very ambitious targets after 2025. Therefore, I am willing to look at all smart solutions, which can make our city greener.”

In our research, we found that 63% of citizens are willing to use healthcare-based smart city initiatives.

Citizen Engagement: According to a BBC survey of over 55,000 people across the world, 40% of young people (ages 16–24) suffered loneliness compared to 27% of those aged 75 or more. This is a significant challenge, as many among this Gen Z population will be making their way to cities for their studies or first job. Developing citizen engagement can help combat loneliness, as it gives citizens a voice and encourages a sense of belonging.

The UK is the first country in the world to create a position of “Minister of Loneliness” and has launched a £11.5 million “Building Connections Fund,” which support projects that prevent or reduce loneliness. In Iceland, “Better Reykjavik” is an online platform that connects the city’s citizens to their council. The platform is used for crowdsourcing solutions to the challenges faced by the city:

- Citizens get to decide how to spend nearly 6% of the city’s investment budget.
- 700 citizen ideas have been implemented and nearly 12.5% of the population have participated in the voting process. In 2019, nearly 37% of the voting population participated in the eighth annual idea-generation process.

Enabling citizen participation improves the sense of belonging and emotional well-being. We found 71% of citizens who have interacted with smart city initiatives feel happier in terms of their sense of belonging. But for citizens who have not used smart city initiatives, this drops to 47%. Similarly, 74% of citizens have a higher level of emotional well-being. But for those who have no smart city experience, this drops to 53%.

Public security: City surveillance, aided by smart technology, can help reduce crime, and 46% say it has improved neighborhood safety. Technology, for example, can help authorities respond to emergency situations faster. In the US, the city of Oakland installed a “Gunfire locator,” with microphones positioned across the city. The microphones detect gunfire and then triangulate the position, allowing the nearest patrol car to get their quickly. Usually, the location of gunfire is detected within 30 seconds. As a result, crime rates have dropped in the areas where the solution is used. In 2012 there were 671 firearm incidents per square mile. Now, this has dropped to 228.

Transport and mobility: Smart transport and mobility solutions save commuting time and effort for citizens. They can also make transitions between different modes of transport more seamless, using one-point ticketing systems and app-based identification and payment. The city of Hamburg in Germany is developing a smartphone app that:
• Detects the current location of a passenger to “check-in” to a bus or train
• The passenger can show a bar code in the app instead of a ticket and the app automatically detects that the journey is over after the passenger leaves the bus or train
• In this way, an entire day’s trips can be processed without the need to purchase a ticket.11

The city of Helsinki has implemented “WHIM,” a single, cross-mobility app encompassing all public transport, bike sharing, and carsharing options in the city.12

Our research shows that citizens have seen significant improvements in both their commute time and efficiency and productivity at work thanks to transport- and mobility-focused initiatives. Examples include:

• Carnegie Mellon University and Pittsburgh city engineers have deployed an artificial intelligence-based system that enables traffic signals to communicate with each other. Each traffic signal makes its own decision by sensing the approaching traffic flow and coordinates traffic movement with nearby signals. This has reduced average travel time by 25%.13
• Copenhagen has installed intelligent traffic signals that prioritize bikes and buses over cars. This system can potentially reduce bus travel time by 5–20% and cycle travel time by 10%. Copenhagen has also built a citywide network of protected bike lanes.14

Multiple cities across the world are creating cycling-friendly infrastructure and encouraging commuters to bike to work. Transport for London is using video sensors with artificial intelligence capability at 20 locations across London to detect the volume of different modes of transport, especially cyclists and pedestrians. This data will be used to assess demand for new cycling routes in the city. City of London authorities have set a target of 80% of the commute in the city to be made by walking, cycling, or public transport by 2041.15 Overall, 64% of citizens are willing to use smart city initiatives for transport and mobility.

58% of citizens want to live in smart cities because they believe that the city will be more sustainable.
**Examples of smart city initiatives benefits**

<table>
<thead>
<tr>
<th>City</th>
<th>Initiative Description</th>
<th>Source</th>
</tr>
</thead>
</table>
| **New York**  | Implemented BigBelly, smart garbage bins. These improve trash collection efficiency by 50%-80%, and also contributes to emissions control by reducing the time spent by garbage trucks on the road.  
(i) NY-Engineers, How New York Is Becoming A Smart City, September 2018, This efficiency is realized by reducing the frequency of garbage collection and effective scheduling for pickup, also leading to lower emissions. |
| **Chicago**   | Deployed a city-wide network of sensors to track presence of air pollutants to predict air quality incidents. This data is also made public.  
| **Coimbra**   | Piloted AI-enabled flood management system. The pilot controlled 60 storms with the downstream flow rate reduced by 37%.  
(iii) Prevention Web, Adaptable, scalable and cost effective local solution to urban flooding prevention, November 2018.                                      |                                                                                           |
| **San Diego** | Will save $2.5mn annually using smart streetlights by connecting the city’s lighting infrastructure to a wireless network, enabling the city to monitor and manage lights remotely.  
| **“Copenhagen Connecting”** | Tracks connected devices such as personal devices to collect and analyze data to provide quick access to information about parking, traffic, transportation cost.  
(v) Here, An introduction to smart transport, April 2019.                                                                 |                                                                                           |
| **Stockholm** | Is working with Telia and Ericsson to implement sensor-based water quality monitoring system.  
(vi) CEO Water Mandate, Using smart technology to monitor Stockholm’s water systems, November 2017.                                                                 |                                                                                           |
| **Dijon**     | Launched a central command center and data from thousands of sensors spread across the city to bring together critical components such as police, traffic, parking, waste management under a unified platform.  
(vii) JDN, In Dijon and Angers, the all-in-one smart city, March 2020.                                                                 |                                                                                           |
| **Singapore** | Launched an online platform named i-Witness. The platform enabled citizens to report on crime incidents, traffic offenses, security crisis etc. via text or multimedia files. The Singapore Police received more than 35,000 submissions through the platform.  
Cities that adopt smart city initiatives will attract talent and businesses

Close to three-quarters (74%) of city officials believe a smart city will attract a highly qualified workforce and provide an attractive destination for startups and established businesses, and 59% of citizens said talented workers and businesses will migrate to other smart cities (Figure 6). Cities may see reverse migration, with citizens and businesses moving to other smart cities that offer better prospects. The remote working that has become the norm during COVID-19 may continue post-pandemic too, leading to greater levels of migration to communities that are seen as better options.

Matthias Wieckmann, head of Digital Strategy, Hamburg, says: “Smart cities are important globally from an industry-driven perspective, for companies to develop smart city solution and thereby tapping this relatively new market segment. If this leads to competitive, citizen-centered products that help us to improve urban services, drive technological development and give local companies a competitive edge, cities will profit in many ways. Better services for cities and citizens will attract companies and talent, thereby increasing employment, resources and well-being in the city.”

