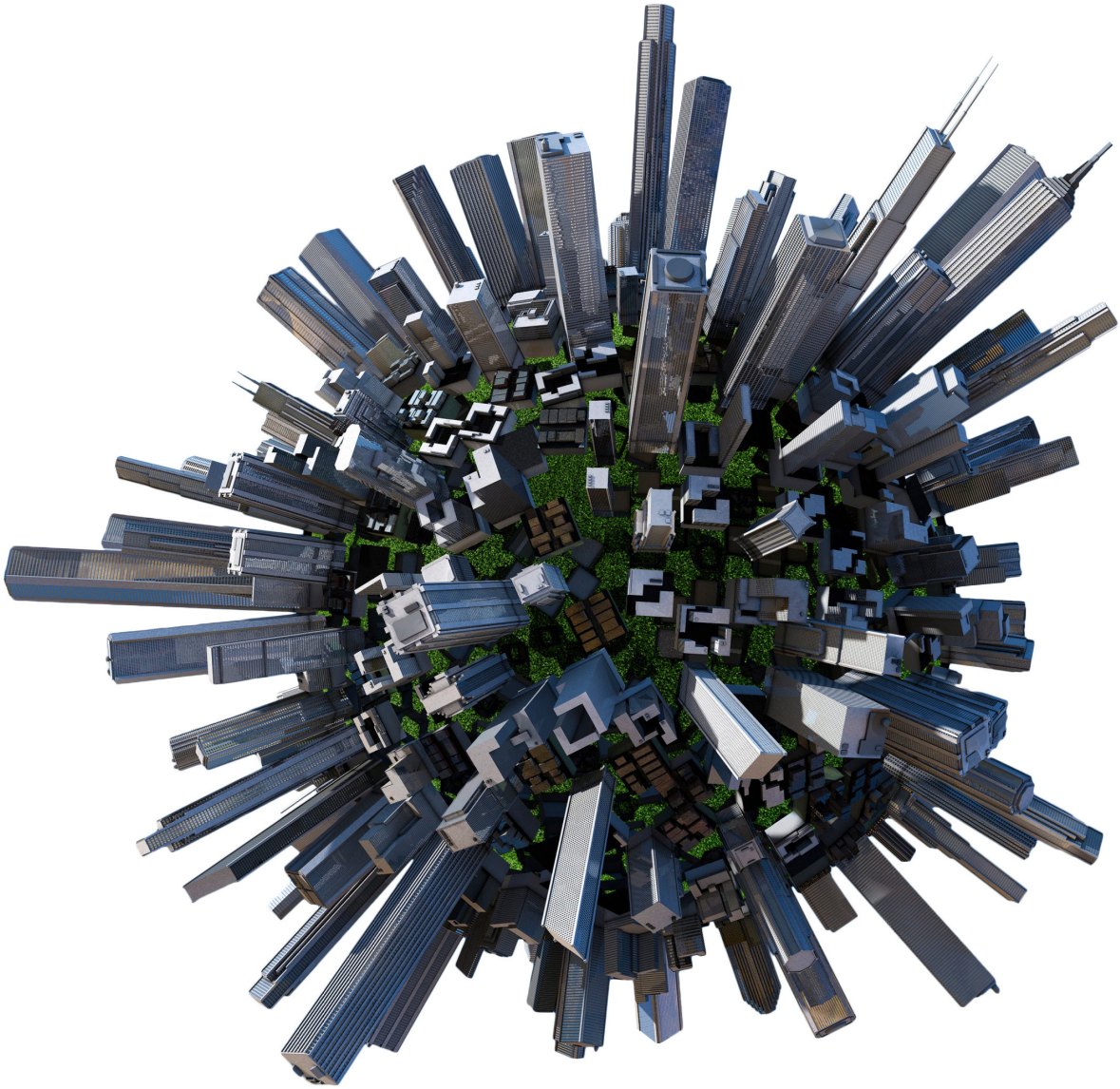


Deloitte.



The integrated digital city

Integrating smart services and diverse stakeholders with a single platform. Enabling citizens, government and the service providers to share data and collaborate to improve urban living.

