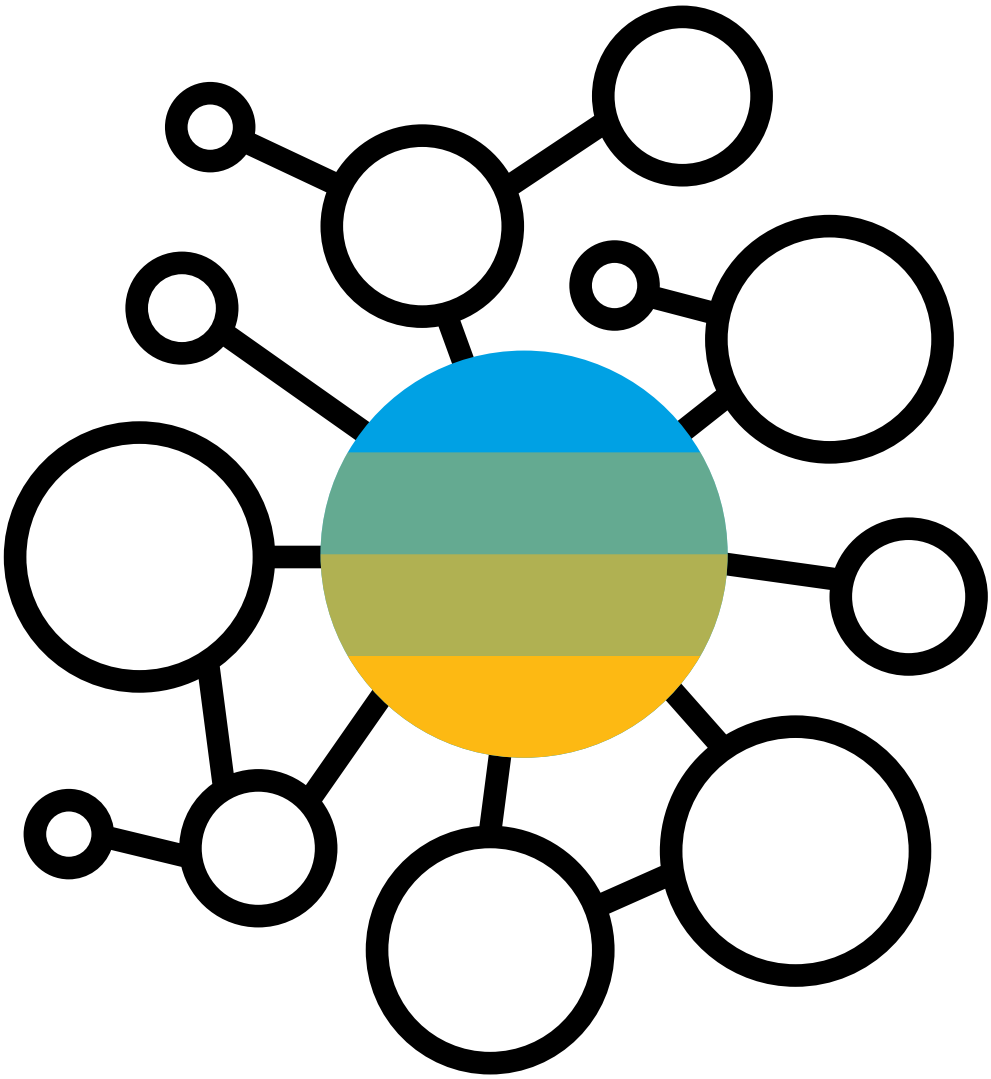
SAP Thought Leadership Paper
Smart City

The Smart City Revolution

Improving Outcomes for Citizens and Businesses by Applying Industry Expertise and Digital Technology



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As the world's population urbanizes, leading cities are working to develop sustainably, protect and serve citizens, and attract new investment, businesses, and talent. By harnessing the power of innovative digital technologies, these cities are becoming more sustainable, livable communities. But governments cannot execute this transformation alone. Increasingly, private sector businesses are contributing support, solutions, and expertise that help urban areas become smart cities while meeting commercial revenue goals.

Meeting the Challenges of an Increasingly Urban World

As urbanization takes hold, cities are faced with increased pollution, congestion, crime, and an underdeveloped or aging infrastructure. In response, they must proactively ensure their ability to develop sustainably, protect and serve citizens, and attract new investment to maintain and improve the quality of their citizens' lives.

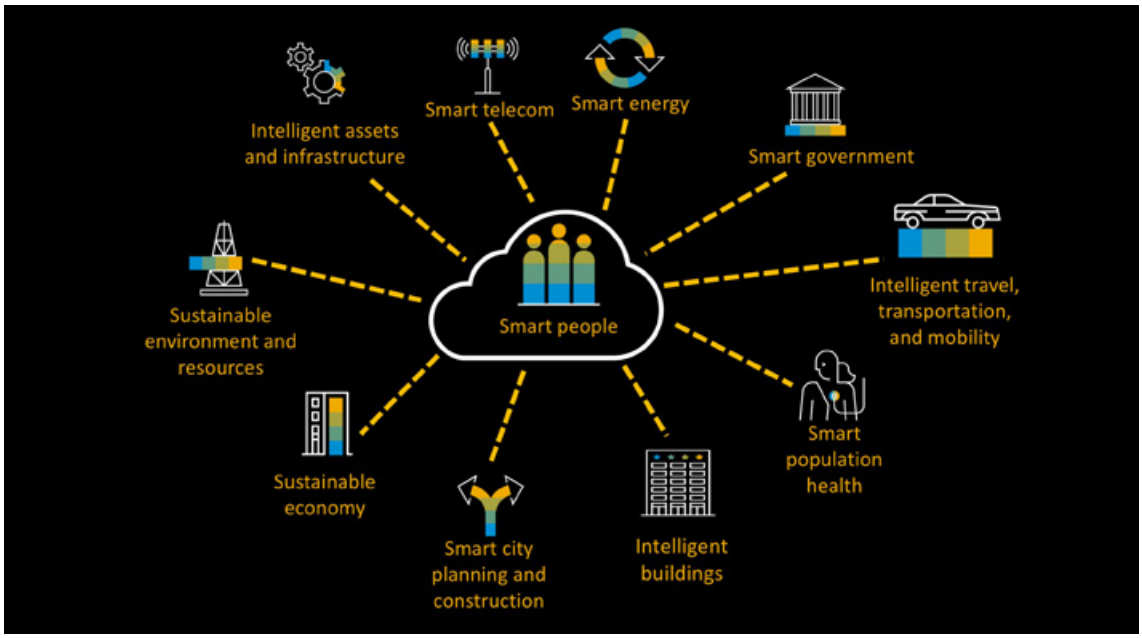
Municipal leaders understand the need to address these issues. After all, the timeless mission of cities is to serve citizens while developing the local economy. Not long ago, public sector organizations took the lead on most smart city projects. Yet, constrained budgets create impediments that can inhibit broad initiatives for change. Siloed agencies and teams – with their own data, technology assets, and missions – struggle to work efficiently and holistically in pursuit of a common goal.