Figure 6. Smart cities will attract talent and investments

<table>
<thead>
<tr>
<th>Country</th>
<th>Share of City Officials</th>
<th>Share of Citizens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netherlands</td>
<td>62%</td>
<td>55%</td>
</tr>
<tr>
<td>Italy</td>
<td>64%</td>
<td>64%</td>
</tr>
<tr>
<td>Sweden</td>
<td>65%</td>
<td>53%</td>
</tr>
<tr>
<td>France</td>
<td>68%</td>
<td>55%</td>
</tr>
<tr>
<td>Spain</td>
<td>73%</td>
<td>64%</td>
</tr>
<tr>
<td>Germany</td>
<td>74%</td>
<td>54%</td>
</tr>
<tr>
<td>Overall</td>
<td>74%</td>
<td>59%</td>
</tr>
<tr>
<td>UK</td>
<td>75%</td>
<td>55%</td>
</tr>
<tr>
<td>India</td>
<td>76%</td>
<td>76%</td>
</tr>
<tr>
<td>Singapore</td>
<td>81%</td>
<td>71%</td>
</tr>
<tr>
<td>US</td>
<td>87%</td>
<td>57%</td>
</tr>
</tbody>
</table>

Source: Capgemini Research Institute, Smart Cities Citizen Survey, April 2020 (n=10,000 citizens), Capgemini Research Institute, Smart Cities Survey, April 2020 (n=310 city officials).
Smart city initiatives help fight COVID-19

Technology has enabled cities to address multiple challenges during the pandemic. In our research, 68% of city officials say that smart city initiatives – such as apps that connect people to their nearest healthcare facility or provide remote patient monitoring – have helped them manage the COVID-19 crisis effectively. There are numerous examples of this in action:

- The University of Newcastle is analyzing the effectiveness of the UK government’s social distancing measures through pedestrian sensor data. (i)
- South Korea is using the country’s smart city data hub to accelerate contact tracing – identifying those people who have interacted with an infected person. The smart city hub is used to request contact details for people who may be infected by tracking their movement. (ii)
- Airports in Rome are using smart helmets with augmented reality and thermal scanners to screen multiple visitors simultaneously while maintaining a safe distance of 8–15 feet. (iii)

City officials acknowledge the value of smart city initiatives in disaster management

**Figure 7.** The vast majority believe disaster management must be ingrained in a smart city plan

<table>
<thead>
<tr>
<th>Country</th>
<th>Overall</th>
<th>Sweden</th>
<th>US</th>
<th>France</th>
<th>Germany</th>
<th>Netherlands</th>
<th>Singapore</th>
<th>Spain</th>
<th>Italy</th>
<th>UK</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td>54%</td>
<td>73%</td>
<td>77%</td>
<td>80%</td>
<td>81%</td>
<td>81%</td>
<td>81%</td>
<td>85%</td>
<td>88%</td>
<td>89%</td>
<td>90%</td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Capgemini Research Institute; Capgemini Smart Cities Survey, April 2020, n=310 city officials
Smart city initiatives also find multiple implementations in disaster management:

- **Buenos Aires** made use of IoT-enabled sensors in their drains to monitor flood situations across 1,500 kilometers of pipeline. The sensor data – along with weather reports and other data – helps the city predict floods and has helped clear all of their 30,000 storm drains even in heavy rainfall conditions. (iv)
- The cities of **Los Angeles** and **San Francisco** use artificial intelligence in their “One Concern” platform. The platform allows them to assess the impact of a disaster by modeling potential disasters and predict the damage. (v)
- **Cincinnati’s** fire department uses predictive analytics to prioritize the circa 80,000 requests that the department receives every year and recommend a response. (vi)
What do citizens want from a smart city?

In this section, we look at how citizens are prepared to embrace smart city initiatives: from what digital channels they use to interact with civic agencies to which areas they prize and are willing to pay for.

Citizens are becoming smart citizens

As consumers of smart city infrastructure, citizens must accept and understand how to digitally interact with smart city initiatives. As Figure 8 shows, citizens are already making extensive use of digital channels to interact with civic agencies – not only websites and apps but also kiosks and voice-response systems. Digital mediums enable a two-way communication with city authorities to report broken infrastructure, crime, or transport requirements help to resolve citizen challenges. For example, the government of Australia has set a deadline of 2025 to get all their services online. While initiatives such as these make such services more easily available to a large share of citizens, it also raises important questions on the digital divide in the society.

City officials must ensure that citizens who are unaware/unable to access services digitally are provided with enough tools and means to access these services. Focused training and digital skilling for citizens who need it is one of the ways to go ahead. For instance, Singapore launched a “Seniors Go Digital” program to support and train senior citizens in adoption of digital technologies. This includes small group-based learning sessions along with financial aids for citizens who cannot afford devices.
We found that nearly half use digital mediums once a month or more with websites being the most popular medium of interaction used by three-fourth of citizens. More than 50% are satisfied with the digital channels they use for interaction. While chatbots are the least-used digital medium, they can be used for repetitive tasks, such as providing details on city services. The city of McAllen in Texas created a smart speaker app that provides details about city services and is available on Alexa and Google. In 2016, the state of Utah was one of the first states in the US to adopt Amazon Alexa so that citizens can use it to practice their driving license exam.

**Citizens are willing to pay more for smart city initiatives**

Citizens want a better urban existence, and some are even prepared to see the cost of living in a city increase to deliver this goal:

- As Figure 9 shows, over a third (36%) are willing to pay more for using smart city initiatives. This figure is higher for Millennials (44%), Gen Z (41%) and citizens in the $80,000+ higher income bracket (43%).
- For the citizens who are willing to pay more, the choice for payment is split across usage-based pay (38%), subscription-based payment (37%), and one-time lump-sum payment (25%).
**Figure 9.** Millennials and Indian citizens are willing to pay more for smart city initiatives

I would be willing to pay more to access smart city initiatives because I want to live in a highly developed and connected city

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Overall</td>
<td>36%</td>
</tr>
<tr>
<td>18–21</td>
<td>41%</td>
</tr>
<tr>
<td>22–36</td>
<td>44%</td>
</tr>
<tr>
<td>37–52</td>
<td>30%</td>
</tr>
<tr>
<td>&gt;53</td>
<td>17%</td>
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<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linkoping</td>
<td>25%</td>
</tr>
<tr>
<td>Rotterdam</td>
<td>31%</td>
</tr>
<tr>
<td>Cologne</td>
<td>32%</td>
</tr>
<tr>
<td>Paris</td>
<td>41%</td>
</tr>
<tr>
<td>London</td>
<td>42%</td>
</tr>
<tr>
<td>Turin</td>
<td>44%</td>
</tr>
<tr>
<td>Washington DC</td>
<td>49%</td>
</tr>
<tr>
<td>Madrid</td>
<td>49%</td>
</tr>
<tr>
<td>New Delhi</td>
<td>76%</td>
</tr>
<tr>
<td>Overall</td>
<td>36%</td>
</tr>
</tbody>
</table>

Source: Capgemini Research Institute, Smart Cities Survey, April 2020 (n=10,000 citizens)
To look deeper into citizens’ willingness to use smart city initiatives and pay more for them, we analyzed 39 use cases across seven areas (see Figure 10). We found that:

- The core transport, utility, and health services that already consume a sizable share of citizen income – show a higher willingness to pay, as these are areas where citizens want improved services. Citizens are also able to view the data related to these services.
- But wider citizen services – such as social welfare schemes, business licenses, permits, or accessing citizen records or e-governance – is an area where they are not willing to pay. This may be because these initiatives may not be so high in the hierarchy of needs of citizens as the initiatives where they already pay, such as transport, and areas where they see some value, such as public security and healthcare. Super apps, where most citizen services are available in a single place, could help citizens get seamless access given the willingness of citizens to use smart initiatives in this area. For instance, citizens of Singapore use a single app for multiple citizen services. The Moments of Life (MOL) app allows citizens of Singapore to access multiple services, from birth registration to tax management in one place.21

Figure 10. High level of citizen interest in smart city initiatives
Urban services where citizens are most willing to pay more for smart city initiatives by city

USA
- Washington, DC
- New York
- Los Angeles
- Boston
- San Francisco

UK
- London
- Manchester
- Bristol
- Birmingham
- Leeds

France
- Paris
- Toulouse
- Marseille
- Lille
- Lyon

Germany
- Berlin
- Munich
- Dusseldorf
- Frankfurt
- Hamburg
- Cologne
- Darmstadt

Netherlands
- Amstardam
- Rotterdam
- The Hague
- Utrecht
- Eindhoven

Italy
- Rome
- Milan
- Florence
- Turin
- Naples

Spain
- Madrid
- Barcelona
- Valencia
- Malaga
- Seville

Sweden
- Stockholm
- Gothenburg
- Malmo
- Linkoping
- Helsingborg

India
- New Delhi
- Mumbai
- Chennai
- Bengaluru
- Hyderabad
- Pune

Source: Capgemini Research Institute; Capgemini Smart Cities Citizen Survey, April 2020, n=10,000 citizens
“We’re collecting a lot of data after 18 months in market and we are currently in our infancy as it relates to insights. Our challenge right now is how do we take that data and harness it to provide better and more personalized service to our customers.”

Lynn Blake,
VP, Mobility, Groupe PSA
What challenges stand in the way of success?

Although smart cities offer solutions to a number of the traditional pain points of the city experience, serious challenges to implementation exist, from finding funding to the need for citizens to trust how their data is used. As Figure 11 shows, there are multi-dimensional challenges: tech, funding, leadership, and process.

**Figure 11. Smart city implementation challenges**

<table>
<thead>
<tr>
<th>Governance</th>
<th>Technology</th>
<th>Funding</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td></td>
<td></td>
<td>68%</td>
</tr>
<tr>
<td>Lack of clear vision and planning of future blueprint for city</td>
<td>Lack of technology expertise to provide digital platforms for urban services</td>
<td>Lack of funding for smart city initiatives in the city’s budget from government</td>
<td>68% 66% 69% 67%</td>
</tr>
<tr>
<td></td>
<td>Lack of political agreement with all stakeholders in governance</td>
<td>Lack of funding for smart city initiatives in the city’s budget from government</td>
<td>65% 66% 69% 67%</td>
</tr>
<tr>
<td></td>
<td>Lack of collaboration with citizens during design of smart city initiatives</td>
<td>Lack of quantification of benefits from smart city initiatives</td>
<td>68% 66% 69% 67%</td>
</tr>
<tr>
<td></td>
<td>Lack of collaboration with technology partners during design and implementation</td>
<td></td>
<td>62%</td>
</tr>
</tbody>
</table>

Source: Capgemini Research Institute, Smart Cities executive Survey, April 2020 (n=310 city officials).

Key challenges include:

- **Technology and data challenges**: City officials struggle to find the tech expertise needed; 68% pointing to the “lack of technology expertise to build digital platforms” as a major challenge. At the same time, they are also concerned that government officials and civil servants lack awareness of digital technologies. At the same time, there are also data challenges. Rich data, along with intelligent analytics, will allow cities to harness the true potential of smart initiatives. However, this entails addressing citizens’ privacy concerns, with 63% saying that the privacy of personal data is more important than improved urban services. There are also major issues in managing and capturing data: 43% of officials point to the lack of technological infrastructure for database management and 39% to lack of funding for collecting and storing data. Harnessing the data is another hurdle that cities and service providers face. Lynn Blake, VP, Mobility, Groupe PSA adds, “We’re collecting a lot of data after 18 months in market and we are currently in our infancy as it relates to insights. Our challenge right now is how to...”
we take that data and harness it to provide better and more personalized service to our customers.”

- **Funding challenges:** More than two-thirds (69%) of city officials say that funding initiatives from the city’s budget is a major challenge. Estimating benefits and quantifying the impact is critical to secure funding. However, it is also very challenging: 67% of city officials say that a major hurdle is the lack of quantified benefits.

- **Leadership Challenges:** While ad-hoc implementation will still deliver some benefits, a holistic approach means you can leverage the synergies of different initiatives. We found that 64% of city officials said that the isolated implementation of different smart city initiatives was a major challenge, and 68% pointed to the lack of a “clear vision and future blueprint”.

- **Ecosystem challenges:** City officials say that they struggle to access an innovation ecosystem. A holistic approach that includes different stakeholders is imperative for a smart city: 68% of executives said that lack of collaboration with citizens during design of initiatives is a major challenge. Almost two in three (62%) city officials cite lack of collaboration with technology partners as a challenge.

- **Connecting with Citizen Needs:** City officials around the world are not fully in sync with what citizens believe to be the most critical initiatives. We analyzed the need for smart city initiatives from the perspective of both citizens and city officials, looking at seven areas that ranged from waste management to healthcare, and found a mismatch in multiple geographies (see Figure 12).

**Figure 12. Smart city initiatives as viewed by citizens and city officials**

<table>
<thead>
<tr>
<th>Country</th>
<th>Transport and mobility</th>
<th>Electric utility</th>
<th>Water utility</th>
<th>Waste management</th>
<th>Healthcare</th>
<th>Public security</th>
<th>Citizen services</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
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<td>UK</td>
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<td>France</td>
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<td>Germany</td>
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<tr>
<td>Italy</td>
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<td>Spain</td>
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<td>Sweden</td>
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<tr>
<td>India</td>
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</tbody>
</table>

**Moon chart legend**

- ○: Lowest
- ●: Low
- ▲: Medium
- ■: High
- □: Highest

**Source:** Capgemini Research Institute, Smart Cities Citizen Survey, April 2020 (n=10,000 citizens), Capgemini Research Institute, Smart Cities Survey, April 2020 (n=310 city officials).
How can cities accelerate smart implementation?

Our research shows that only one in ten officials says their city is in the advanced stages of implementing a smart city vision (9%) and only 22% have started implementing a few smart city initiatives (see Figure 13). Smart city initiatives are evenly spread across multiple areas with the greatest level of implementation in transport and mobility. However, even here, only 28% of city officials say they are already implementing, whereas 35% say they are not aware of anything or confirm that nothing has been implemented. It is clear that an accelerated approach is required if smart city programs are to meet citizens’ considerable appetite for solutions and services.

