



Building Smart Communities of the Future

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INTRODUCTION

Smart Cities and communities are towns, cities, counties, states and provinces, military installations, and other ecosystems that embrace a process of outcomes-based digital transformation (DX). This multidimensional and complex process is, at its core, a holistic strategy to apply digital technologies and technology innovation to continually enhance experiences, streamline and automate processes, and deliver value, such as increased sustainability and resilience or improved financial and operational performance. A holistic strategy goes beyond the technology itself to include:

- Engaging and connecting with citizens with a user-centric focus on the needs of the community
- Modernizing the government workplace and having an empowered workforce
- Enhancing government services by leveraging technology and data to operate more efficiently and effectively
- Managing risk as the enterprise continuously learns and adapts
- Developing new governance and cultural models, supported by updated policies

This white paper discusses these areas in the context of what actions Smart Cities need to consider today to accelerate their digital transformation, with an eye toward future digital developments.

Smart Cities need to understand what is possible with technologies that exist now, such as the Internet of Things (IoT), mobile and edge devices, and artificial intelligence (AI) and analytics tools; what is coming with future innovations; and what resources your organization already has at its disposal. To answer these questions, Smart Cities should approach digital transformation as an enterprise-wide program that works to innovate now for a future-ready Smart City.

METHODOLOGY

This paper was developed using existing content from IDC's ongoing research in its Smart Cities and Communities practice, including several global surveys completed in 2019. In addition, IDC conducted phone interviews with key Microsoft staff and the CIO of the City of Westminster.



THE FUTURE IS CONTINUOUS DISRUPTION AND INNOVATION

The only certainty for the future is that there will be a continuous fast-paced disruption and innovation. Global trends in urbanization, demographic shifts, and the rapid advancement of new technologies are shaping the way city leaders create and deliver public services. We not only live in a world experiencing economic turmoil, climate change, changing population demographics, and rapid urbanization but also in the midst of tremendous technological innovations that have the potential to help government leaders address many of their current challenges in more cost-effective and innovative ways — ways that simultaneously meet a community's financial, social, and environmental goals.

There are many global trends that have pushed government leaders to reconsider the role of technology, shifting its function from one focused solely on cost savings and operational efficiencies to one focused on solving social and environmental challenges. This shift is a result of current and impending factors that are critical to consider for the future Smart City:





Critical urban growth challenges. Urban growth stresses existing infrastructure and resources, while a shrinking population can lower tax revenue to the point where essential services are reduced. Governments must cope with finite resources and limited budgets and build smarter, leveraging technologies such as IoT solutions and analytics and AI to more efficiently manage existing infrastructure and plan for future growth.



Impact of climate events. Weather volatility will increase its impact on urban areas from storm surges and flooding to vital resources like water and food supply, as we saw recently with severe water shortages in Cape Town, South Africa and Chennai, India. These risks will require detailed strategies to protect people and assets and improve climate preparedness and resilience. The IoT and AI can monitor risks in real time and help communities cope with emergencies.



Changing public expectations around government services and the government workplace. Customers accustomed to the personalization and ease of dealing with digital-native companies expect the same kind of service, convenience, and personalization. At the same time, they want more control of what data is collected and how it is used. More modern government services use digital data more effectively with improved analysis, digitizing operations and processes to support a new culture of collaboration and transparency.