That's why many leading public sector organizations are partnering with enterprises from key industries to support smart city initiatives.

TRANSFORMATION DRIVEN BY INDUSTRY EXPERTISE AND TECHNOLOGY

To improve citizen's lives, foster economic growth, and use city resources to attract businesses and residents, leaders in both the public and private sector are turning to innovative digital technologies. Consider the positive impact of the cloud, Internet of Things (IoT) sensors, Big Data, mobile apps, machine learning, blockchain, and analytics on urbanization today. Using such innovations, a new generation of city managers, politicians, business leaders, and not-for-profit executives is transforming communities into smart cities that deliver better outcomes to all stakeholders. Smart city initiatives aim to improve the lives of citizens and make urban living sustainable by excelling in governance, the economy, transportation and mobility, healthcare, education, environment and resources, and serving people (see Figure 1).

Figure 1: Focus Areas for Smart City Initiatives



These initiatives can extend beyond legal entities or city borders. In many areas, the efforts encompass geographic regions and communities of interested citizens and businesses. Initiatives are often spearheaded – and funded – by partnerships of public sector organizations and private enterprises working with or supported by nonprofits and academic institutions.

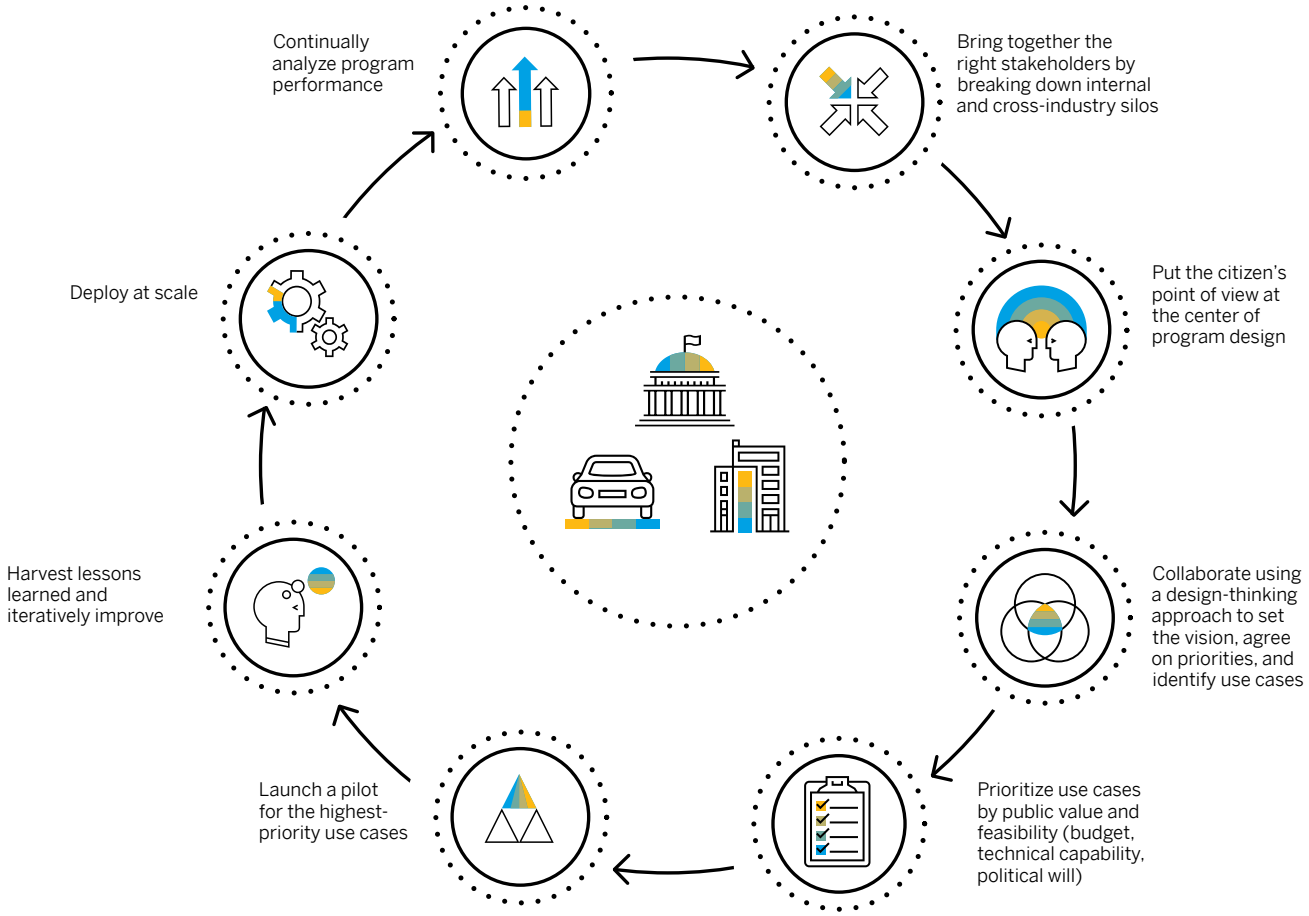
Smart city initiatives also rely on the expertise of leaders from companies across various industries. Because they work within urban areas, these companies are highly motivated to cooperate and collaborate with government agencies to create the best possible future cities. Breaking down silos between private and public sector organizations is essential to working together to improve outcomes and improve the quality of citizens' lives. Recognizing this reality, organizations from the utilities, waste and recycling, telecommunications, automotive, travel and transportation, healthcare, higher education, and engineering, construction, and operations sectors are critical contributors to the success of any smart city efforts.