Figure 13. Smart city initiatives need a major push

Share of city officials who agree with the below statements

- 15% We have just started the process to ideate and create a smart city plan
- 32% Our city administration is working to create a smart city plan
- 22% Our city has published a plan document/vision to become a smart city
- 22% Our city has published a plan document/vision to become a smart city and has started a few initiatives
- 9% Our city is in advanced stages of implementation of the smart city vision
Share of city officials by country who say their city has published a plan document/vision to become a smart city and has started a few initiatives

<table>
<thead>
<tr>
<th>Country</th>
<th>31%</th>
<th>29%</th>
<th>28%</th>
<th>23%</th>
<th>22%</th>
<th>19%</th>
<th>19%</th>
<th>8%</th>
<th>2%</th>
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<tbody>
<tr>
<td>US</td>
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<tr>
<td>Sweden</td>
<td>31%</td>
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<tr>
<td>Germany</td>
<td>29%</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Italy</td>
<td>28%</td>
<td></td>
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<tr>
<td>Netherlands</td>
<td>23%</td>
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<td></td>
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<tr>
<td>Overall</td>
<td>22%</td>
<td></td>
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<tr>
<td>France</td>
<td>19%</td>
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<td></td>
<td></td>
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<tr>
<td>Spain</td>
<td>19%</td>
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<td></td>
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<tr>
<td>UK</td>
<td>8%</td>
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<tr>
<td>India</td>
<td>2%</td>
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</tbody>
</table>

Share of city officials on level of implementation of smart city initiatives

<table>
<thead>
<tr>
<th>Service</th>
<th>Not aware</th>
<th>Not implemented</th>
<th>My city is implementing a pilot</th>
<th>Already implemented in my city</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste management</td>
<td>13%</td>
<td>32%</td>
<td>33%</td>
<td>22%</td>
</tr>
<tr>
<td>Public security</td>
<td>14%</td>
<td>27%</td>
<td>36%</td>
<td>23%</td>
</tr>
<tr>
<td>Water utility</td>
<td>13%</td>
<td>28%</td>
<td>37%</td>
<td>22%</td>
</tr>
<tr>
<td>Healthcare</td>
<td>12%</td>
<td>28%</td>
<td>37%</td>
<td>22%</td>
</tr>
<tr>
<td>Citizen services</td>
<td>13%</td>
<td>25%</td>
<td>36%</td>
<td>26%</td>
</tr>
<tr>
<td>Electric utility</td>
<td>11%</td>
<td>27%</td>
<td>38%</td>
<td>24%</td>
</tr>
<tr>
<td>Transport and mobility</td>
<td>9%</td>
<td>26%</td>
<td>37%</td>
<td>28%</td>
</tr>
</tbody>
</table>

Source: Capgemini Research Institute; Capgemini Smart Cities Survey, April 2020, n=310 city officials
Accelerating implementation requires close collaboration between key stakeholders – city officials, citizens, and external parties (such as startups, academic institutes, or venture capital funds). It also requires a focus on three drivers: trust, innovation, and data.

In our experience, three development areas will be key:
1. Create a smart city vision with sustainability and resilience as cornerstones.
2. Empower city officials to act as entrepreneurs and at the same time ensure data protection and trust.
3. Build a culture of innovation and collaboration with citizens and external entities.

**Figure 14: Smart cities framework**

Source: Capgemini Research Institute Analysis
1- Create a smart city vision with sustainability and resilience as cornerstones

We found that close to half of city officials (47%) admit their city does not have a smart city strategy document or comprehensive transformation plan. A clear vision and strategy are critical to avoiding ad-hoc smart initiatives, which in turn lead to siloed developments that then become difficult to scale. Cities must build their vision on the foundations of sustainability and resilience to ensure they thrive into the future. Martin Gull, CDO, city of Helsingborg, says, “We can’t develop new facilities or infrastructure that are not built with their sustainability in mind from the start. That’s going to be a prerequisite for anything we do for the future.”

Weave sustainability initiatives into the smart city plan

Our research shows that sustainability must be a key focus area for city officials:

• Looking back over the past three years, 42% of city officials believe that sustainability initiatives have been lacking and more than three-quarters believe the situation has not improved today.
• More than half (52%) believe that sustainability challenges will only intensify in the future.

Technology will be key to sustainability. We found that 41% of executives believe that cities becoming more unsustainable over the next 5–10 years is one of the top five consequence of not adopting digital technology. In addition, 58% of citizens say that technology-enabled smart city initiatives will help make cities more sustainable. For instance, air pollution is a major issue for most large urban areas, and a recent study found that pollutants near busy streets can be 10 times worse than background levels at air monitoring stations.

Ensure resilience measures are built into the smart city plans

The importance of smart city initiatives for effective disaster management has never been more apparent than in today’s pandemic situation. We found that 80% of city officials say disaster management must be ingrained in a smart city plan. The majority (57%) of city officials also believe that a command center is a critical asset. These centers optimize emergency response, gathering data from various sources to issue timely warnings and provide a coordinated response to major incidents. Command centers that monitor the entire city for routine activities — such as traffic, utilities, or public security — can also easily be converted to effective command centers for emergency/disaster management.

COVID-19 led to multiple cities using smart city initiatives to manage the crisis. For instance, the city of Bengaluru, India, repurposed its command center within 24 hours into a corona war room. The war room was used to track patients and draw up containment plans using heat mapping technologies. Similarly, the government of West Java, Indonesia, recently launched a command center that is also used as a COVID-19 response hub.

Identify high-potential use cases

To ensure authorities direct resources to the highest-potential use cases, and identify the value drivers underpinning ROI/the business case, we analyzed a long list of 39 use cases. These are spread across a range of areas — transport, utilities, public security, healthcare, and citizen services (see the Appendix for the full list) — and we assessed them against two criteria:

• Whether citizens are likely to use the solution
• Whether citizens are willing to pay more for the solution.

The resulting analysis identifies six use cases that are more likely to see sustained use while generating revenue, from app-based access to all transport modes to real-time water quality monitoring (see Figure 15).
Figure 15. High potential use cases for smart city initiatives

Willingness to use-Willingness to pay (standarized values)

- App-based bicycle/electric bike rentals
- Carbon credits for in-house solar energy generation & consumption
- Apps that provide central payment options for a combination of transport methods
- App for ride sharing
- Autonomous vehicles that interact with traffic sensors for efficient movement
- Smart leakage detection using sensors/drones
- AI based Cybersecurity to protect citizen data
- Smart garbage bins to alert municipalities when the garbage bin is nearing capacity
- App to check dynamic electricity pricing
- Access to Government sponsored social welfare schemes digitally
- Optimization of waste collection routes based on availability of garbage
- Digital tracking of waste clearance and payment
- Facial recognition to identify citizens to help track known criminals/offenders
- Gamification to promoting healthy living
- Central digital citizen records via app for 24/7 access to vital citizen data
- Workshops for digital education of citizens to use the smart city initiatives
- Predictive policing
- Automated connectivity of buildings to emergency services
- Remote patient monitoring for elderly citizens
- Smart home energy consumption tracking
- Centralized building energy automation systems to control heating, ventilation, and air conditioning
- Smart card or app-based access to public transport
- Real time water quality monitoring
- Data-driven public health interventions
- Citizen app to connect to nearest facility in case of epidemic/pandemic
- Smart surveillance of public areas
- City Command Center for emergency response optimization
- Water consumption tracking at homes through digital meters
- Smart parking for parking spaces management
- Smart streetlights to automatically operate
- Access to WiFi in stations/in transit
- WiFi hot spots in public areas in the city
- Intelligent traffic signals for real-time traffic management
- Citizen app/chatbot for reporting accidents, crime, corruption, complaints
- Incentives for citizens to walk/cycle instead of driving
- Citizen app for real-time public transit information
- Workshops for digital education of citizens to use the smart city initiatives
- Predictive policing
- Central digital citizen records via app for 24/7 access to vital citizen data
- Gamification to promoting healthy living
- Facial recognition to identify citizens to help track known criminals/offenders
- Digital tracking of waste clearance and payment
- Optimization of waste collection routes based on availability of garbage
- Access to Government sponsored social welfare schemes digitally
- App to check dynamic electricity pricing
- Smart garbage bins to alert municipalities when the garbage bin is nearing capacity
- AI based Cybersecurity to protect citizen data
- App for ride sharing
- Autonomous vehicles that interact with traffic sensors for efficient movement
- Smart leakage detection using sensors/drones
- App-based bicycle/electric bike rentals
- Carbon credits for in-house solar energy generation & consumption

