



IDC Government Insights

AI and Digital Twins in Smart Cities

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Unprecedented Growth Needs Exponential Innovation

Globally, as of 2020, 55% of people live in cities according to the World Bank and by 2050 that number is estimated to reach 70% of the worldwide population, totaling nearly 7 billion urban inhabitants. With this unprecedented growth, the challenges of making these environments safe, healthy, productive, and thriving have never been more difficult.

Governments worldwide are also under pressure to reduce costs while at the same time improving and modernizing services. These dual pressures are pushing cities to be smarter and look to innovative tech solutions to help drive outcomes. It is in this context that we see the rise of Artificial Intelligence(AI) and Digital Twins as they are applied more frequently to address the most pressing concerns for city officials and constituents.



By the Numbers: Some of the Most Pressing Challenges Cities are Facing

As cities look at the issues they are facing, they know they're not alone. Some of the following numbers that highlight the magnitude of what governments are up against paints a vivid picture, one that demonstrates why innovative technology solutions are not just needed but must be approached in entirely novel ways.

1 in 4

Bridges are Deficient in the US according to the US GAO Report

\$415 Billion

Global average annual losses from weather-related and other disasters in cities by 2030

706

The worldwide number of cities with populations over a million by 2030

\$120 Billion

In yearly costs to the US economy due to traffic congestion

45 Years

The average age of 1.6 million miles of water/sewer pipes in the US as of 2020

24%

The percentage of Worldwide Urban Population living in slums in 2018

Essential Guidance for Building Digital Resiliency in Smart Cities and Communities

Artificial Intelligence (AI) Applications are defined as enterprise applications powered by intelligent technologies such as machine learning including deep learning for natural language processing, voice/speech recognition, image/video analysis and time series analysis that drive insights, provide predictions, support conversations, recommendations and/or automate tasks and processes. Some areas where AI is being applied in smart cities are the following:

Top 10 Artificial Intelligence Uses Cases having the Greatest Impact on Mission Outcomes in Government

1. Public health promotion, disease prevention and management (including contact tracing)
2. Shared digital workspace, productivity and collaboration tools
3. Employee self-service tools
4. IT infrastructure security monitoring
5. Loans and grants management
6. Environmental monitoring (air quality, water quality, weather monitoring)
7. Digital content, document and workflow management
8. 311 and constituent self-service
9. Facilities and building management
10. Public safety, security, surveillance

Where AI Fits in Your Organizational Processes is as Important as What AI is and Can Do

Now that we've defined AI and you are thinking about applying AI-enabled solutions to pressing problems, understanding where in the process it is most appropriate is an important step. As humans and AI work together knowing who does what and when can ensure that the process remains smooth and that vital tasks don't fall through the cracks. This can also be important for auditing and compliance functions where the data and what it is used for is highly regulated.



	Human Led	Human Led, Machine Supported	Machine Led, Human Supported	Machine Led, Human Governed	Machine Controlled
1 Who produces insights?	<ul style="list-style-type: none"> Human analyzes and produces insights using limited technology. 	<ul style="list-style-type: none"> Human analyzes and produces insights using a portfolio of tools. 	<ul style="list-style-type: none"> Machine analyzes and produces insights with human review. 	<ul style="list-style-type: none"> Machine analyzes and produces insights without human review. 	<ul style="list-style-type: none"> Machine analyzes and produces insights.
2 Who decides and how?	<ul style="list-style-type: none"> Human decides based on experience and rules. 	<ul style="list-style-type: none"> Human decides based on optimized machine prescriptions. 	<ul style="list-style-type: none"> Human decides based on machine prescriptions constrained by all factors. 	<ul style="list-style-type: none"> Machine decides within a framework of human governance. 	<ul style="list-style-type: none"> Machine decides.
3 Who acts based on decisions?	<ul style="list-style-type: none"> Human acts or executes. 	<ul style="list-style-type: none"> Human acts or executes. 	<ul style="list-style-type: none"> Human acts or executes with machine oversight. 	<ul style="list-style-type: none"> Machine acts or executes with human oversight. 	<ul style="list-style-type: none"> Machine acts or executes.



What is a Digital Twin?

Digital twins are the extended application of simulation and visualization throughout a digitally transformed organization, for better communication and collaboration using complex, rich data. IDC predicts that by 2023, 25% of successful [Smart Cities](#) digital twin platforms will be used to automate processes for increasingly complex, interconnected ecosystems of assets and products.

The digital twin is a solution-based approach capable of producing high-fidelity copies of a city or other geographic space. This digital copy is based on a wealth of potential data sources such as GIS base layers, IoT sensor data, historical data sets, and other "Smart City" sources such as crime data and multichannel nonemergency citizen reporting systems like "311" systems, environmental monitoring, planning and permitting, and transportation infrastructure. Bringing together this breadth of information in a three-dimensional (3D), high-fidelity, single source of information enables organizations to conduct better analysis and more accurate scenario planning.