Section 1. Introduction – The challenges cities face

Cities are likely to see more change in the next 30 years than the last 100.

People continue to migrate to urban areas with expectations of convenience, a good standard of living and being part of a vibrant economy. This influx puts increasing strain on city infrastructure and has social and environmental impacts that make cities less liveable.






City and state management, infrastructure and service providers face the complex task of maintaining an urban environment that encourages people and businesses to stay.

How do they achieve this within their often-shrinking budgets? How do cities respond to the needs and concerns of their growing number of citizens, and deliver services people expect in the 21st century?

The potential benefits of digitally transforming city functions

Smart city technologies present a compelling solution to the complex problems created by urbanisation. The concept of smart cities is attractive and easy to grasp, gather, analyse and share data to improve how assets and resources are managed leading to improved public services, urban living and mobility.

The potential economic benefits of digitally transforming cities continue to encourage and drive future development worldwide.

 Environment energy	 Environment water	 Mobility	 Living	 Others
Amsterdam's smart city recorded 9-4% saving on energy bills, with projected 40% reduction in carbon emissions by 2025	Barcelona's smart water initiative saves the city USD58 million annually	Barcelona's smart parking increased parking revenue by USD50 million per year	In Songdo smart building solution reduced energy consumption by 30% in each building	Smart initiatives have resulted in saving of USD1.2 billion for Dubai Government from 2003 to 2005

Despite this compelling vision, a market brimming with innovative technologies, and real-world examples of successful smart city projects, most cities have made slow progress along the smart city journey.



Why have we not seen the digital transformation of cities at scale?

There are several reasons why smart city schemes have not scaled or been rolled out more widely. These include:

- Difficulties in demonstrating a business case (i.e. a clear path to steady revenue and return on investment) in turn making it difficult to access financing;
- Immature Internet of Things (IoT) technology and infrastructure – the backbone of any smart city reliant on a giant network of connected devices (and people, via their smartphones);
- A lack of interoperability between disparate technology platforms as well as the challenge of digitally transforming legacy city systems so they can be integrated with other services;
- The need to comply with data privacy rules – a regulatory area still undergoing change as policy catches up with public sentiment; and
- The lack of collaboration across government, the market and citizens in terms of data collection, sharing and feedback that significantly improves smart city functions.

In practice, most cities remain unsure how to start their journey to becoming “smart”, while others have failed to scale smart initiatives beyond their pilot phase.

Implementing smart city solutions is challenging. The concept masks underlying complexity and the focus has primarily been on the technologies and engineering solutions behind the schemes rather than the outcomes they need to achieve.

Our research shows that among those cities that have started the digital transformation, many are busy collecting a deluge of data they don't use or share citywide.

Keeping data separate – in vertical silos – is the very opposite of ‘smart’. Sharing and analysing data from different parts of a city's functions provides critical insights that lead to better decisions, responsive services and greater efficiency.



What is different now that makes a digital transformation achievable?

After more than a decade of Smart City evolution, technologies have progressed, along with ideas and strategies on how best to achieve digital transformation across city functions.

Digital solutions still need to be tailored to each service and urban situation, but those solutions are increasingly mature.

Improving collaboration across government, the market and citizens is no longer a technical challenge now smart phones and cloud computing are ubiquitous. Instead of being passive end users, connected citizens can provide feedback and data to improve smart city functions.

Together these developments are making the transition to becoming a smart city more manageable, practical and financially feasible.

We believe the path ahead for Smart Cities will be determined not by the technologies in use but by how well they work together, enabling better decision-making for each stakeholder involved.

This report explores two key factors that make digital transformation across city functions a success.

First, beginning the journey not with the technology but by shining a light on an individual city's challenges and opportunities. To support that we developed a comprehensive approach – the 360° Smart City Framework– that reveals the smart city goals appropriate to each city's unique situation.

Second, implementing a secure single platform that integrates all the city's siloed platforms so that:

- Data and insights are shared securely across all functions (complying with data privacy rules); and
- Citizens connect and collaborate with services.

We developed the CitySynergy™ platform collaborating with AWS to address this problem of vertical data silos by integrating them. Our platform acts as the brain and nervous system of the city, connecting citizens, businesses, and government in new ways.