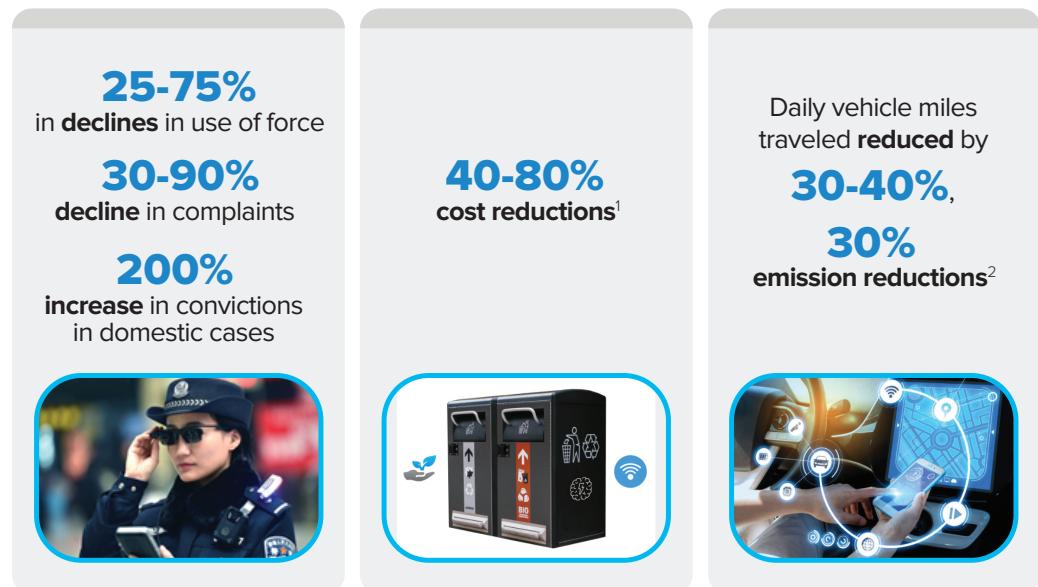


Technology innovations that outpace government procurement and profoundly shape investment decision making. Municipal organizations will need to manage workforce challenges by finding the right skills to harness the power of AI and data science, as well as keep on top of fast developments in cybersecurity. Retraining staff, acquiring resources, and increasing reliance on partners will shape investment and procurement options.

Decisions Now Impact Future Options

There are dystopian and ideal scenarios for the future; Smart City leaders tend to focus on the ideal scenario while preparing for significant challenges as economic and climate trends unfold. The ideal scenario is one in which a digital set of services is seamlessly embedded into the lives of government workers, visitors, and commuters and the lives of citizens. To get to this ideal scenario, most cities have begun with pilots or point solution deployments before integrating into larger systems or moving to full-scale production. There is evidence of the success and direct benefits of these deployments around the globe (see Figure 1).

FIGURE 1 The Benefits and ROI of Smart City Solutions



Sources: 1. "Smart Garbage" Startup Cuts City Trash Costs by 40 Percent, April 11, 2016, Government Technology;
2. SFpark Pilot Project Evaluation Summary, June 2014, SFpark.

As we read about the City of Westminster, home to the iconic West End and Oxford Street in London, digital transformation begins with a vision and then the identification of key technology tools to help innovate new services, use data better, and shift to a more collaborative culture.



The key is digital transformation, but there is no massive, one-time transformation; changes will happen incrementally as prioritized systems get modernized and new work processes are learned and embraced.

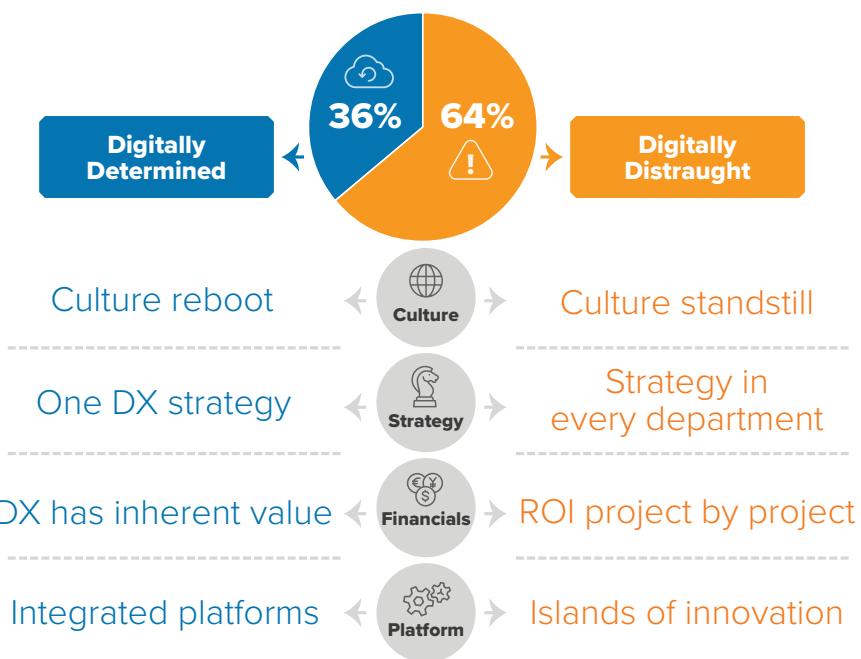
Digital Transformation Road Map to Becoming a Digital-Native Enterprise

The terms "Smart Cities" and "digital transformation" bring to mind fast-paced progress that takes advantage of technology innovations and disruptive new business models. However, the reality is that, despite several years of growth in awareness of the opportunities of Smart Cities, most municipalities are still struggling with putting ideas to reality, often with difficulty in securing funding, determining which solutions or vendors to use, scaling initiatives, or measuring ROI.