Multidisciplinary teams can take advantage of cutting-edge information and communications technologies to bring disparate organizations, enterprises, business and agency leaders, and buying centers into a unified whole. Organizational silos give way to a problem-solving ecosystem, supported by technology solutions that help address a broad swath of challenges and opportunities. Not only are these smart cities able to deliver higher-quality services to citizens more efficiently, but they can reduce operational costs and free resources for additional value-added efforts.

An ideal road map to execute strategy through technology could utilize an approach as illustrated in Figure 2.

Smart city initiatives rely on the **expertise** of leaders from companies across various industries.

Figure 2: Stages of Realizing a Smart City Initiative



ANOTHER VIEWPOINT

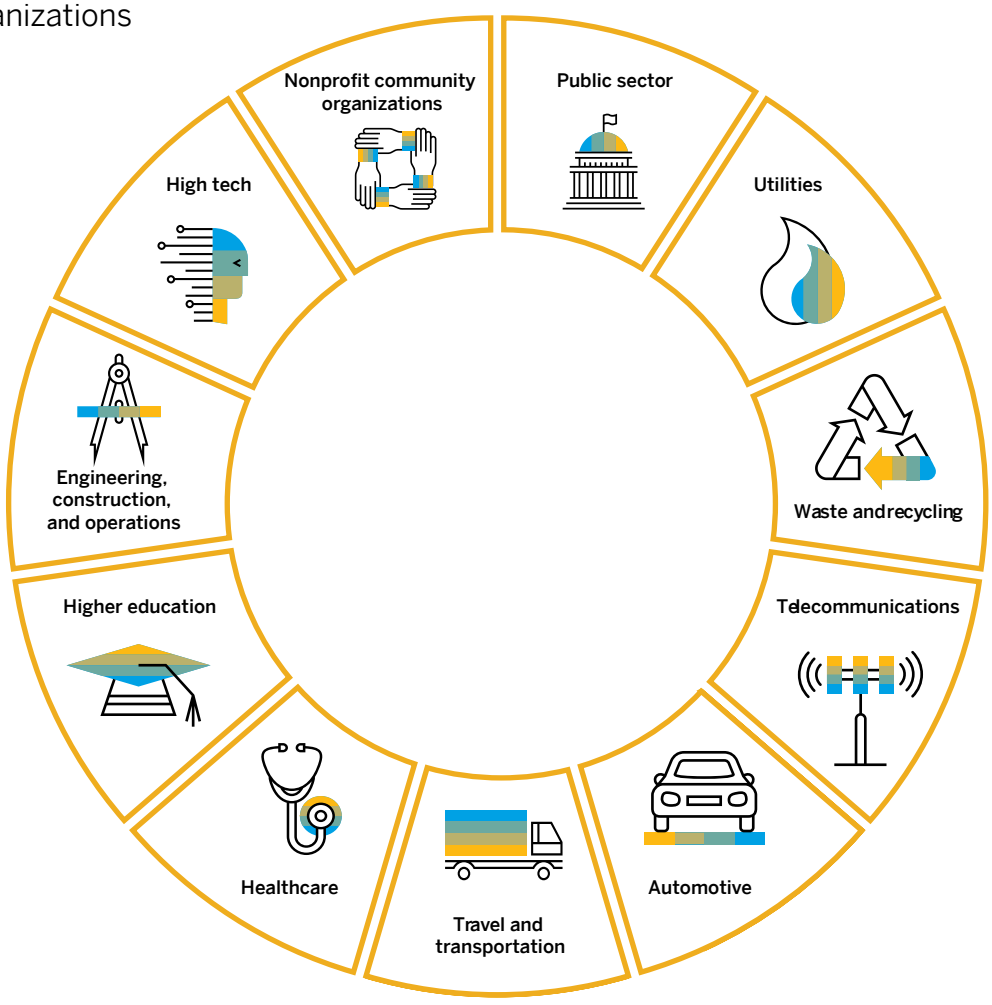
Although many experts believe that continued urbanization is inevitable, some industry watchers expect the opposite outcome: digitalization could make it easier to live outside city centers. With digital technologies such as self-driving cars, personalized remote medicine, automated delivery, 3D printing, and other services that can be ordered and managed on the Internet, more people may choose to live and work in nonurban areas. If digital technologies can deliver the amenities of urban living – with lower costs and cleaner air – individuals and businesses may find it worthwhile to stay in or move to peripheral areas.

Creating Smart Cities Through Cross-Industry Collaboration

Not long ago, public sector organizations took the lead on most smart city projects. Today, leading public sector organizations are partnering with enterprises from the following key industries to contribute expertise and technology to these initiatives:

- Utilities
- Waste and recycling
- Telecommunications
- Automotive
- Travel and transportation
- Healthcare
- Higher education
- Engineering, construction, and operations
- High tech
- Nonprofit community organizations

Using their market expertise – and often employing cutting-edge technologies such as the IoT, machine learning, analytics, and blockchain – industry leaders are becoming essential partners in smart city initiatives. Let's consider how leaders in the private and public sector can play a role.



PUBLIC SECTOR

Government organizations, from the mayor and city council to individual departments, are typically the driving force behind a smart city initiative. Leaders must work with teams to scope out projects and overarching goals. They also need to bring together discrete organizations and distinct buying centers from groups such as information technology, public works, transportation, education, and city services organizations. Digitalization is key to connecting disparate groups, overcoming traditional silos, and realizing better outcomes for stakeholders.

Yet, not all players in these initiatives are from the city itself. Some public sector organizations shepherd public-private partnerships where interested parties join together to achieve specific goals, often with creative financing models. Others bring together public, private, and nongovernment organizations (NGOs) to lead advocacy and change efforts.

Citizens are also critical contributors to the success of smart city efforts. Without the input and partnership of citizens, cities will not be able to progress as quickly. Additionally, universities need to work side by side with companies, nonprofits, citizens, and municipal leaders to address the city's toughest challenges. If this is done correctly, everyone can work in concert to deliver services more effectively and efficiently to constituents.