Section 2. Defining the challenges and opportunities unique to your city

Because no two cities are the same, we advocate using a holistic approach to help city and state management, infrastructure and service providers implement smart city solutions.

Before considering suitable technologies, the digital transformation of a city and its functions requires a clear road map of long- and short-term goals that will address its unique social, economic and environmental issues.

Deloitte has developed a framework to help cities define their challenges and opportunities. This in turn highlights precisely which transformational initiatives present the most compelling business case.

Our approach is “Think Big, Start Small, Scale Fast”, and it’s at the core of our 360° Smart City Framework.

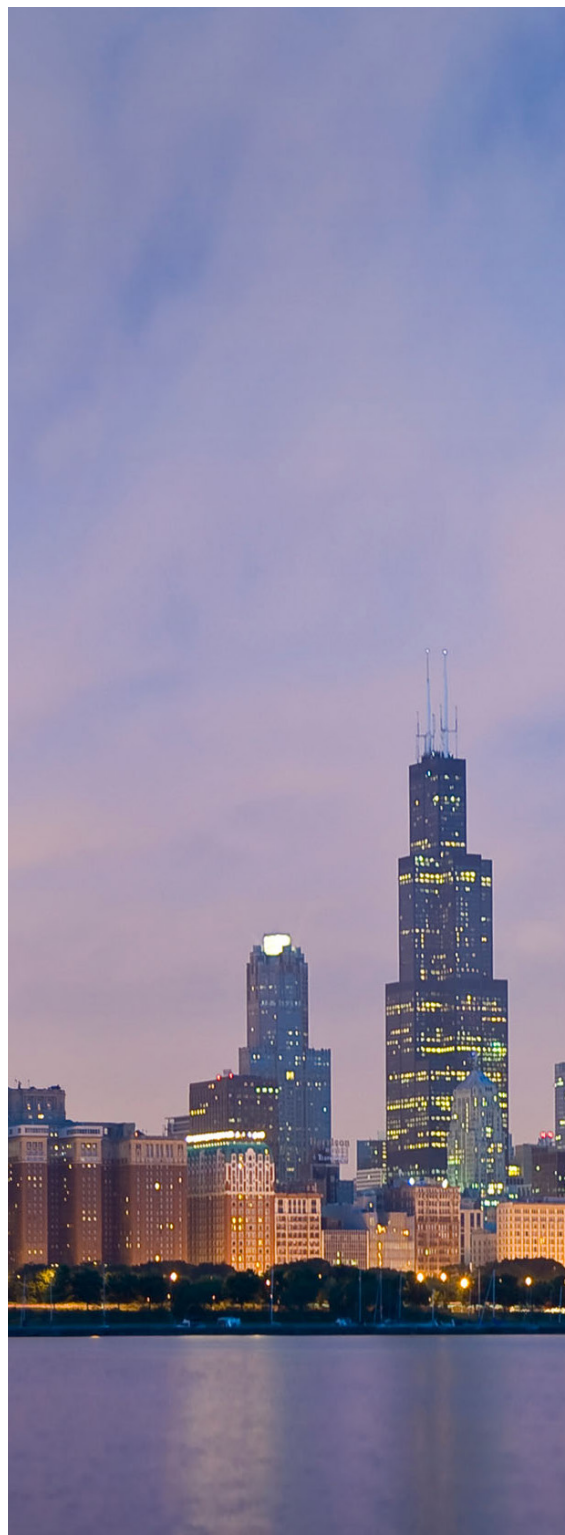
Think Big, in terms of your smart city goals and an actionable plan to reach them.

People often assume a city’s problems are understood, and typically projects start by defining those problems which then shapes their choices for solutions. This runs the risk of missing opportunities or worse, implementing solutions that address the wrong problems. To achieve a better outcome Deloitte takes a different approach.

Think Big begins with a discovery stage to build a clear understanding of the challenges faced. This “problem-finding” stage ensures we identify and define correctly what the problems are before developing solutions.

Start Small, because it’s easy to go too fast too quickly, particularly when tackling innovation projects. It’s essential to follow a plan with achievable steps and to recognise how much is too much for your organisation or city.