Transport and mobility
Electric utility
Water utility
Waste Management
Public healthcare
Public security
Citizen Services
Top 6 use cases citizens are likely to use and pay more

<table>
<thead>
<tr>
<th>Use Case</th>
<th>Description</th>
</tr>
</thead>
</table>
| Electric Utility | To make public transport hassle-free, Berliner Verkehrsbetriebe (BVG), Berlin’s public transport Authority Launch Jelbi, a one-stop app to access all public modes of transport such as subways, buses, trams and ferries. This also includes bikesharing, ride hailing, carpooling, taxis integrating multiple apps in a single place.
| Water Utility | City of Stockholm is working with Ericsson and Telia to install sensors for real-time water monitoring. These could also be used for spill detection and leakages in the pipelines, while also monitoring water quality.
| Electric Utility | Electric utility company, Duke Energy, has started installing ‘Smart meters’ in the Cape Fear region. These meters will enable consumers to track hourly consumption and where they could cut back to enable more savings.
| Public security | Panorama Tower, the tallest building on the US East Coast implements many smart initiatives for people living and working there. These include safety measures such as access control and centrally integrated fire safety system.
| Remote patient monitoring for elderly citizens | City of Seoul launched U-Health (Ubiquitous Health) strategy to enable senior citizens to live independent lives in their own homes as long as possible. This includes improving remote monitoring in elderly citizens by monitoring devices to a citizen’s homes.
| Centralized building energy automation systems to monitor and control HVAC in public buildings | City of London with their RE:FIT program targeting public buildings. Under this program, the city aims to reduce CO2 emissions by 60% of the 1990 levels by 2025 by retrofitting energy saving measures on these buildings.

**Source:** Capgemini Research Institute, Smart Cities Survey, April 2020 (n=10,000 citizens).

Please refer to the appendix for a complete list of use cases.

i. Fast Company, “In Berlin, there’s now one app to access every mode of transportation,” February 2019.
ii. Digital Demo Stockholm, “How do we measure and maintain the quality of the most important natural resource we have – clean water?,” December 2019.
2-Empower city officials to act as entrepreneurs and at the same time and ensure data protection and trust

Empower city officials to become smart city entrepreneurs

Even before their minds and attention turn to the challenge of smart cities, city authorities face multiple issues in running their own departments and “keeping the lights on.” To move beyond business-as-usual activities – and build momentum – cities have begun appointing chief digital officers (CDOs) who are responsible for smart city initiatives (London, for example, appointed its first CDO in 2017).

One of the key characteristics of the role is working across departmental silos, ensuring the wider body of city officials participate. This means they need to embrace an entrepreneurial mindset: understanding the critical issues, coming up with ideas and pilots, scaling the successful pilots, and integrating these solutions with the city’s ongoing operations. Empowering city officials across all levels to come up with ideas – and then supporting them financially to create the initial pilots – is one way to drive faster implementation. Martin Gull, CDO for the city of Helsingborg, adds, “We provide innovation funds to every city department and provide financial opportunities for officials to run innovation projects. The innovation fund is not for regular development work you do every day. It is about taking the chance to test something unproven – something that we haven’t done before in the city. Every city department has set up an innovation and idea screening process, idea facilitation, and idea coaching.”

Explore alternate funding approaches

Most smart city funding comes from national, state or local city governments. However, lack of government funding for smart city initiatives is a key challenge cited by 69% of city officials. In response, some city officials explore alternate sources of funding:

• 22% approach international organizations (e.g., European Union, World Bank). A few countries in Europe – such as Spain (46%) and the UK (31%) – have a higher-than-average use of this approach.
• 20% seek loans from banks/venture funds

Another approach in a budget-constrained environment is to start with very small initiatives, and then test and expand them, identifying those with viability for funding. Matthias Wieckmann, head of Digital Strategy, Hamburg, adds, “It is best to start with smaller, focused solutions that provide a good example and visibility rather than starting with a big overall solution for everything. It is easier to find partners, support and finance for projects that start from something small and have been shown to be useful.”

Governance to ensure protection and trust for how data is managed and used ethically

Almost half (46%) of citizens are aware of the benefits of sharing their personal data to power smart cities, but only...
39% are willing to do so. This is indicative of a lack of trust: we found that only 39% of citizens trust the technology systems that urban utilities have in place currently, in areas such as transparency into how data is captured and used.

Building trust depends on designing ethical ways of collecting citizen data in compliance with individual freedom and data compliance laws. Digital principles must be laid out to clarify how the data is collected, anonymized, accessed, and shared. According to our earlier research, the use of artificial intelligence algorithms for smart city initiatives may lead to social and human biases and must include ethical principles to avoid this.25 Eric Legale, general manager, Issy Media – which is leading the IT development strategy of Issy-les-Moulineaux, Greater Paris area – says, “Smart City is increasingly associated with privacy problems, as sensors and data are associated with surveillance tools, and due to scandals reported by the media. This is the most important challenge to overcome for a trusted relationship between citizens and their city”.

The reluctance to share data can be overcome by putting in place governance mechanisms to enforce guidelines and robust security, and making citizens aware of these procedures. For instance, 55% of citizens would only hand over their data if they were aware of the encryption protections available. Sharing citizen data collected with urban services or private players ensures transparency in rules for sharing, data use, and data anonymization. Estonia launched one of the earliest open-sourced data sharing platforms, “X-Road.” Using this system, various government and private entities can link their databases in a secure way – ensuring confidentiality, integrity, and interoperability between data exchange parties.26

The “London Datastore,” launched in 2010, was one of the first initiatives in the world to enable free access to data to address the city’s challenges. Sadiq Khan, the mayor of London, stated that transparency is a key pillar for the London Datastore, “By responsibly opening up a huge amount of data held by our public sector partners and working with London’s brilliant tech sector, we’re helping to tackle some of the most urgent challenges facing our city as it grows. The next step is to create a shared approach for the city so we can all benefit from the innovation this will bring – while using the data we hold on Londoners’ behalf transparently, safely, and securely”.