IMPROVING EMERGENCY RESPONSE AND SAFETY

The city of Cape Town uses new data collection and analysis technologies to create an integrated public safety solution. By sharing and analyzing data for fire and rescue, traffic, metro police, law enforcement, disaster risk management, and its special investigative unit, the city is revolutionizing the delivery of public safety services. All six agencies have real-time insight into the approximately 500 incidents that occur each day, along with their locations, service requirements, and the progress of each responder – helping improve the safety of citizens and city workers.

Learn more.

UTILITIES

After a century of following essentially the same business model, the utilities industry is experiencing rapid change. The value chain is splitting into discrete pieces, requiring new business models. Many companies are becoming service providers that help clients accelerate their independence from fossil fuels, while continuing to sell energy-generating equipment and fuels. These services range from delivering usage-related analytics and recommending high-efficiency burners to more futuristic offerings. For example, some companies are creating virtual power plants from groups of "prosumers" who use solar panels to produce their own energy, consume their own energy, and sell the surplus back to the grid.

The evolving marketplace provides utilities with an unparalleled opportunity to help communities succeed with smart city initiatives. Some utilities are adopting smaller initiatives, such as supporting electric-vehicle charging stations or developing public events that help raise environmental and sustainability awareness. Other firms are pursuing ambitious goals such as moving cities toward a zero carbon emission, zero waste, energy prosumer–supported environment that uses regenerative energies and intelligent energy-storage solutions.

As they become more experienced in these initiatives, utilities can reimagine their business models, embrace new strategies, and develop additional services. Companies can create interdisciplinary teams that bring together experts and citizens. By engaging in open workshop methods such as design thinking, utilities can introduce valuable smart city initiatives that extend beyond the traditional realm of utilities providers and help cities meet their sustainability goals.

LIGHTING UP INSIGHT WITH SMART LAMPPOSTS

The city of Karlsruhe, Germany, partnered with a local energy provider to run a pilot project called smart city light or "Sm!ght." New lampposts in this city of 300,000 offer free Wi-Fi, an emergency button, a charging point for e-cars, and environmental sensors that measure pollution levels. The lamps collect data, which is analyzed and disseminated to the city and its citizens. For example, radar sensors monitor traffic levels and provide alerts when e-car drivers approach a lamp with a charging station. Environmental data such as particulate matter emissions is also recorded by the lamps, allowing the city to take action to improve air quality.

Learn more.

WASTE AND RECYCLING

Commercial waste and recycling companies have traditionally focused on maximizing their volume of services in a take-make-consume-dispose economy. In contrast, environmentally aware communities and providers are seeking more sustainable approaches. These organizations are looking for ways to create a circular economy that generates zero waste. By recycling everything from water to consumer goods and construction materials, forward-thinking vendors can enhance the environment while taking advantage of profitable new business opportunities.

Achieving this goal requires extensive collaboration between waste and recycling companies and the municipalities they serve. In some older cities, for example, waste from the demolition of existing structures is the largest contributor to landfills. Yet, many cities have not yet developed programs to reclaim salvageable materials for reuse. To achieve a true circular economy, companies offering waste, recycling, and environmental services need to partner with municipalities and construction firms.

Digital technologies can support a smart city's focus on waste and recycling. Existing planning and scheduling tools, routing software, geographical information systems, and smart sensors can be deployed to monitor trash cans, track and optimize trash collection, and develop more efficient routes for collection vehicles. For cities, this technology can decrease the number of trucks on the streets, cut noise levels, and reduce pollution. For waste and recycling providers, digital solutions – such as ultrasonic sensors on garbage bins that measure fill levels – can create new opportunities for streamlined routes, enhanced quality of service, and improved customer engagement.

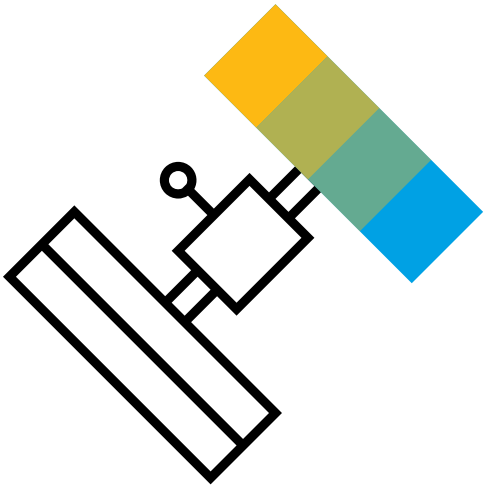
MAKING WASTE COLLECTION MORE SUSTAINABLE

Today, smart cities are bundling and expanding their waste disposal services using logistics software, sensors, and RFID tags. With such digital technology, they can handle the delivery, collection, and disposal of packaging, trash, and waste in one operation. The technology helps service providers identify refuse containers, plan collection routes, and optimize vehicle capacity. The technology-enabled insight can also enable cities to use smaller, electric collection vehicles – reducing noise, pollution, and traffic.

TELECOMMUNICATIONS

With their widespread digital networks, telecommunications companies (telcos) are taking a leading role in smart city initiatives. Telcos can provide the fundamental technology platform that supports digital technologies, including communications and data processing. Some providers have used their platform to deliver individual smart-city services or comprehensive, citywide solutions.

Many cities turn to telcos to provide readily available services that advance their initiatives while respecting tight budgets. With long-standing experience in monetizing digital services, telcos can help cities reduce time to benefit by providing revenue management services and applications, for example. These services turn capital expenses into operating expenses, freeing funds that can be reinvested in smart city initiatives.



With experience monetizing digital services, telcos can help cities reduce time to benefit by providing **revenue management** services and applications.

AUTOMOTIVE

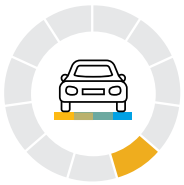
The rise of "megacities" – urban areas with more than 10 million inhabitants – is an impetus to plan for multimodal mobility solutions.

Smart cities face a big challenge when it comes to personal transportation. Combining personally owned automobiles with public transportation and shared vehicles is the status quo, but congestion, pollution, and noise are forcing many cities to consider more creative options.