IDC's research has shown that 64% of cities and regional governments are digitally distraught — lacking some foundational tools to move in a determined, enterprisewide process to digital transformation (see Figure 2). Digitally distraught organizations lack

an enterprise strategy and a truly collaborative culture. This results in departments and agencies deploying point solutions that may be highly successful but ultimately generate future integration challenges, reinforce silos, and hide the true cost of ownership. With the lack of interoperability, each new service requires integration with security, operations, information, compliance, reporting, and more. Managing inconsistency and redundancy is not only a waste of valuable resources, but, worse, it also reduces the agility of the entire municipality to respond to opportunities or challenges.

FIGURE 2 Digital Determination



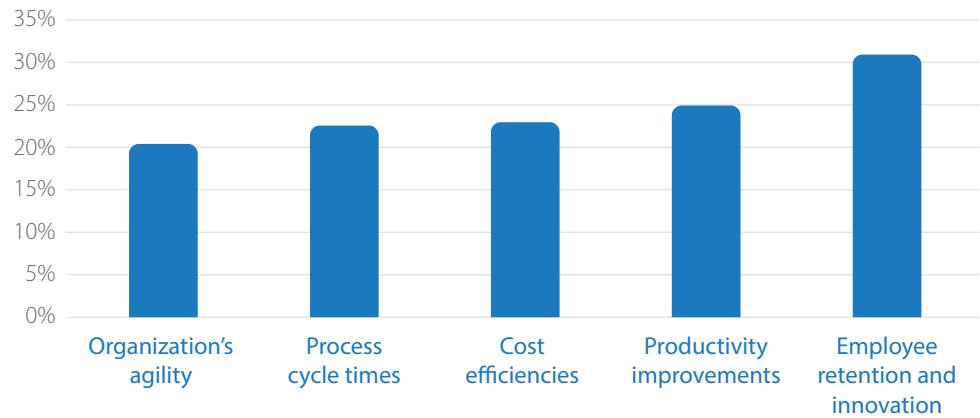
Smart City DX strategy connects the city priorities and desired outcomes to technology investments; however, 48% of respondents to IDC's 2019 *Digital Transformation Executive Sentiment Survey* have DX initiatives that are disconnected from citywide strategy or initiated at the function or department level, with only some connection to citywide plans. Cities and regional governments around the world indicate that they are "connected Islands;" 35% of respondents said that "we employ multiple digital technologies that run separately to our core IT platform."

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Where have you achieved the biggest benefits from your current DX programs/projects?

In response, many local and regional governments worldwide will develop a DX road map strategy in the next one to two years. Over 17% of organizations have a bifurcated strategy, with separate technology and citywide plans. Even without a developed road map, cities are focused on using Smart City projects and initiatives for priority areas, with almost half prioritizing talent, including change management collaboration and an innovation culture, followed by providing superior products and services and operational excellence for the creation of new offerings. This corresponds to where cities are seeing the most benefits as well, as shown in Figure 3. As we discuss , talent and employee productivity are essential focus areas for Smart City transformation.