Similarly Transport for London (TfL) collects citizen movement through wireless tracking across the London Underground to understand how public moves across the city and provide better services. However, TfL ensures the data is pseudonymized and encrypted to prevent identification of the device.28

3-Build a culture of innovation and collaboration with citizens and external entities

A forum to regularly review progress and take important decisions is key to accelerating implementation. While many cities do have governance councils, only 39% of city officials say smart city initiatives are implemented by a central governing body that includes the elected leaders,

“We provide innovation funds to every city department and provide financial opportunities for officials to run innovation projects. The innovation fund is not for regular development work you do every day. It is about taking the chance to test something unproven - something that we haven’t done before in the city. Every city department has set up an innovation and idea screening process, idea facilitation and idea coaching.”

Martin Gull, CDO at the City of Helsingborg
city administrators, urban service providers, private firms, and citizens. Martin Gull, CDO, city of Helsingborg, says, “Smart cities are not just about technology, with big control rooms where multiple screens visualize what is going on. It is also about smart people who can collaborate to create a smart city together. This includes not only city officials but also external entities, such as citizens and local organizations. We are constantly working in different ways to stimulate other actors – beyond us – to contribute to the city.”

Increase citizen participation in smart city implementation

The citizen, as the consumer of urban services, must be an essential component of initiatives. While officials do elicit citizen opinion through surveys (62%) and citizen councils (66%), only one in three (33%) involves citizens in decision making. The lack of end-to-end citizen involvement is reflected in the diverging priorities of city officials and citizens, as Figure 19 shows. For example:

• 66% of citizens are willing to use smart initiatives in the water utility space
• But only 56% of officials feel there is the need for initiatives in this area.

Taking citizens’ views to the next level by making them more involved in decision making and implementation will ensure that the gap between the two is bridged and mutual understanding strengthened. For example, the city of Tallinn developed the AvaLinn mobile app for urban planning. It enables citizens to provide feedback on development plans and the opportunity to co-create urban space with the municipality. Citizens can view the plan, comment on it, like or dislike it and submit their own ideas.29 Singapore has also

“Smart City is increasingly associated with privacy problems, as sensors and data are associated with surveillance tools, and due to scandals reported by the media. This is the most important challenge to overcome for a trusted relationship between citizens and their city”

Eric Legale, General Manager, Issy Media
created a virtual 3-D model of this city which provides real-time data from the city infrastructure which will be useful to identify challenges and implement new initiatives and will be available for citizens for access.30

Smart city initiatives also play a pivotal role in democracy by making citizens views heard. With COVID-19, more citizen interactions will be virtual and smart cities initiatives enable this interaction. Voting for elections will be an area which will be impacted a lot due to COVID-19. Estonia has already implemented systems that allow citizens to vote virtually. In fact, 44% of the votes for the previous election was cast using e-voting in Estonia.31

Collaborate externally, from design to implementation

The major reason for cities not having a smart city strategy document or comprehensive transformation plan is lack of clarity on who to approach externally to get help (68%). While large metropolitan cities may have the resources and in-house capabilities to create this strategic plan, many smaller cities may need external help, and collaboration with external parties will be key.

Overall, collaboration is seen as key, with three-in-four officials saying it is essential to involve external entities such as startups, academic institutes, and telecom firms (see Figure 19). However, it is also important to have basic expertise internally to understand the best way forward. Matthias Wieckmann, head of Digital Strategy, Hamburg, adds, “Of course, cities need to possess and strengthen digital competencies in their administration, state agencies, public companies, and so on. But you don’t need to know everything. You need the capabilities inside the administration to choose the right partner to cooperate with. City officials should not just buy anything that is offered, but should be able to decide which solution is the best for a city and its citizens.”

“Smart cities are not just about technology, with big control rooms where multiple screens visualize what is going on. It is also about smart people who can collaborate to create a smart city together. This includes not only city officials but also external entities, such as citizens and local organizations. We are constantly working in different ways to stimulate other actors – beyond us – to contribute to the city”

Martin Gull, CDO, City of Helsingborg
The collaboration could be a win-win, with external entities sharing their expertise on smart solutions and cities sharing their knowledge on citizen behavior. London authorities, for example, are working with the Alan Turing Institute to manage the COVID-19 crisis, with a “trigger” communications campaign to help ensure people maintain social distancing. Greater London Authority CDO Theo Blackwell adds, “Bringing together open data gives us another tool to understand how the capital is responding to public health measures, as well as how our high streets and shopping centers are doing, as we move from restrictions to recovery.”

**Establish innovation centers for smart city initiatives**

Innovation centers bring together startups and technology firms with citizens and local businesses to understand local challenges and brainstorm solutions. The city of Helsingborg has established “HBG Works” as an innovation hub where city officials, citizens and entrepreneurs can meet to innovate, develop solutions, and receive the support needed for delivery and scalability. This innovation hub allows the best ideas to be scaled up after testing and provides a forum for citizens to contribute to the smart city initiatives. Initiatives from the HBG Works include a hackathon for digital inclusion for elderly and a healthcare app.
Conclusion

In our urbanized world, technology-led interventions are essential for giving citizens the experience they need and want. The current city experience is broken – with social, environmental, and infrastructure challenges resulting in citizens threatening to leave their current city in pursuit of the more sustainable future promised by smart cities, as well as improved urban services.

However, innovative technology – and the funds to innovate and deliver – will not in themselves create a smart city. Success will be driven by a number of factors. You need to create a compelling smart city vision that has sustainability and resilience at its heart. City officials need to feel empowered to act as entrepreneurs. The use of citizen data must be governed by protection and trust. A culture of innovation and collaboration with citizens and external entities will also be key. Finally, it is critical to put citizens at the center of smart city initiatives, based on a deep understanding of the areas where they are willing to use smart city initiatives and their willingness to pay more to access smart solutions. After all, the citizens of a city are its greatest asset, and involving them in this endeavor will be key to its success.
Appendix A

We analyzed 44 smart cities use cases across the areas of transport and mobility, public security, healthcare, sustainability, electricity and water utilities, waste management, and citizen services.