Mobility solutions are common starting points for smart city initiatives. Finding ways to use pooled transportation resources to support personal mobility is a priority. Multimodal transportation strategies that use buses, trains, cars, and shared vehicles are growing in popularity. These modes – which a consumer may select according to time, traffic, or season – can free up government and personal resources. But, who provides these transportation services – the municipality, an automobile manufacturer, or a third-party vendor, for example – depends on the city and the available partners.

Seeing the potential for new business, many automotive companies have already begun to participate in smart city initiatives. For these vendors, the challenge is to create the collaborative relationships needed to partner with cities, citizens, and consumers. They also need to develop flexible business models that will help them do business with institutions and monetize shared-vehicle operations.

In the near future, real-time sensor data coming from connected and self-driving vehicles within the smart city infrastructure will provide valuable insights to improve city services and citizen safety. Self-driving vehicles that use machine learning to move people and goods in and around a city are likely to become mainstream technologies. After more than a century of generating revenues from sales, maintenance, and service, many auto firms may soon offer citizen-mobility services that enhance regional transportation options.



IMPROVING CITIZEN MOBILITY

The city of Nanjing, China, uses connected logistics to better measure, understand, and manage huge traffic volumes. There are about 10,000 taxicabs, 7,000 buses, and 1 million private cars running throughout the city road network. To help cope with this volume, Nanjing developed a next-generation, smart traffic system that includes sensors and RFID chips that generate continuous data streams about the status of transportation systems across the city. Nanjing uses advanced analytics that process 100 million records per day and a huge digital map that visually represents traffic events to identify traffic patterns and trouble spots. The system publishes traffic results in real time on a mobile app, which citizens can use to plan their travel and avoid the worst congestion.

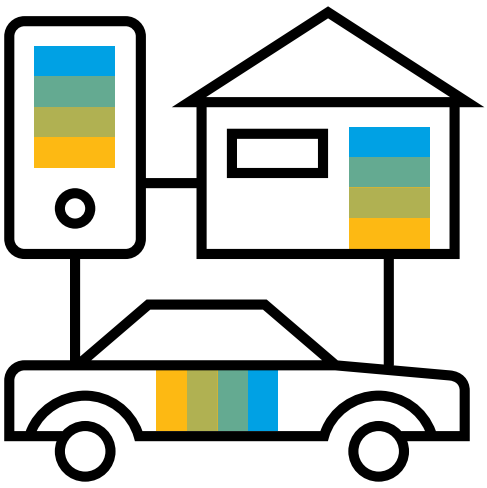
Learn More.

TRAVEL AND TRANSPORTATION

Creating travel and transportation services that make it easier to visit or live in a city and transporting assets into or out of urban environments can be challenging – especially while appealing to the sensitivities of 21st-century consumers. People expect secure travel, smooth transitions between timely intermodal and cost-effective transportation options, next-day delivery from online businesses, and congestion-free travel. Travel and transportation companies are creating a new generation of services to meet these needs.

The growing use of e-commerce has resulted in exponential growth for last-mile delivery services, creating heavy traffic on city streets. To help alleviate this congestion, savvy transportation companies – some that already transport people – are adding freight services to their portfolio.

As consumers' appetite for guidance grows, digital mobile assistants build on traditional GPS solutions to include the entire end-to-end journey. Using a smartphone, a traveler can receive further navigation support and hospitality assistance after leaving the vehicle, even while traveling by plane, to arrange ground transportation at the destination or navigate to a hotel in a different city.



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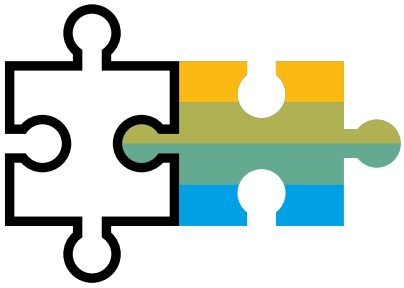
Additional guidance services are in the early stages of development. Location services and augmented reality technologies could be used to guide consumers in indoor locations such as large office buildings or retail malls. These services will allow consumers to choose the way they prefer to be guided, using everything from multilingual communications to machine learning to provide a personalized, companion-like service that acts as a digital concierge.

Providers will need to develop subscription- or usage-based business models to make services affordable and profitable. Mobility accounts will help the services recognize authorized consumers and secure payment. But, providers must be careful not to overwhelm or spam consumers with floods of unnecessary communications or data. Travel and transportation companies must anticipate consumer service needs without becoming intrusive.



Digitalization is key to connecting disparate groups, overcoming traditional silos, and realizing **better outcomes** for stakeholders.

HEALTHCARE

Health and wellness may seem like a concern for individuals or families, but the economic and social impact of an ill or aging population on communities can be dramatic. For this reason, many healthcare organizations are becoming valuable partners in smart city initiatives.

Healthcare leaders recognize that the challenges facing many communities can be addressed with connected digital technologies. Using monitoring tools that share healthcare data with loved ones and caregivers, medical providers could help elderly residents age in the residence they desire. Wearable technologies and teleconferencing could seamlessly transmit information, allowing senior citizens and chronically ill people to receive the care they need while continuing to live independently. For example, patients with nervous system disorders such as Parkinson's disease could wear socks embedded with sensors that monitor walking pace and gait. People suffering from depression might be monitored using devices that measure physical activity.

Digital technology could also help people receive healthcare services from providers. Using autonomous vehicles and location-based navigation services, older and less healthy patients could safely be transported to care appointments, without the assistance of relatives or paid caregivers.

The technical foundation for these services – such as bandwidth, wiring, and handicapped access – is still developing, but momentum is building. As they begin to reach critical mass, these technologies will help healthcare providers overcome their biggest challenge: delivering care to an aging population with a relative scarcity of care providers. Because these wellness applications generate huge volumes of data, healthcare organizations will need advanced technologies, such as signal processing, event alerts, anomaly detection, and process orchestration, to pinpoint data that requires further review. Once the tools identify circumstances warranting closer inspection, healthcare professionals can reach out to the patient to learn more and, if necessary, initiate treatment.