Scale Fast, means implementing a system that is capable of ramping up quickly to get results at scale when you move beyond the pilot stage. It is achieved using data lakes deployed in the cloud. Data lakes provide the ideal repository to collect, process and share data from the millions of IoT devices and mobile apps that enable smart cities. This is because data lakes can store all types of data (structured and unstructured) from any sources in real time and in their original format. Without the need to structure the collected data, systems can scale rapidly to data of any size. Working with data from all different sources, data lakes enable users to run different types of analytics (accessed via real-time dashboards) to uncover insights, find new trends and guide better decisions.



Our approach is to utilise the 360° Smart City Framework and focus on a short Test-and-Trial phase. Deloitte works with local actors, the community and government to quickly build and run simulations to refine the best solutions to achieve three goals:

01. A positive quality of life – creating a great place to live and minimising the hassles of city life;
02. Economic Competitiveness – creating the conditions for a business-friendly and healthy economy;
03. Sustainability – promoting sustainable living that safeguards economic growth for the long term.

This approach will result in better decision making and the realisation of smart solutions that can be scaled.

Within the 360° Framework, there are six elements (or “Domains”) that cities can leverage to support their smart city objectives: education, the economy, transportation and mobility, security and public safety, health and living, environment and energy.

Education: Virtual learning, digitisation, and augmented reality transform the way we raise education levels and improve the workforce’s skills to meet the job needs of the future. Smart learning is more accessible and personalised – allowing individuals to pursue only the coursework they need for their personal goals. Connecting students, teachers and outside experts paves the way for lifelong learning and a workforce capable of re-skilling to match changing job market requirements.

Economy: How do we generate revenue from local businesses, and attract new businesses to create job opportunities for a growing population? Advances in technology help cities streamline government procedures, such as permitting and licensing, providing more efficient customer service to businesses. Digitisation and big data analytics improve city regulators’ ability to track performance and outcomes.

Case study: In India¹, Deloitte is providing overall program management and technical support for India’s mission to develop 100 smart cities by 2022. Launched by the government in 2015, Deloitte is heavily involved in key areas including policy development, process improvement and innovative financing. Deloitte identifies and recommends remedies for bottlenecks in the implementation process and evaluates proposals and potential partnerships. We also monitor best practices and lessons learned to educate other cities facing similar challenges.



¹ <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/process-and-operations/us-cons-smart-cities-client-stories-india.pdf>

Transportation and Mobility: A growing population and workforce require mobility. In a smart city, transport apps enable ridesharing and end-to-end trip planning across all modes of transport, helping tackle traffic congestion. Autonomous vehicles, dynamic pricing, IoT devices that collect and exchange data, and advanced analytics enable more people and goods to move faster, safer, cheaper, and cleaner.

Case study: Deloitte helped the Portuguese city of Cascais launch MobiCascais in 2016, a mobility app that integrates different public and private transport services into one single collaborative ecosystem². Using one app, people can plan and pay for a seamless journey that includes public transport, taxi, carpooling, bike sharing and parking.

Environment & Energy: Technology enables cities to maximise the efficient use of resources and encourage smart choices by everyone — the city itself, businesses, universities, hospitals, non-profits and individuals. Sensors detect leakage to preserve natural resources, such as water. Responsive devices (e.g., washing machines) temporarily stop consuming energy when demand for energy (and prices) increase. Cities use behavioural economics and gamification to encourage positive resourcing decisions.

Case study: In Jordan³, Deloitte worked with the Amman local government to improve solid waste management by launching the CityPerform project in 2015. Previously waste management operations were inefficient, with trucks not completely filled while others skipped stops due to volume limits. After building an overall understanding of the institutional, financial, and technical aspects of the city's waste services, CityPerform was rolled out in multiple phases. The pilot project laid the foundation for a continuous process of measuring performance and making critical adjustments to waste management operations over time. Dashboards using data and visual graphics track route optimisation, wait time, customer feedback, collection efficiency, and staff utilization on a real-time basis.



²Scott Corwin, Jeff Wood et al, "Toward a mobility operating system: Integrating the future of mobility," Deloitte Insights, October 9, 2017, https://dupress.deloitte.com/content/dam/dup-us-en/articles/4169_FoM-Mobility-operating-system/4169_FoM%20MoS_FINAL.pdf.