<table>
<thead>
<tr>
<th>Areas of smart city initiatives</th>
<th>Use cases for smart city initiatives</th>
<th>Citizens’ willingness to use</th>
<th>Citizens’ willingness to pay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport and mobility</td>
<td>Citizen app for real-time public transit information about delays and service disruptions</td>
<td>75%</td>
<td>35%</td>
</tr>
<tr>
<td></td>
<td>Intelligent traffic signals to automatically update traffic signals based on real-time traffic (e.g., automatic lane clearances for commuter vehicles such as buses and vans)</td>
<td>66%</td>
<td>35%</td>
</tr>
<tr>
<td></td>
<td>Smart parking to count available parking spaces in the neighborhood</td>
<td>65%</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>Smart card or app-based access for all public transport modes (e.g., metro, buses, ferries, etc.)</td>
<td>68%</td>
<td>46%</td>
</tr>
<tr>
<td></td>
<td>Access to Wi-Fi in stations/in transit (e.g., at metro stations, bus stops, within metros, buses, etc.)</td>
<td>72%</td>
<td>37%</td>
</tr>
<tr>
<td></td>
<td>App for ride sharing with people going to the same area (e.g., office, college)</td>
<td>56%</td>
<td>42%</td>
</tr>
<tr>
<td></td>
<td>App-based bicycle/electric bike rentals for last-mile connectivity</td>
<td>61%</td>
<td>49%</td>
</tr>
<tr>
<td></td>
<td>Apps that provide availability and payment options for a combination of transport methods, such as car and bike sharing, taxis and car rentals/leases, and public transport</td>
<td>59%</td>
<td>43%</td>
</tr>
<tr>
<td></td>
<td>Autonomous vehicles (used for shared services on fixed routes) that interact with traffic sensors to autonomously move more efficiently</td>
<td>52%</td>
<td>43%</td>
</tr>
<tr>
<td>Electric utility</td>
<td>Centralized building energy automation systems to monitor and control heating, ventilation, and air conditioning (e.g., stadiums or offices using solar panels to minimize carbon footprint, lights based on motion sensors)</td>
<td>67%</td>
<td>45%</td>
</tr>
<tr>
<td></td>
<td>Smart home energy consumption tracking (e.g., running heavy electricity consumption appliances at non-peak hours, automatic setting of temperature based on weather patterns)</td>
<td>66%</td>
<td>45%</td>
</tr>
<tr>
<td></td>
<td>Smart streetlights to automatically turn on/off and reduce brightness based on ambient light</td>
<td>71%</td>
<td>38%</td>
</tr>
<tr>
<td></td>
<td>App to check dynamic electricity pricing enabling different energy prices based on current demand and use household appliances accordingly</td>
<td>61%</td>
<td>38%</td>
</tr>
<tr>
<td></td>
<td>Carbon credits for in-house solar energy generation and consumption to encourage green energy</td>
<td>61%</td>
<td>42%</td>
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## Areas of smart city initiatives

<table>
<thead>
<tr>
<th>Areas of smart city initiatives</th>
<th>Use cases for smart city initiatives</th>
<th>Citizens’ willingness to use</th>
<th>Citizens’ willingness to pay</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water utility</strong></td>
<td>Water consumption tracking at homes through app-based digital meters</td>
<td>68%</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>Smart leakage detection using sensors/drones, enabling immediate response at home or in public places</td>
<td>61%</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>Real-time water quality monitoring</td>
<td>69%</td>
<td>45%</td>
</tr>
<tr>
<td><strong>Waste management</strong></td>
<td>Digital tracking and payment for waste disposal</td>
<td>56%</td>
<td>36%</td>
</tr>
<tr>
<td></td>
<td>Optimization of waste collection routes based on availability of garbage to be collected, saving time and effort</td>
<td>64%</td>
<td>37%</td>
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<tr>
<td></td>
<td>Smart garbage bins to alert municipalities when the garbage bin is nearing capacity and needs to be collected</td>
<td>63%</td>
<td>38%</td>
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<tr>
<td></td>
<td>Smart drainage alerts for timely flood warnings</td>
<td>63%</td>
<td>39%</td>
</tr>
<tr>
<td><strong>Healthcare</strong></td>
<td>Real-time air quality information at public places</td>
<td>67%</td>
<td>37%</td>
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<tr>
<td></td>
<td>Citizen app to connect to nearest facility in case of epidemic/pandemic(e.g., corona outbreak emergency care)</td>
<td>66%</td>
<td>40%</td>
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<tr>
<td></td>
<td>Remote patient monitoring for the elderly (e.g., active and assisted living for elderly citizens through use of sensors/smart watches)</td>
<td>64%</td>
<td>46%</td>
</tr>
<tr>
<td></td>
<td>Data-driven public health interventions – city level healthcare steps taken based on specific local needs driven by citizens’ healthcare data – for example, regular monitoring of air quality due to traffic emissions and health drives, screening for deadly viruses (e.g., coronavirus)</td>
<td>63%</td>
<td>39%</td>
</tr>
<tr>
<td></td>
<td>Incentives for citizens to walk/cycle instead of driving</td>
<td>66%</td>
<td>37%</td>
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<tr>
<td></td>
<td>Gamification to promoting healthy living (e.g., 30 sit ups in front of a smart machine in a metro station/community center for a discount code/game tickets)</td>
<td>54%</td>
<td>34%</td>
</tr>
<tr>
<td><strong>Public security</strong></td>
<td>Smart surveillance of public areas – AI-enabled cameras capable of detecting and tracking abnormal or alarming situation in public areas</td>
<td>66%</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>Predictive policing: using data to predict crime in the near future based on data from recent incidents (e.g., burglaries, muggings)</td>
<td>60%</td>
<td>37%</td>
</tr>
<tr>
<td></td>
<td>Facial recognition to identify citizens to help track known criminals/offenders</td>
<td>55%</td>
<td>35%</td>
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### Areas of smart city initiatives

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<thead>
<tr>
<th>Public security</th>
<th>Use cases for smart city initiatives</th>
<th>Citizens’ willingness to use</th>
<th>Citizens’ willingness to pay</th>
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</thead>
<tbody>
<tr>
<td>City command centers for emergency response optimization for gathering data from various sources and timely warnings with coordinated response during disasters, crises, or accidents (e.g., earthquakes, accidents, shootings)</td>
<td>66%</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>AI-based cybersecurity to protect citizen data</td>
<td>62%</td>
<td>39%</td>
<td></td>
</tr>
<tr>
<td>Automated connectivity of buildings to emergency services (fire, police, hospitals) – dedicated panels for centralized emergency services access</td>
<td>68%</td>
<td>42%</td>
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</tbody>
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<tr>
<th>Citizen services</th>
<th>Use cases for smart city initiatives</th>
<th>Citizens’ willingness to use</th>
<th>Citizens’ willingness to pay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citizen app/chatbot for reporting accidents, crime, corruption, complaints such as streetlights not working, damaged roads, or citizen queries, provide information and get feedback for local development initiatives</td>
<td>65%</td>
<td>36%</td>
<td></td>
</tr>
<tr>
<td>Wi-Fi hot spots in public areas in the city (e.g., metro stations, bus stops, parks)</td>
<td>72%</td>
<td>36%</td>
<td></td>
</tr>
<tr>
<td>App for government services (e.g., birth/death certificates, local taxes, licenses, social welfare schemes)</td>
<td>68%</td>
<td>37%</td>
<td></td>
</tr>
<tr>
<td>Workshops to educate citizens on how to use smart city initiatives</td>
<td>60%</td>
<td>36%</td>
<td></td>
</tr>
<tr>
<td>Central digital citizen records via app for 24/7 access to vital citizen data</td>
<td>55%</td>
<td>33%</td>
<td></td>
</tr>
<tr>
<td>Digital access to government-sponsored social welfare schemes for citizens in need (unemployed, disabled, etc.)</td>
<td>65%</td>
<td>38%</td>
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</table>