COLLECTING HEALTH DATA FROM HOME

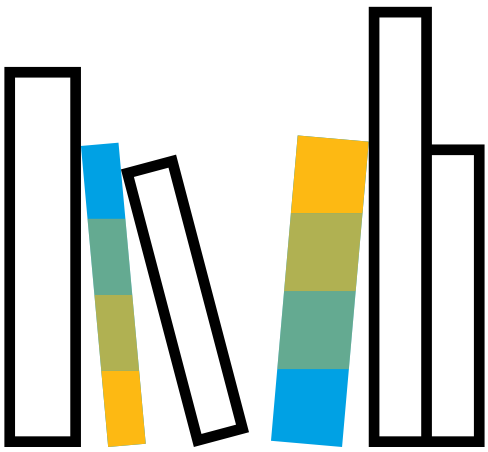
Several companies are delivering solutions that use digital technologies that can support a smart city initiative. EarlySense LTD, a high-tech startup company with expertise in hospital-bed monitoring devices, offers a wellness sensor that can be slipped under the patient's mattress to detect and monitor vital signs. Using Bluetooth and Wi-Fi capabilities, the product measures the heart rate, respiration rate, and sleep and movement patterns of patients in the home. It sends the collected data through the cloud to the user's mobile app, where it can be shared for healthcare, research, and personal purposes.

Learn more.

HIGHER EDUCATION

Higher education institutions are under tremendous pressure to serve students cost-effectively and use public funds responsibly. To help advance the vision for smart cities, universities need to produce workers who are educated and skilled to contribute to the digital economy. They must also help students graduate without incurring high levels of debt that will inhibit their ability to live as independent adults and participate in the global economy. Meeting these goals may require universities to adopt integrated operations to boost efficiency, new staffing models such as shared services, and greater use of analytics for real-time decision-making.

Higher education administrations can also play an important role in smart city initiatives by partnering with urban governments and nongovernmental agencies on research and development (R&D) activities. With established laboratories, leading-edge technologies, and intellectual capital, universities can serve as ideal R&D leaders in solving critical urban problems. In some cases, cities can act as test beds for new smart city initiatives and approaches. For example, several universities have directly partnered with cities to better understand how autonomous vehicles could address their citizens' public transportation needs.



To help advance the vision of the smart city, universities need to produce workers who are **educated and skilled** to contribute to the digital economy.

PARTNERING FOR BREAKTHROUGHS

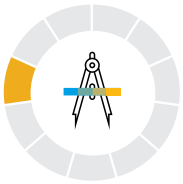
Some universities are working with cities to solve community-based problems through collaborative hackathons and working groups.

ENGINEERING, CONSTRUCTION, AND OPERATIONS

To keep pace with expanding urban populations, public sector executives must address changing infrastructure requirements. Achieving the goals of easing congestion, reducing pollution, and enhancing safety requires extensive collaboration between city planning, architecture, and construction firms.

Engineering, construction, and operations (EC&O) firms are expected to work closely with city partners to design, plan, and build new critical infrastructure, buildings, and homes in ways that meet their needs – and those of the community.

Digital technology can help these companies build future cities. Visualization and augmented reality tools can help designers better understand population shifts, demographic changes, and traffic patterns so they can plan and develop infrastructure that best addresses the city's goals. By offering simulation services, EC&O providers can help city planners understand the likely outcomes of potential growth scenarios before infrastructure is planned. Cross-enterprise procurement tools and processes can help increase financial transparency and accountability, eliminating fraudulent activity – such as pay for play and kickbacks – that can give unfair advantage to certain builders or real estate brokers. With this insight, cities and EC&O firms can help ensure that a city of the future meets the needs of all stakeholders for generations to come.



REDUCING MAINTENANCE COSTS

Trenitalia, the leading Italian rail transport operator, uses sensors and powerful data analytics solutions to create a dynamic maintenance management system. Instead of performing asset maintenance on a fixed schedule, Trenitalia analyzes the data and uses system-defined rules to determine required maintenance activities. By anticipating asset requirements and proactively handling maintenance, the company expects to reduce total maintenance costs by 10% per year, decrease equipment downtime by 20%, and increase equipment availability by 5% by avoiding unplanned outages.

Learn more.

HIGH TECH

The high-tech industry has historically supplied products to city governments, utilities, transit authorities, and many other stakeholders within the city ecosystem. The breadth of its engagement includes energy generation and distribution equipment, water distribution and treatment, public lighting, traffic lights and sensors, video cameras, and IT hardware, software, and services.

Today, the city ecosystem is witnessing a paradigm change involving the high-tech industry as it shifts away from a transactional supplier-customer relationship that entails a one-off capital investment. High-tech companies now provide more products as a service, thus becoming entrenched in the city ecosystem operating model. Municipal and corporate leaders also consider them a source of knowledge, skills, and employment; hence, they get involved in the city economic development strategy and action plan. What's more, the boundaries between high-tech suppliers are blurring, as software is embedded in all sorts of equipment to enable remote, real-time, and predictive capabilities.

NONPROFIT COMMUNITY ORGANIZATIONS

Nonprofit community organizations have operated in cities for a long time. They have historically complemented and collaborated with city services in areas like social care, homeless care, healthcare, education, training, and culture and entertainment.

Budget constraints are putting pressure on municipal leaders to continue innovating through alternative service delivery in collaboration with these organizations. And digital technologies such as social media, analytics, and mobile are offering nonprofits new opportunities to integrate their processes more closely with local governments to increase personalized citizen services. Looking ahead, community organizations are also expected to play an increasingly important policy role. Since citizens are demanding greater transparency and engagement with their cities' strategic plans and programs, nonprofit organizations can become the connective tissue that aligns top-down city mandates with bottom-up neighborhood realities.

Cutting-Edge Technologies

In developing smart city initiatives, industry leaders are turning to several powerful technologies that support transformation. These technologies introduce new data and insights that can help cities run smarter and simpler.

THE INTERNET OF THINGS

Industry experts estimate that tens of billions of devices, appliances, machines, and other physical objects will soon be connected through the Internet of Things. This connectivity will allow these devices to communicate over the Internet through embedded sensors, generating hundreds of trillions of gigabytes of data and delivering unprecedented, real-time insight into business processes. For enterprises supporting smart city initiatives, the IoT offers tremendous opportunities to reimagine business models and deliver innovative new services.