FIGURE 3 Benefits from Smart City DX Transformation



Source: IDC's Digital Transformation Executive Sentiment Survey, 2019

Smart City DX in Action



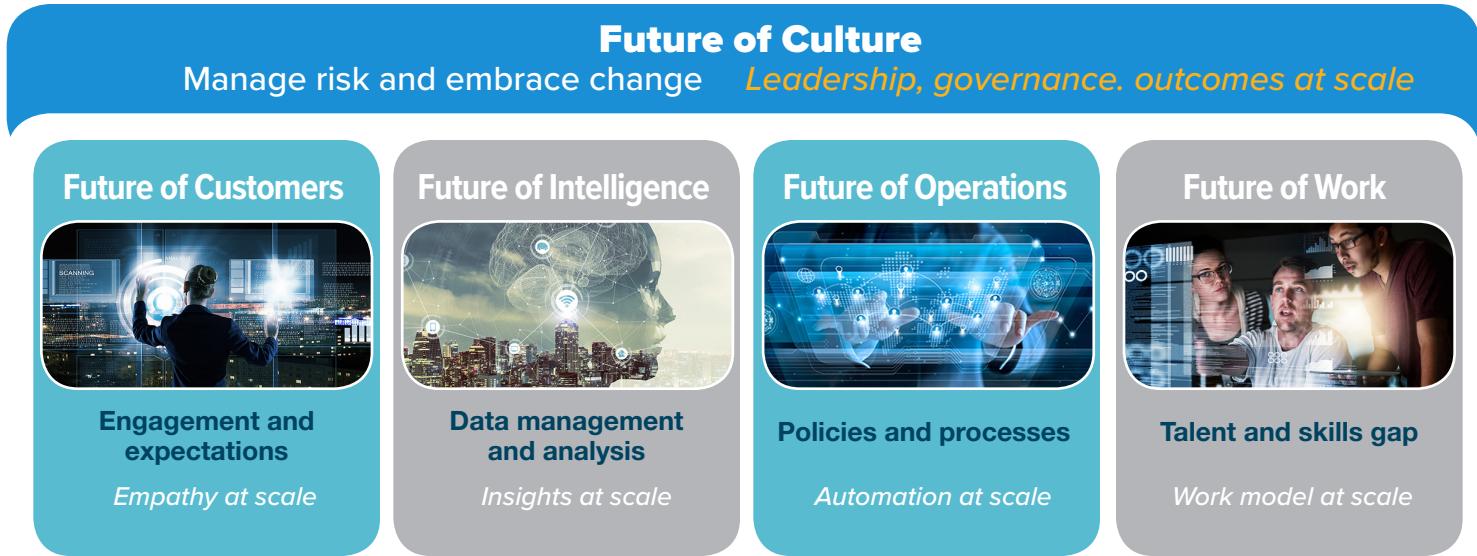
A great local government digital transformation example is the city of Antwerp in Belgium. Antwerp is the second-largest port in Europe and a worldwide tourist destination for travelers. Like most cities, Antwerp struggled with traffic congestion on primary and residential roads and experts estimated that 20,000 vehicles daily would have to be removed from the roads to reduce traffic delays. Antwerp created an app to make it easier for people to leave their cars behind and use other transportation models. The Smart Ways app was created by Be-Mobile, a Microsoft partner. Microsoft Azure was used as a unified data hub and provided the processing power the city needed to deliver real-time journey planning to each user. As a result of Smart Ways, there has been a 10% decrease in car use for commuting and 14,000 fewer cars entering the city center daily.



THE ART OF THE POSSIBLE

Planning effectively now, while preparing for the future Smart City, means understanding more clearly what the future holds. IDC looks at five major areas of ongoing and future transformation: the future of culture, customers, intelligence, operations, and work (see Figure 4).

FIGURE 4 The Future City



Source: IDC, 2019

Let's consider two of these, the future of intelligence and the future of work, areas of rapid change that encompass key challenges for Smart Cities around the world. As we see, these areas overlap and need to be considered in concert. For example, the city of Los Angeles is using a chatbot to help citizens navigate their website to find information faster, leaving more complex service requests to employees.

The Future of Intelligence

Today, data and intelligence represent a unique opportunity for creating value. Real-time data from IoT, mobile devices, and other devices at the edge combined with historical data, enterprise systems, and global information can continually sense an environment and put it into new contexts. With IoT, millions of connected devices have resulted in a store of data that is vast, immediate, and varied. Combining data with AI, machine learning, and human knowledge, organizations can spread intelligence to turn data into action and action into value.

AI can cull through vast amounts of data to pull out what's relevant and embed wisdom into analysis. This makes employees more productive; employees can spend more time on higher value work and respond more effectively to data based on AI insights. AI is

being used in cities, from web digital assistants to help people navigate city websites to self-diagnostics in city fleets to intelligent intersections that respond proactively to changes in traffic flow. In each example, AI helps redesign processes to deliver new services.