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<thead>
<tr>
<th>Sustainable development</th>
<th>Use cases for smart city initiatives</th>
<th>Citizens’ willingness to use</th>
<th>Citizens’ willingness to pay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestion tax on vehicles – a tax levied on vehicles that pass through a congested area during peak times (e.g., vehicles passing through downtown during morning rush hour)</td>
<td>49%</td>
<td>33%</td>
<td></td>
</tr>
<tr>
<td>Smart lockers – lockers placed in public places that can be authenticated and operated by a smartphone</td>
<td>55%</td>
<td>39%</td>
<td></td>
</tr>
<tr>
<td>App-based, real-time availability of food kitchens and shelters for the homeless</td>
<td>56%</td>
<td>38%</td>
<td></td>
</tr>
<tr>
<td>App-based points/discounts for not using or returning plastic bags/bottles for recycling, which can be redeemed for paying utilities bills or museum tickets</td>
<td>65%</td>
<td>40%</td>
<td></td>
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<tr>
<td>Coupons for childcare access for the underprivileged</td>
<td>58%</td>
<td>40%</td>
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</tbody>
</table>
Research methodology

Citizens survey

For this research, we conducted an extensive consumer survey of more than 10,000 citizens spread across 10 countries in the following cities:

- **France**: Angers, Dijon, Lille, Lyon, Marseille, Paris, Toulouse
- **Germany**: Berlin, Cologne, Darmstadt, Dusseldorf, Frankfurt, Hamburg, Munich
- **India**: Bengaluru, Chennai, Hyderabad, Mumbai, New Delhi, Pune
- **Italy**: Florence, Milan, Naples, Rome, Turin
- **Netherlands**: Amsterdam, Eindhoven, The Hague, Rotterdam, Utrecht
- **Spain**: Barcelona, Madrid, Malaga, Seville, Valencia
- **Sweden**: Gothenburg, Helsingborg, Linkoping, Malmo, Stockholm
- **UK**: Birmingham, Bristol, Leeds, London, Manchester
- **USA**: Boston, Los Angeles, New York, San Francisco, Washington, DC
- **Others**: Espoo, Geneva, Helsinki, Oslo, Singapore, Tampere, Vienna, Zurich
By Country

- Singapore: 10%
- Others: 10%
- US: 10%
- UK: 10%
- France: 10%
- Germany: 10%
- Netherlands: 10%
- Italy: 10%
- Spain: 10%
- Sweden: 10%
- India: 10%

By age

- 18-21: 15%
- 22-36: 13%
- 37-52: 28%
- >52: 44%

By work status

- In the military: 1%
- Retired: 5%
- Self-employed, consultant, or freelancer: 7%
- Unemployed: 9%
- Part-time employed: 12%
- Full-time student: 12%
- Full-time employee: 54%

By income

- Less than $20,000: 9%
- $20,000 - $39,999: 20%
- $40,000 - $59,999: 27%
- $60,000 - $79,999: 16%
- $80,000 - $99,999: 24%
- $100,000 - $119,999: 3%
- $120,000 or more: 2%
Executive survey

We complemented the citizen survey with an executive survey of city officials spread across 10 countries. We also interviewed senior city officials (CIO/CDO) across major cities for this research.
Capgemini helps communities become smart territories.

An approach in three phases:

Our approach is to help the community in developing its smart territory strategy and tools. To these ends, we rely on resources that have already successfully worked on similar implementations, such as the Dijon Métropole project. Our team is also working on a new architecture to provide a more sustainable integrated system.

- Smart Territory design

The first phase consists of defining with the community its global strategy. The final deliverables of this phase are a roadmap, including a plan for building solutions. The time spent on this stage is very important because it makes it possible to set up the best practices linked to the GDPR, cybersecurity, and the sizing of the hardware infrastructure to be developed. It makes it possible to highlight the main issues the different actors (citizens, firms, associations, institutions, deputies, etc.) face in their daily lives. The last exercise is the calculation of potential ROI and study of business case to reveal the importance of the long-term strategy.

- Smart Territory Tech Foundation

This second phase is dedicated to building the data territory platform. At the heart of a cloud or on-premises environment, our platform based on open-source technical bricks is the nerve center of the digital transformation of the territory. The idea is to benefit from an interoperable system that can communicate with all data sources independently of the communication protocol used. That’s why the platform is in constant relation with IoT equipment, external information systems (e.g., platform of private partners), internal information systems (e.g., software already in place in the information system of the community), or other sources, such as open data or a mobile app dedicated to citizen relations, for instance.

Once the data has been integrated, a data lake within the platform can manage it at different levels (real time vs historization). A rule engine makes it possible to enrich the data and create workflows to manage it. APIs are also present to expose the data outside with strong authentication rules. This confers an ideal ecosystem to develop AI use cases.

- Smart Territory Services

The main aim of a smart territory strategy is to bring new services to citizens and other actors. To these ends, we developed a mobile app that is GDPR compliant and offers individual and general services to citizens. From a smartphone, citizens can access information and functionalities regarding waste management, economic development, mobility, environment, reporting on anomalies in the area, e-administration, and sharing between inhabitants. For the community agents, we developed a hypervisor that provides a 360° view of the area in real time so that each event can be treated with a predefined procedure. The procedures include steps to follow and for each step, the contact coordinates to use. Our proven solution recently obtained the JO2024 label.

These solutions are made to evolve with futures needs of the communities.
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Dr James Robey has led the sustainability agenda at Capgemini since 2008, creating and driving a broad ranging program to reduce the Group’s own environmental impacts whilst identifying opportunities to support Capgemini’s clients with their own sustainability challenges. In addition, he teaches at a number of leading universities on the topic of Sustainable Business.

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René is a Director based in the Paris office of Fahrenheit 212 part of Capgemini Invent. In his role, René works with clients to build innovation strategy that generates top line growth and is supported by robust business models. He already helped several big companies to define their growth strategy within the Smart City ecosystem solving issues for the business and the citizen at the same time.

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Hans leads the Dutch Smart & Sustainable Cities practice. He works with city and central governments in the EU and the Netherlands on smart city strategy, innovation and implementation of solutions to find new ways to solve societal challenges with use of technology and data together with their ecosystems.

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Mehdi Essaidi is leading the Smart Mobility business in France. He has been working for Capgemini Invent for 15 years leading major Transformation programs, designing and launching new digital services and business models. He spent 4 years to build a joint venture between Valeo and Capgemini to design and launch a carsharing platform “Mov’Inblue”. He is working currently on several MaaS initiatives at a worldwide level.
The authors would like to especially thank Sharang Gaikwad and Abhishek Jain for their contribution to this research. The authors would also like to thank Guillaume Duranton, François MAZELLA DI BOSCO, Alexandre RYCKMAN, Jeanne Heuré, Alexandre Grandremy, Pierre Fortier, Kevin Loeffelbein, Andreas Lampen, Morgan Rees, Alex Slater, Amy Hehir, Johannes Häußler, Patrick de Bas and Luc Baardman for their contributions to the report.

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The Capgemini Research Institute is Capgemini’s in-house think tank on all things digital. The Institute publishes research on the impact of digital technologies on large traditional businesses. The team draws on the worldwide network of Capgemini experts and works closely with academic and technology partners. The Institute has dedicated research centers in India, the United Kingdom, and the United States. It was recently ranked Top 1 in the world for the quality of its research by independent analysts.

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Smart Stores
GDPR
5G
Conversations 13
Automation in Utilities
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AI Powered Enterprises
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