USING SENSOR DATA TO SAVE LIVES

The city of Buenos Aires has always experienced seasonal torrential rains that cause flooding, property damage, injury, and death. By deploying real-time sensors in storm drains that feed data to analytics solutions, the city can help ensure that streets and drains are clean and free of flood-causing debris. In addition, these solutions help Buenos Aires manage more than 700,000 city assets, including streets and lights, parks, bus stops, drains, buildings, and bridges. As a result, a three-day downpour caused no flooding at all. Using sensor data and analytics to upgrade asset management, the city has enhanced safety and transparency for citizens and tourists alike.

Learn more.

MACHINE LEARNING AND PREDICTIVE ANALYTICS

New advanced analytics and machine learning models can use the data collected by IoT sensors and other sources to provide deeper insights at unprecedented speed. Machine learning gives computers the ability to learn how to spot patterns and make connections without being programmed to accomplish a specific task. Machine learning technology does this by developing algorithms that can change and "learn" when exposed to new data.

By using intelligent applications that use text, predictive, spatial, event stream, social media, sentiment analysis, and time series capabilities, cities can transform data into insights that improve life for citizens. Some cities are analyzing water usage data to predict water consumption and the impact of potential droughts. Others are exploring predictive policing applications and using advanced analytics to anticipate the impact of weather events.

MITIGATING NATURAL DISASTERS

One proof-of-concept exercise combines earth observation data from the European Space Agency with machine learning algorithms, predictive analytics, and spatial data to predict natural disasters. The technology synthesizes data about known tropical storms, reviews satellite images, and uses heat maps to visualize the likelihood of landslides in a specific area. Local governments could use this information to determine when to evacuate populations or initiate disaster preparations.

Machine learning algorithms can be trained to analyze known patterns from satellite images, classify land usage, assess soil moisture levels, and evaluate land topologies. In the event of a landslide, for example, technology could combine land data with other sources such as social media, road maps, and population data. Government workers could use the system to understand which roads are open, the best route to get to a specific location, and the ideal location for a rescue camp.

Learn more.

BLOCKCHAIN

Blockchain technology uses cryptography, peer-to-peer networks, and consensus algorithms to form a digital ledger of transactions. Every participant in a blockchain can view verified transactions, which are recorded in a chain of information. This built-in transparency allows blockchain participants to conduct business transactions directly with each other, eliminating the need for trusted third parties.

Cities can use vast repositories of live data and interactions guaranteed by blockchain to automate routine tasks and execute business processes. For example, imagine that every house or apartment in a city had an entry on a blockchain used as a city's digital ledger. The data recorded in the digital "twin" could reflect everything from property ownership to transactional data such as utility use, property tax assessment, and past and current contractor relationships.

Using blockchain, property owners would have a verified, trustworthy way to perform transactions such as renting an apartment, hiring contractors to do lawn work, or selling power generated by solar panels back to the grid. Utilities could assess power consumption data and generate energy-saving recommendations for each residence. They could also use smart contracts – which automatically manage power consumption between smart appliances and the grid – to lower costs and improve energy efficiency.

UNIFIED, INTELLIGENT DIGITAL PLATFORMS

Digital platforms enable organizations to perform end-to-end processes using integrated solutions, from the edge to a digital core. The digital core connects the organization with people, business networks, sensors, and Big Data, and manages core operations. These connected solutions are all built on a simplified data model that combines business processes with business intelligence.

Also connected to the digital core is support for the extended processes that enable the organization to engage with customers or constituents. Extended processes could include constituent engagement, supplier engagement, managing spend, and procuring contingent workers.

CREATING A TRUSTED SOURCE OF INFORMATION

The province of South Tyrol, Italy, investigated the use of blockchain to help streamline administrative processes. Although the government uses about 1,000 software applications to collect and use citizen information, employees in the capital city of Bozen (Bolzano) spent too much time stating, confirming, or sharing facts.

Using blockchain, the government can build inherently transparent systems that reduce the effort of authenticating documents. By eliminating redundant data collection processes and integrating data across applications in compliance with data-sharing regulations, the government can increase administrator efficiency, simplify IT landscapes, and deliver a new level of data truthfulness and security to citizens.

Learn more.

Choosing the Capabilities to Support Transformation

Municipal leaders pursuing smart city initiatives must successfully embrace opportunities afforded by new digital technologies that can support collaboration, e-commerce, and data sharing with powerful analytics that enable instant insight. Only by taking advantage of these opportunities can municipal leaders stay ahead of the innovation curve to meet their policy mandates, while better competing with other cities for investment resources. Their success requires solutions that align with the following key principles of a future city.

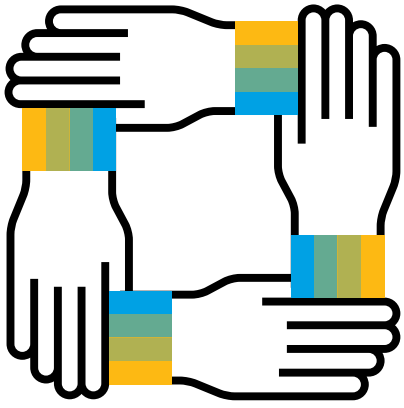
Flexible, extensible technology platform – Because growth is almost inevitable for any smart city initiative, the scope of your technology system is likely to expand with the reach of the project. A flexible technology platform that can meet changing business requirements can help you scale efficiently and cost-effectively. Look for a development platform that allows you to quickly build new services while managing huge volumes of both structured and unstructured Big Data.

Openness and interoperability – To share information among various stakeholders in a smart city, you need to eliminate data and application silos. Choose open technologies that work with multiple protocols and open application program interfaces (APIs). Interoperable solutions must support a wide variety of users – including citizens, businesses, employees, and city visitors – and the devices they are likely to use.

End-to-end processes across the value chain – Processes that enable a smart city can be complex and wide reaching. They need to consider the end user's experience, incorporate data from external sources such as location intelligence and sentiment analysis applications, and consume and update information from back-office solutions. Software that provides built-in support for end-to-end processes can help streamline the collection, analysis, and sharing of data with relevant stakeholders, so they can get the right information at the right time in the right place.