AI shows promise in curating information, but data shows that the public has little trust in whomever is managing the AI or the information. AI uses algorithms to program decision-making judgement and “learn” as benchmark data sets grow. There can be bias in this decision making, often based on nonrepresentative benchmark data sets that can result in false negatives or positives. In addition, as data is collected from a variety of devices, analyzed, and often combined with other data, concerns about data anonymization and personally identifiable information (PII) become more important.



Strong policies, strategies, and proper data preparation are essential for effective AI deployment:



Developing ethical and inclusive policies. Policies must address the opportunities for misuse, surveillance, and invasions of privacy. There are justifiable concerns around AI-enabled applications, bias, transparency, and the long-term impacts of these on workforce transitions. Privacy, AI, and data ethics policies can mitigate organizational and stakeholders’ risks associated with the use of AI technologies and improve trust by accountability as well as ensure inclusiveness and accessibility for people of all backgrounds and abilities.

Policies should include how security and privacy violations are managed and how the security and diversity of data are managed. Cities must also consider how regulations from other regions impact them. For example, GDPR in the European Union (EU) may also affect cities and states that are working with EU organizations for visits, trade, and business.



The City of Denver, Colorado, has found new ways to protect public safety and health, manage transportation, and ensure environmental quality. Denver uses Microsoft Azure Data Lake and Azure IoT Hub to gather and analyze data from smart traffic lights, air-quality sensors, and connected vehicles to optimize traffic flows, prioritize emergency and transit vehicles, make intersections safer, and monitor air quality near public schools.



Effective data preparation. Cities cite that data preparation, followed by model deployment and use case identification, is the most challenging area to get ready for analytics and AI. Key aspects of data preparation include:

- Clearly articulated business value
- Identified stakeholders with a high level of engagement
- Governance and oversight in place that includes security, privacy, and compliance processes and procedures
- Data collection, cleaning, standardizing, and storing (extract, transform, and load)
- Quality control, cataloging, and master data management
- Rigorous analysis that is statistically sound and using clear methodology
- Insight delivery through reports, dashboards, APIs, maps, and other visuals
- Good coding practices (version control, code reviews, documentation, and testing)

Cloud computing was also cited as one of the key technology enablers in a recent IDC cognitive and AI study of Asia/Pacific government organizations (IDC's Asia/Pacific Enterprise Cognitive/AI Survey, 2019). 100% of respondents indicated that they are investing in cloud-first AI systems because cloud provides the flexibility to choose from multiple options, offers better clarity about IT resource use, improves security and recovery resources, and provides real-time application updates.

Spotlight on Security

There are five pillars to any digital trust program. These include security, risk management, compliance, data privacy, and ethics. Security breaches can undermine digital trust and impact privacy and compliance.

Secure collaboration, from anywhere and any device, can be critical for delivering new services and benefits. As cyberattacks become more sophisticated, security tools are required to safeguard sensitive information, protect data as it is shared inside and outside of government, and ensure that the right people are accessing the right information. It is important to work with technology products that take security as paramount.

The Future of Work

Cities around the world are facing staffing pressures as they compete for talent and have a high percentage of retirement eligible employees. This talent gap is more pronounced in IT functions, such as security and data science. The result is that Smart Cities are very actively looking for ways to make government work more gratifying and modern to retain and attract employees. Meanwhile, the entire work model is fundamentally shifting across all industries; this shift describes a future of work that is made up of three interrelated pillars and key associated technologies and services (see Figure 5):



Culture: Culture is focused on engaged and empowered workers who are tasked with high-value, desired tasks that are aligned to new digital skills. Culture in Smart Cities means cross-disciplinary teams that work together to leverage and share data and technology and even physical assets that can be used for multiple uses, like light poles as an IoT platform. HR and IT departments must react by reskilling existing workers and onboarding new workers, using inclusive hiring practices, building agile teams, and aligning skills requirements and metrics to business goals.