How Digital Twins are Being Used in Smart Cities

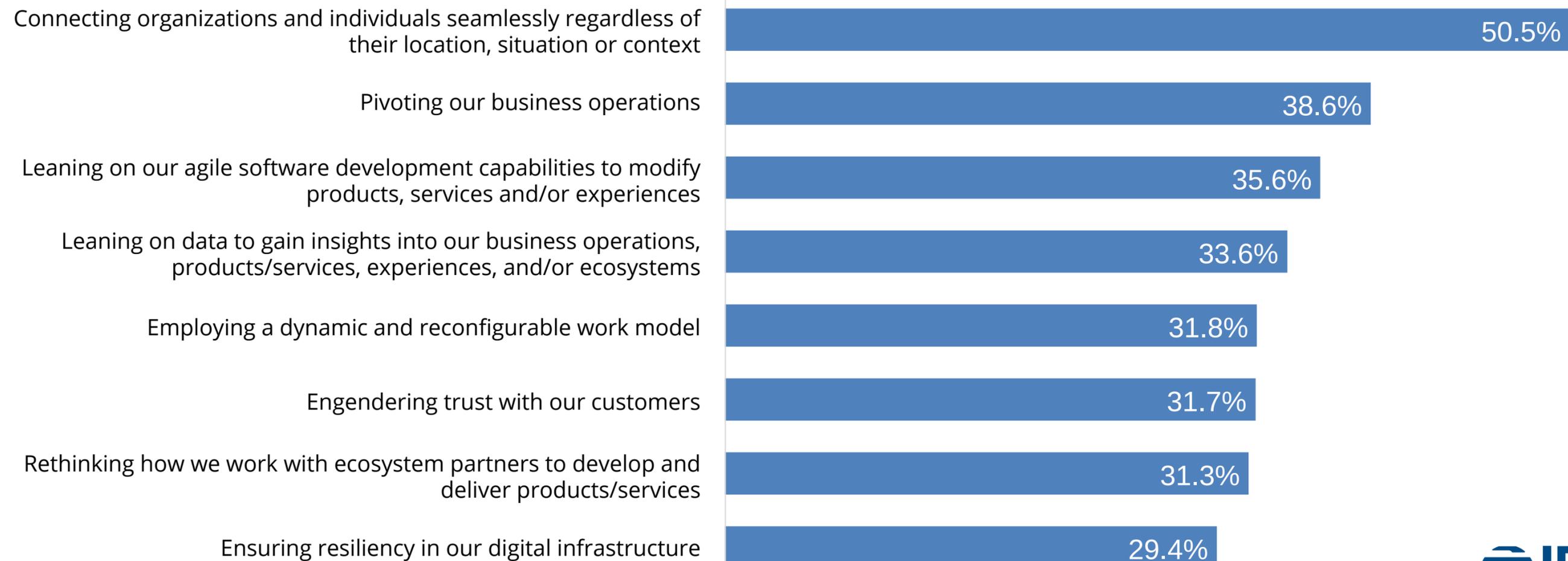
Digital Twins are finding success in a wide range of domains relevant to cities, each one potentially brings in different data and has different challenges to implementation. Defining your use case can be critical to your success.

Type	Description	Critical Data / Technologies	City Departments
Urban Planning / Zoning / Development	Both greenfield and older cities are better managing their developments by using the data to better visualize the impact of new buildings on the areas around them. By managing lands use, economic opportunities, and even the physical impact on wind and shadow they are able to answer questions from the public in a much more detailed way.	Land use, building footprints and details, shadow and wind patterns	GIS, Planning, Zoning board, Economic Development
Asset & Infrastructure Management	Asset management and especially preventative maintenance are a pressing need for cities that need to make their infrastructure dollars go further. Modeling when infrastructure needs service, or where new infrastructure can have desired outcomes becomes easier with a high - quality platform.	Asset tagging and geolocation, IoT sensors on infrastructure	Parks, Public Works, Transportation
Environmental & Climate Monitoring	Sensors that measure noise, air pollution, temperature, water levels, and flood risk are being used to look at both quality of life issues(noise complaints) and scenario planning around climate change and sea-level rise. Cities where this is a factor are better able to plan development and see how critical infrastructure is impacted.	IoT sensors, topography, water, climate models	Environment, Facilities/Property Management, Parks, Public Works
Public Safety and Crowd Dynamics	Some cities are using surveillance as well as scenario planning around critical events to understand if something goes wrong how to deploy resources such as police and how to move people out of harms way efficiently and safely.	Optical sensors, video, GPS	Police, Fire, EMS, Emergency Management
Transportation and Pedestrian Planning	Understanding the transit needs and congestion of crowds are both important parts of vision zero and complete streets initiatives. These models can help for planning the streetscape and planning transit investments. In the case of parks and other public facilities, pedestrian information can be critical to understanding usage	Ped counting, optical sensors, ridership, traffic counts and light timing	Transportation, Parks, Public Safety
Facilities Management	Security, HVAC, occupancy, and lighting information is helping cities manage the extensive facilities they maintain such as schools, libraries, police stations, etc. These use cases will often bring a near -real time component in to complement the planning/maintenance usage	Building details, HVAC, security, ped counting, optical sensors, utilities	Facilities/Property Management
Energy Usage and Solar Deployment	From reducing carbon footprints to finding strategic places to add solar panels to buildings, cities are using the tech to better plan deployments and opportunities for cost savings	Utility, building details, solar radiation	Environment, Facilities/Property Management