³<https://www2.deloitte.com/jo/en/pages/about-deloitte/articles/Deloitte-works-with-Amman-Municipality-improve-internal-management-practices.html>

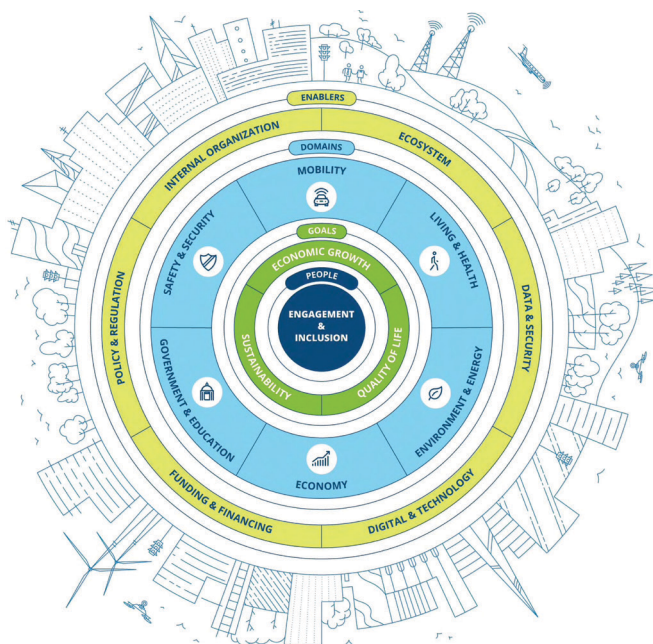
Security and public safety: Drones, wearable computing, crowdsourced data and facial-recognition help police fight crime and protect public safety. Secure platforms and clear governance ensure that data is safeguarded against cyber threats. Smart tools provide residents with an easily, accessible way to navigate city services.

Case study: Orange County, California⁴, approached Deloitte to improve how the public works department addressed service requests and managed its resources. In April 2017, the department launched “myOC eServices” – a web- and mobile portal that gives residents an accessible way to navigate city services, and submit and check the status of requests. Within four months, the average resolution time dropped from as long as 20 days to four. The solution provides visualisation capabilities that enable the department to pinpoint problems, deploy resources and send real-time updates to citizens. The platform offers other capabilities, including permitting, enforcement and inspection functions which Deloitte is currently rolling out as part of a second phase.

Case study: Deloitte helped the Argentine city of Buenos Aires⁵ streamline the process its citizens use to submit complaints, from fixing a pothole to removing graffiti. Previously the feedback mechanism was largely ineffective since the city averaged almost two years⁶ in addressing complaints. Deloitte’s solution and included a mobile app that citizens can use to submit complaints. The average time to resolve a complaint has now plunged 93% without additional budget.

Health and living: Cities promote connected communities by designing and facilitating public spaces that encourage people to interact and engage with each other. Smart buildings, health care innovation and the use of data to monitor and enhance social programs all contribute to improved quality of life and sustainability.

Case Study: The Edge⁷, Deloitte’s state-of-the-art office in Amsterdam, The Netherlands, is the world’s most sustainable office building and has the certification to prove it. The Edge produces more electricity than it consumes, while rainwater is collected and used to flush the building’s toilets and water its gardens. Sensors make The Edge an interesting and enjoyable place to work, streamlining climate control systems, building security, maintenance, and more. Complying with data privacy rules, tracked personal data cannot be accessed by managers or anyone else.



⁴<https://www2.deloitte.com/content/dam/Deloitte/us/Documents/process-and-operations/us-cons-smart-cities-client-stories-orange-county.pdf>

⁵<https://www2.deloitte.com/content/dam/Deloitte/us/Documents/process-and-operations/us-cons-smart-cities-client-stories-buenos-aires.pdf>

⁶Alvaro Casalins, “Digital Transformation: Modernizing the Buenos Aires City Government,” Meeting of Minds, October 24, 2016, <http://cityminded.org/modernizing-buenos-aires-city-government-17341#>

⁷<https://www2.deloitte.com/ru/en/pages/about-deloitte/articles/gx-the-edge-of-tomorrow.html>

Section 3. Improving city functions with a single platform to coordinate and share data

Many smart city schemes are busy collecting a deluge of data they don't use or share citywide.