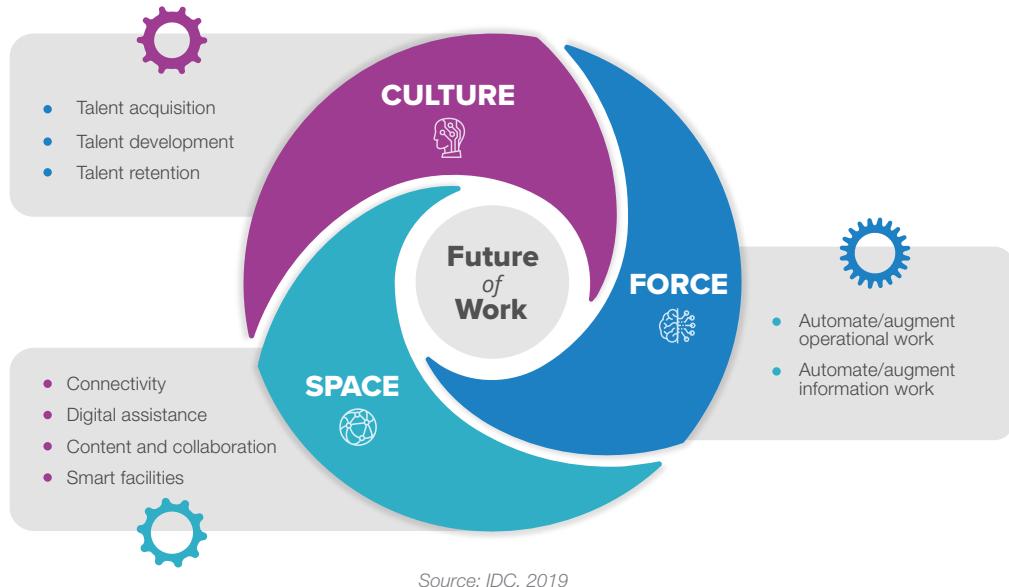
Space: Space is focused on not only a connected and secure work environment but also one that is modern, with a design that fosters collaboration and teamwork. Beyond a physical office space, space also refers to the need to provide a work environment independent of place where workers, like those in the field, can access applications and information anywhere and at any time.



Force: Force is the amplification of the work effort via the collaboration between humans and technology. This force initially augments the work of humans with automation and analytics and is tied closely to the future of intelligence. Over time, AI, data analytics, robotics, and intelligent process automation will augment work, replace work, create new jobs, and generate new business value.



FIGURE 5 The Future of Work Framework



Getting Ready for the Future of Work

Over half of the Smart City and community workers are digital and knowledge workers who rely on digital tools and information to get their jobs done. As digital workers make up a growing share of the workforce, Smart Cities need to:

- **Identify technologies, such as AI, that amplify human ingenuity and extend capabilities and augment tasks, processes, and jobs.** Examples of this include digital assistants for help desks, tying resident apps to work order systems, using voice assistants to find city information, and automating notifications of fleet repairs or light outages instead of manual inspections.
- **Reskill and empower existing employees when the half-life of a skill is five years or less.** With high IT vacancies in cities and an inability to offer the same wage levels as the private sector, Smart Cities should identify employees who can be retrained for new jobs, especially in analytics, data science, or IT security. The focus should be on talent acquisition, development, management, and creation of new roles and cultures of continuous learning.
- **Develop executive leadership skills for digitally diverse and distributed organizations.** Cities are used to working together in physical spaces during defined work hours. As more workers are mobile and more physical assets get digital

connected via the IoT, the hours of the typical worker may start to move beyond regular hours and consist of work outside of the office. Leaders will have to learn ways to managing employees when they are remote and using a multitude of digital tools.

- **Create “Smart” workspaces that facilitate collaboration.** This doesn’t mean a costly redesign of a facility, though some cities are upgrading spaces, but rather the effective use of collaborative tools like shared digital workspaces and messaging apps to communicate quickly and securely in real time. IDC research shows that the average collaborative application user saves an average of 15 hours per week in work process and receives 31% fewer emails.

IDC’s future of work team believes that culture and space must be developed to support greater automation and augmentation and that increased adoption of AI, AR/VR, robotics, and intelligent process automation to drive innovation, work improvement, and business results. IDC’s Smart Cities and communities team predicts that, by 2024, 70% of city data scientist jobs will be unfilled, resulting in increased investment in AI-native systems that will exponentially grow data capabilities without adding head count.





CUSTOMER CASE STUDY:

Westminster, London

The City of Westminster is a London borough that is home to many iconic attractions, including Buckingham Palace; the Houses of Parliament; the famous shopping areas of Oxford Street, Regent Street, and Piccadilly; and the nightlife of Soho. The area is important economically for both London and the United Kingdom, bringing in over £2 billion in tax revenue as well as supporting jobs throughout the region.