By the Numbers: How Smart Cities are Prioritizing Digital Investments

[Cities](#) are applying these technologies to their most pressing issues. Below we can see how prioritization is leading to innovation and investment. AI and Digital Twin solutions can be a vital component of all these priorities. Initiatives that can further move legacy systems into a more efficient and future-proof way of doing things will be essential. According to several IDC survey respondents, connecting organizations and individuals is now the highest priority, and this will be reflected in the coming years as governments invest in resilient network infrastructure, cybersecurity, and cloud-native digital platforms to make the most of this new paradigm.

Government Digital Investment Priorities





Adopting new technologies and processes, especially ones as paradigm shifting as AI and Digital Twins means you really need to look across many areas of the organization beyond just the underlying tech components. Successful deployment and a real return on the investment in time and funding requires adopting new approaches to process and culture as well, and of course these can only be as successful as the clarity of the vision they hope to achieve.

So, You're Considering Investing in AI and Digital Twin Solutions. Is Your Organization Ready?



Vision – strategy, leadership, business case development, budgeting



Culture – innovation, constituent engagement, transparency



Data – data protection/privacy, open data, data sharing, discovery & analysis



Technology – IT architecture, network, security, disruptive technology



Process – governance, partnerships, org structure, measurement (KPIs)



Foundations: Walking Before you Run

Both AI and Digital Twins rely on high quality data to function well and provide real value to the organization. Taking a hard look at your data ecosystem and building some important foundations can pay off later when more advanced solutions are implemented. Without these questions answered it is a sure path to failed projects and cost overruns.

- How secure is your data?
- In a regulated environment, what can you legally use the data for?
- What does your Master Data Management ecosystem look like?
- Do you have good metadata and data dictionaries available for developers and end users?
- Do you have a secure and standardized way to move data between systems?
- Where do you keep your source code and are you using version control?
- What is your appetite for risk, and do you have a mitigation strategy in place should things go wrong?



It is more critical than ever to have a scalable strategy for the deployment of advanced technological solutions.

Ready for AI and Digital Twins? Here's Where to Start

- ☑ Identify Use Cases to Pilot.
- ☑ Define the scope of the project and align key stakeholders.
- ☑ Clearly articulate your success criteria.
- ☑ Locate critical data sources and assess which you have internally, and which you will need to acquire?
- ☑ Determine who your users will be and what new skills and training they will need.
- ☑ Evaluate technology integration and data interoperability issues.
- ☑ Focus on your current technology ecosystem capabilities and where there are synergies that can ease that deployment and lower cost.
- ☑ Develop your rollback plan should things go wrong.
- ☑ Think about how these technologies can aid transparency and engagement as well as break down traditional silos.
- ☑ When successful, what comes next? How do you sustain that success throughout its lifecycle?

The Future

By 2025, 30% of cities will leverage automation via IoT, AI, and digital twins, to blend the physical and digital and improve the remote management of critical infrastructure and digital services.

Artificial Intelligence and Digital Twins are only just beginning to become a critical component of how cities operate. This will continue to accelerate as the tools not only become more mature but also become incorporated into the tools and processes that we are already familiar with. Like many paradigm shifts and great leaps in innovation they happen slowly and then out of nowhere are everywhere at once. Getting ahead of the curve and preparing City Hall to take advantage of this change will represent a rare generational opportunity.



To learn more about Digital Twins, read the IDC report, [IDC PlanScape: Smart City Digital Twins](#).

To understand more about IDC Government Insights' coverage of Smart Cities and Communities, [click here](#).



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To learn more what IDC can do for your organization, you can contact [Tessa Rago](#), AVP, Marketing and End User Sales, IDC Asia/Pacific.