By not sharing and analysing data across a city's functions, these schemes fail to capture data-driven insights that lead to better decisions, responsive services and greater efficiency.

Deloitte's smart tool – CitySynergy™ – is a customer centric and process driven platform that integrates all the vertical city services and legacy systems that run a city. These include transport, traffic management, Wi-Fi, smart parking, street light management, waste collection, and video surveillance among others.

It allows city stakeholders to speak a common language as they decide together how new tools can improve the experience of city life. The platform is co-designed with City of Cascais and further enhanced using real world use cases.

At its core is the Digital Command Centre (or DCC) – a place where existing staff can monitor in real time what's happening across all services and respond to events with actions driven by data insights.

This core feature is missing from many smart city projects today. Without a central place or command centre to capture, process, share information across city functions, smart city initiatives become siloed. Consequently, their service function is not improved by insights based on data captured and shared across the city.

CitySynergy™ is a proven and tested platform as a service that incorporates capabilities from various smart city projects. High upfront costs can be a barrier for some cities, but CitySynergy™ is available as a pre-packaged subscription.

Previously, many smart city pilot projects were designed for a particular use case and service domain. Which meant it was not possible to roll them out to a large scale without first re-implementing them.

CitySynergy™ is built on top of a modular architecture that makes it flexible and easily scaled as services expand.

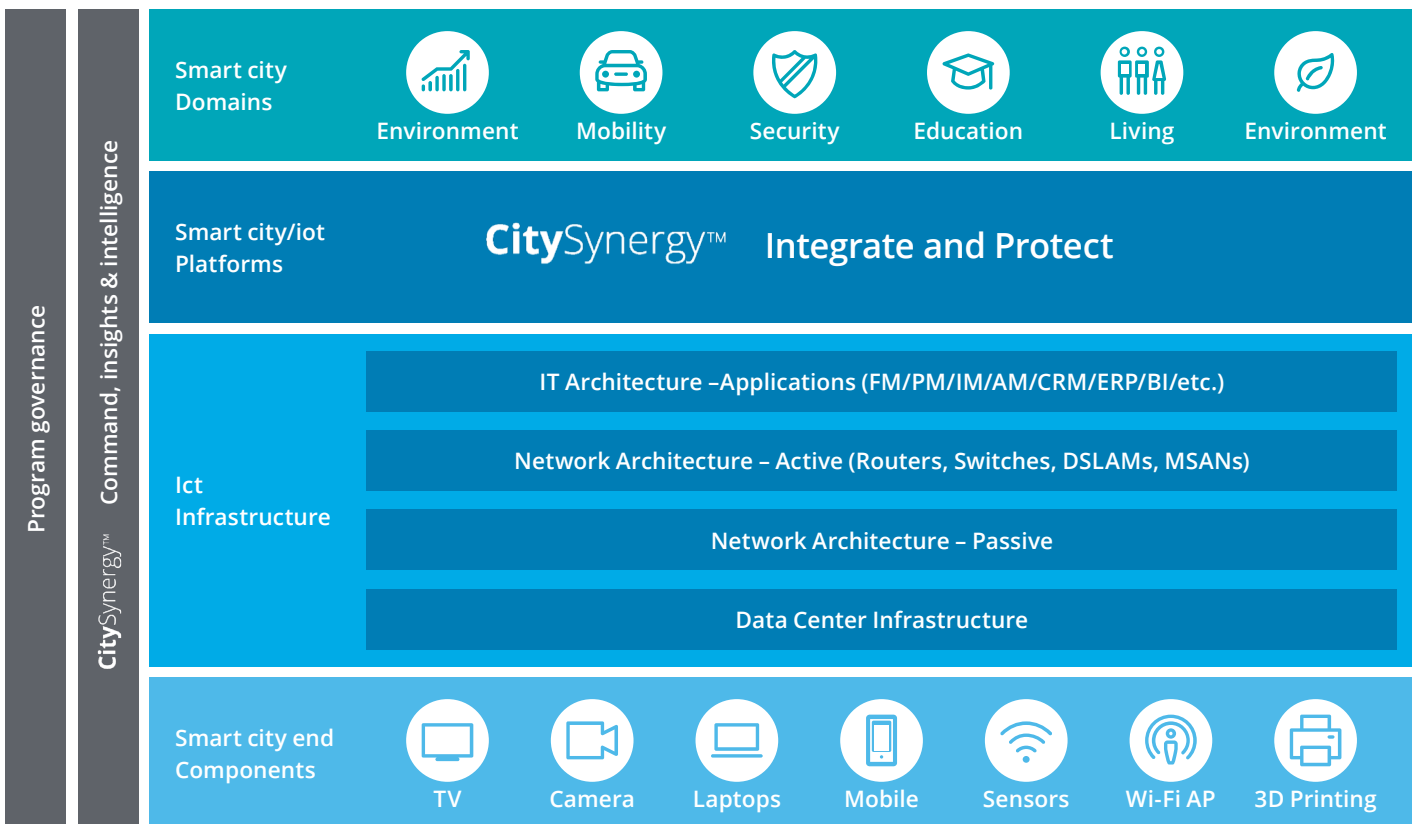
Deloitte works with each city's partner ecosystem to guide them on integrating multiple service domains. This work sets up the necessary guidelines, including the type of data they can capture and share, to ensure a project's success.