Support for cutting-edge and disruptive technologies – Powerful new technologies are helping organizations radically transform the way they serve their stakeholders. Creating a future-proof infrastructure requires technology that supports mobile apps, the cloud, Big Data, artificial intelligence, and analytics. Cities also need solutions that can incorporate data from the Internet of Things, machine learning applications, and cutting-edge technologies such as blockchain.

Our strong digital core helps you innovate and make **citizen and business participation** more immediate, intelligent, and integrated.



Simplified, engaging experience – Every technology interface must be designed to meet the needs and expectations of designated users, such as citizens, visitors, employees, businesses, and contractors, who are the ultimate consumers of the information shared in any smart city initiative. Choose solutions with a consumer-like interface that makes it easy for users to access information and engage services. Role-based access can simplify what users see and how they interact with the technology.

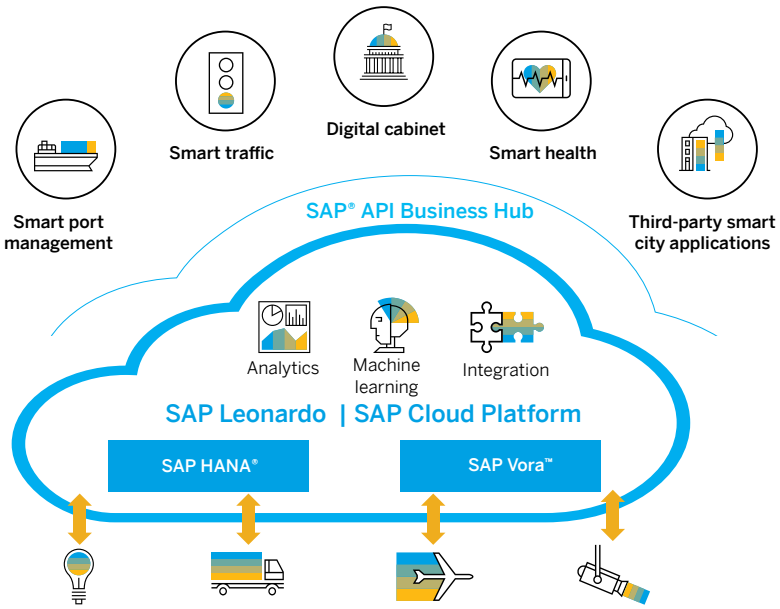
Services that shape the solution to your challenges – This is no time for business as usual. Solving the problems of today's – and tomorrow's – cities requires broader, more holistic thinking. Partnering with technology providers can help you bring together stakeholders from different areas, identify needs, and brainstorm new approaches to your city's issues. Organizations must be prepared to fundamentally reimagine and transform all aspects of their business or operations. They need a digital backbone that is agile enough to change with dynamic technology advances and robust enough to support collaboration across organizational silos to build out a digital strategy.

SAP® SOLUTIONS AND EXPERTISE FOR SMART CITY INITIATIVES

As part of the SAP® Future Cities program, we are working with cities worldwide. Our goal is to help them better engage with citizens, deliver enhanced services, improve revenue collection, streamline the movement of goods and people, address social inclusion and open government, increase public safety, ensure sustainability, and drive prosperity. We also engage with companies in all of the key industries that can help or work with public sector organizations on their smart city initiatives.

SAP offers advanced solutions that can support your smart city initiative (see Figure 3).

Figure 3: Smart City Technologies from SAP



The foundation for our smart city solutions is SAP Cloud Platform. This open platform collects data independent of its source and can add contextual information from software such as enterprise resource planning (ERP) and customer relationship management (CRM) solutions. SAP Cloud Platform supports integration with other applications, devices, sensors, and open APIs. Developers can create solutions for smart city projects. They can also build communities that support transformation through shared data, collaboration, and transparency. SAP Cloud Platform uses the in-memory technology and acceleration provided by the SAP HANA® platform to transform Big Data into meaningful information.

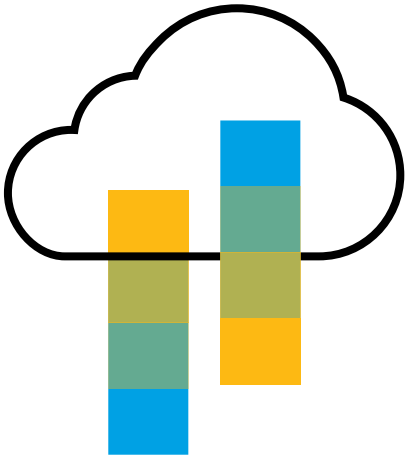
Our strong digital core creates a smart city backbone that helps you innovate and make citizen and business participation more immediate, intelligent, and integrated. SAP S/4HANA®, our next-generation ERP system, supports operational excellence, automation, and technology integration. SAP Digital Boardroom helps executives and leaders understand trends and gain a holistic, in-context, and real-time view of city operations and progress against policy objectives.

SAP Leonardo is our new digital innovation system that enables rapid innovation and digital transformation to help customers reimagine their business. It integrates breakthrough technologies with capabilities focused on the Internet of Things, machine learning, analytics, Big Data, and blockchain technology. At SAP Leonardo Center locations around the world, we offer workshops that help enterprises use design thinking methodology to rapidly adopt new capabilities and business models while accelerating their smart city initiatives.

We also provide an ecosystem of experts who partner with us in co-innovating end-to-end solutions along entire city value chains. To help cities succeed with their initiatives, we work with industry leaders, technology vendors, and consulting and services providers.

Our work with leading companies in 25 industries for nearly 45 years gives us the expertise to serve as a trusted provider. With our cross-industry expertise, integration, applications, interoperability, and open ecosystem – together with solutions that touch more than 70% of the world's business processes – SAP is uniquely positioned to help you meet your smart city goals.

With new digital technologies intersecting and combining, transformation will soon happen on a massive scale. Cities – and the organizations they work with – cannot afford to wait to begin their smart city initiatives. By thinking through the likely possibilities and developing scenarios with the expertise of SAP, you can prepare to maximize the positive outcomes in a future we've just begun to imagine.



LEARN MORE

Discover how SAP® Future Cities software can help your smart city initiative succeed.

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