Despite its abundance of attractions, the borough, with a population of over 225,000, is mostly residential and faces many of the same challenges of urban areas around the world. It has a high population density, with many vulnerable populations: 7% are estimated to have a moderate or severe disability and 17% are over 65. Westminster also has an expensive rental housing stock and high pay inequality. Given this, the borough has embarked on an expansive "City for All" program.

City Vision: A City for All

The "City for All" vision is a commitment to ensuring that city development considers all its citizens and visitors and that the city is a welcoming place, of high quality of life, for everyone. Westminster is focused on the role of economic development and the important role the West End plays in driving economic opportunity for the United Kingdom at large. The borough wants to create an environment where business thrives and employment is growing while supporting poorer areas where more affordable

housing and social services are needed. Westminster has also declared a climate emergency; with its high population density and tourism, the borough's 8.9 square miles attract 1 million visitors each day and produce more carbon emissions than the whole of Cardiff or Newcastle, resulting in it also suffering some of the worst air pollution. The council has committed to becoming carbon neutral by 2030; the borough itself is expected to follow suit by 2040 — 10 years ahead of government targets.

The borough is also preparing for a "fast-changing and unpredictable future." While Westminster is just embarking on its Smart City journey, the council's leadership team is focused on making the most intelligent use of the available data. This includes a massive focus on connectivity including mobile/5G and high-speed broadband with fiber to the premise expanding beyond business and wealthy customers to all communities, including social housing.

Key Initiatives



The Westminster Way

There are multiple initiatives underway, one of which is the borough's internal culture change program, The Westminster Way. Senior leaders on the council believe that this change program is crucial to meeting the goals outlined in the City for All vision, as a supported workforce will provide better services to the community. This involves equipping field workers such as social workers, planning officers, and environmental health inspectors with Surface Pro devices as well as the latest Office 365 tools to support collaboration and using Yammer to break down silos between different teams within the council.

Technology deployments supported a wide culture change program that focused on empowering workers to use the new tools, such as Microsoft Teams, effectively and how to use mobile applications to be less dependent on the physical office. Westminster also refurbished its main head office space, accommodating staff in a smaller space through the shift in work process to mobile and agile.



Children's Social Care: The FamilyStory Application

Westminster is focused on how it uses the suite of technologies, from Microsoft Cloud to Surface Pros, to be more innovative. A great example of this is FamilyStory, an application for its Children's Social Care team that is in beta and currently up for a U.K. IT award.

This application changed the way the borough delivers core services to at-risk children. In the traditional model, social workers conduct an onsite interview with the child and family. The social worker takes notes on a clamshell laptop and writes the case notes in the case management system back at the office. The data is not transparent to the family, nor to other stakeholders such as doctors, teachers, and police.

In the new system, the social workers use the Surface Pro as an engagement tool. It's used, with the family's consent, to record the interview. The device not only is shared and laid flat on the table, which is less threatening to the family, but also allows the child to use the Surface pen to draw pictures or otherwise provide their own story directly into the system.

The information is uploaded to the Azure Cloud environment, and there is a portal for users in their child's ecosystem to access the information. The child's doctor, teachers, police, and family can all see what is happening with the life of the child. All of this is consent driven, which is captured in the application, and the FamilyStory belongs to the family and the child. This data sharing required a great deal of up-front work on data security protocols to comply with U.K. security standards, but now, where previously nothing was shared, key information is shared, and the ecosystem of caregivers see not only the FamilyStory from the interview but also the interventions provided over time.



Solutions and Technologies

This is just the beginning of Westminster's innovation. The borough is consuming Office 365 productivity tools, Surface Pro and Surface Go devices, and Azure cloud capabilities to replace legacy on-premise datacenter services. Of high importance is the strategic use of analytics and storing data into a Power BI data warehouse and data lake to deploy machine learning and AI algorithms to automate processes.

Such capabilities are being piloted to allow Westminster to track illegal subletting of social housing. The borough wants those who need affordable housing to use these apartments and not have people rent them out and live elsewhere. The borough is working to take data from online advertising feeds, such as age, ethnicity, gender, and compare it with tenancy information. This enables Westminster to start to build up a picture of illegal subletting.



Why Microsoft?