Case Study: Deloitte helped the Portuguese city of Cascais establish a collaborative and effective smart city ecosystem composed of more than 30 city partners. The city's legacy systems were integrated with its smart city operations using Deloitte's Digital Command Centre and CitySynergy™ solutions to manage the complex smart city environment.



Real-time data analytics help cities improve decision making and continuously prioritise and respond to events efficiently.

The DCC also helps cities stay connected with citizens and address their concerns through tools, such as mobile apps, where citizens can photograph and report incidents and problems or plan and pay for mobility services.



Leveraging the power of the cloud - AWS

Smart cities generate enormous amounts of streaming data from sensors and other devices. Capturing, storing and analysing this real-time data from millions of devices requires significant computing capacity.

CitySynergy™ is built on top of AWS, which enables our platform to respond rapidly to change, as well as providing agility and innovation via its built-in cutting-edge AI and analytics capabilities. Deloitte partnered with AWS because alongside data security, privacy and reliability it offers other key benefits including:

- Rich communication via multi-channel engagement;
- Data analytics and insights by leveraging AWS machine learning services;
- Scalable and resilient Infrastructure as a service (IaaS)
- Easy integration of services masking legacy integration complexity;
- Access to a vast range of IoT and AI solution capabilities (such as AWS IoT, AWS IoT Greengrass, Amazon Pinpoint, Amazon Rekognition, Amazon Polly, AWS Lambda and Amazon SageMaker).

Section 4. Summary: the integrated digital city

Smart city technologies present a compelling solution to the problems caused by urbanisation.

Although the digital transformation of cities has not yet happened at scale, technologies have progressed, along with ideas and strategies to make the transition practical and financially feasible.

Because no two cities are the same, Deloitte advocates using a holistic approach to help city and state management, infrastructure and service providers implement smart city solutions.

This process begins with our 360° Smart City Framework to build a clear understanding of the challenges and reveal the smart city goals appropriate to each city's unique situation. This "problem-finding" stage involves working with local actors, the community and government to refine a plan with achievable steps.

Alongside our 360° Framework sits our smart tool – CitySynergy™ – a proven and tested platform as a service that integrates all the city's siloed platforms so that:

- data and insights are shared securely across all functions;
- it delivers operational efficiencies via optimising processes; and
- citizens connect and collaborate with services.

At its core is the Digital Command Centre (or DCC) – where staff can monitor in real time what's happening across all services and respond to events with actions driven by data insights. This core feature is missing from many smart city projects today which collect data, but don't use or share it citywide.

CitySynergy™ is built on top of AWS's managed cloud service and IoT solutions which offer key benefits including data analytics and insights by leveraging AWS machine learning services (like Amazon SageMaker), and easy integration of other services.





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