The CIO of Westminster City Council, Ben Goward, reports that the work with Microsoft is “very positive” and is a result of looking for an organization that had an ambition that matched its own. Westminster is a high-profile area with great economic impact, and the city wanted a technology partner that had an ambition around productivity and innovation that matched its values. The borough also needed an organization that could form a more strategic and holistic relationship for a Smart City approach with a focus on data and analytics. Westminster is pleased with Microsoft’s enterprise architecture approach while it isn’t locked in to only using Microsoft products and has extensibility as needed.



The Next Phase

The next phase will include a focus on Smart Cities — how the council can utilize existing and emerging technologies in a coherent way to deliver improvements to how it serves residents and businesses. While this is in very early stages, Westminster feels very positive about its future plans based on the current successes it has enjoyed so far.



BALANCING TRUST AND EFFECTIVENESS IN A DIGITAL WORLD

Digital transformation and technology innovation impact many areas beyond the realm of the technology itself and often involve balancing the public trust and transparency with the effective use of digital data and the systems that generate this data. Best practices for Smart Cities encompass the following:

- **Being user centric and having an empowered workforce.** The community and public must be informed and educated about technology deployments to maintain their trust and ensure technologies are deployed for the outcomes prioritized by the public. As more services become digital, special care must be taken to ensure services are accessible to all people. An empowered workforce means employees may need training to learn new skills, especially for hard-to-fill technology positions in security and data science.
- **Managing risk as the enterprise continuously learns and adapts.** Smart Cities need to innovate at a fast pace. Innovation as a process itself must be learned and embraced so that failure is allowed and managed and cities learn from their mistakes. A culture of cross-departmental collaboration and data sharing will need to be nurtured. Policies may need to be updated, or new policies should be created; policies will impact procurement as well as important community concerns such as privacy and data security.
- **Leveraging technology and data to operate more efficiently and effectively.** Data from a multitude of sources must be managed so it can be shared, analyzed, and used for new actionable insights; platforms are needed to support cross-agency or department collaboration. In addition, technologies need to be deployed that are flexible and scalable over time and so that investments now can be used for future services.
- **Developing new partner and stakeholder relationships.** As IT connects more physical assets and operational systems, new areas can be digitized like waste, lighting, and water. Agencies and departments may find themselves working with new partners, while IT departments may start working with operational technology suppliers, engineering and urban planning firms, and community engagement groups. These new relationships also need to be leveraged to help scale initiatives and find the right business model for funding initiatives.



CALL TO ACTION

Your City Can Start Now

As more and more cities embrace the Smart City concept, they are confronted with complexity in IT and operational systems, the connection between digital and physical environments, creating the supporting regulation and policy, and effecting behavior change to meet desired goals. Here's a checklist of eight things your city can start now that will help to engage and connect with citizens, modernize the workforce, and enhance government services:

- Pay attention and spend time on the up-front design phase of point initiatives and also your larger Smart City DX strategy. Develop a Smart Cities road map that links DX and tech innovation to departmental or programmatic outcomes.
- Get community input on initiatives during the design phase and beyond. Collect sentiment information about technologies, how users want to access services, and other technology-related areas.
- Embed accessibility and inclusion into all Smart City initiatives to ensure digital inclusion and equity goals are being met.
- Tie policies to your overall strategy to ensure that privacy, trust, and ethics are included and aligned with initiatives. Conduct a policy review to determine which policies need to be updated or created.
- Identify the skills and talent needed for Smart Cities. This includes community catalysts that can evangelize new projects as well as people who could be retrained to use analytics and AI tools or help with security operations.
- Keep pace with technologies by bringing in outside expertise to understand the future around technologies or other city functions such as lighting controls, IoT platforms, connected vehicles, and chatbots. Be sure to include start-ups, consultancies, engineering firms, and IT suppliers.
- Connect with other city leaders to understand what they are doing and what has worked and what has not. Given the marketing around Smart City efforts, personal conversations may uncover important details and more realistic information on what is truly happening in leading cities.
- Prioritize the investments needed and take an inventory of what systems or infrastructure needs to be upgraded or modernized so tech innovations can be used.

The key is to start somewhere and start now. Funding and scaling Smart City initiatives takes time and persistence; however, the potential impact of Smart City transformations can touch the majority of people in the world, impact the environment in significant ways, and support most of the global economic growth. With the inflexibility of urban-built environments to adapt at the pace of digital transformation, it is up to cities to leverage data, technology, and people to effect change.

About IDC

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