

Creating cities of the future today

**How digital is
transforming
an increasingly
urbanized world**



**Business
Services**



Smart cities: lands of opportunity

The smart city revolution is underway and in the process of transforming how we live, work and entertain ourselves. Smart cities, built on foundations made from traditional infrastructure married to the latest digital technology, are the future of urban habitation and commerce.

According to the United Nations¹, by 2050 the world will be home to 2.5 billion more people, of which 2 billion will be in cities, bringing the urbanization rate from 50% today up to 70% by 2050. Resources will be scarcer, as energy consumption will have increased by 36% between 2008 and 2035. Today, 80% of greenhouse gases are generated by the world's cities, and cities are responsible for three-quarters of worldwide energy and resources consumption².

These changing factors in global demographics and habits have had an impact on countries' economic and social development, to the extent that, according to McKinsey, by 2025 the world's 600 leading cities will generate over 60% of global growth³.

Smart cities can help manage the challenges faced by the urban environment including rapid population growth, climate change, and their consequences: pressure on basic services such as access to clean water, housing shortages,

increased pollution, increasing levels of traffic on our roads and more. Smart city technology spending around the world already reached \$80 billion in 2016 and is expected to grow to \$135 billion by 2021, according to IDC⁴.

A successful smart city project requires the right ICT infrastructure to allow transformation of the urban environment, smarter and more efficient urban operations, and attractive environments that improve quality of life.

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But first, what is a smart city?

A smart city is an urban destination that leverages digital technology to improve efficiency, attractiveness and quality of life for residents, workers and visitors.

Projects can cover any part of the urban environment, such as: downtown business areas incorporating smart buildings to improve the working experience; smart stadiums where connectivity and digital services deliver a next-generation experience to sports and music fans; smart districts and smart precincts where local services are coordinated using data and digital tools to make life better for all; and city or territory-wide projects that center on renewing ageing urban infrastructure.

A common thread through all smart city projects is that they employ IoT sensors, artificial intelligence (AI), automation, big data, hypervisors and other digital technologies to connect components and layers of the city, air to the roads to underground. Smart cities utilize this connectivity to derive data from everything and then use that data to improve their efficiency and ultimately provide better services to improve the lives of citizens and improve communication between citizens and public bodies.



Leading the way: Dubai's Silicon Park setting the standard

Q1 2019 saw the full launch of the first services at Silicon Park, a project on which Orange worked, and the first smart city introduced as part of the Dubai Silicon Oasis initiative. The Silicon Oasis is a free trade zone powered by technology and with an emphasis on efficiency. The project includes energy management tools like smart metering, irrigation and street lighting, all designed to achieve efficiencies in energy consumption and make the best use of renewable energy resources. A LoRa™ network and network core on premise plus business intelligence and data analytics, digital signage and way finding services and security systems integration all ensure an enhanced experience for residents and visitors.



Urban infrastructure: the smart city enabler

Smart cities projects answer challenges such as aging legacy infrastructure, siloed systems and the development of new urban areas and services, while addressing critical security vulnerabilities.

Smart cities are built on technological infrastructure, including the fiber cabling and wireless networks that provide the infrastructure to carry data, the sensors that create the smart city elements such as connected lamp posts, waste bins, traffic lights and smart signage, the back-office servers and analytics that process the data, and the connected buildings themselves. A successful smart city is one that can incorporate these multiple elements of infrastructure into one connected, codependent whole for the good of all residents, workers and visitors.

All this connected infrastructure generates lots of data, data that needs to be aggregated, normalized and consolidated so as to be used to create an efficient city and services. The goal for a smart city should be full interoperability of data, applications and technology.

The vital role of Master System Integrators (MSI)

Orange Master System Integrator (MSI) role covers supply, installation, configuration, integration, commissioning, operations and maintenance of Smart City or Smart Building solutions. MSI works alongside technology vendors and manufacturers to deliver cross-system integration with complete interoperability.

Working with a master systems integrator can give cities the support they need in both cases, and can help smart city stakeholders understand what solutions will best answer their needs and what the associated business case is.

When data is available, they will help translate it into real operational insight and valuable decision-making support so as to best match the initial business case that was established. MSIs will also make sure all systems communicate properly together and they collaborate with stakeholders to ensure systems information is easily accessible and usable. They also develop software layers to manage integration, aggregation and communication of systems at various scales, including building, district and territory.

MSIs can become key strategic partners that work alongside technology vendors and manufacturers but also energy providers, civil engineering firms and real estate companies to help cities deploy full end-to-end smart solutions that are tailored to any type of site.

Greenfield vs brownfield sites

Developing a smart city on a new, greenfield site offers the chance to start from the ground up, to plan from the basic architecture stage and include smart systems and digital services within building and site design.

A brownfield environment on the other hand, means adapting to existing and legacy built infrastructure, systems and technologies and establishing what areas you need to address and in what order. Both types of build require a solid strategic vision and in-depth planning.



Systems of systems

Cities are highly complex and involve many fundamental systems that residents need, such as energy, water and sewerage, food, transport, health and biodiversity, plus also economic, social and cultural systems. Smart cities create a “system of systems” from this encompassing network of systems, by building interconnections and flows between them.

In practical terms, what this means is that all the objects and devices, once connected, become “smart” and start to generate and process data. All these connected objects and devices are linked to the city infrastructure to become a smart system within the overall city. In turn, these assorted systems under the city umbrella, such as transport networks, public services, health, education, and sanitation, can be made to interconnect, share data, and interact with each other to improve the experience of living and working in the city.

An example comes in the form of connected cars and other smart transportation systems that can communicate with other city systems. This provides travel and user information to government, businesses and other residents. In a system of systems, the data this creates can positively impact the environment, traffic flow and the overall daily living experience. This is systems thinking in a smart city: the city operates as a set of components that are interconnected for the purpose of improving the whole.



Connecting the smart city: the networks question

With so many different connected objects and devices all comprising smart systems within the city, getting connectivity right is paramount. What networks should smart cities deploy to power all its new smart services?

To begin with, it is important to understand that there is no one-size-fits-all option. Furthermore, what networks are right varies from country to country and depends on the use case in question. A smart office building will require different connectivity to an industrial site, or to IoT sensors on street furniture.

In practice, smart cities will be a well-planned out combination of networks including fiber, LoRa™, Wi-Fi, Bluetooth, Zigbee and 5G will provide the next-generation network infrastructure that powers IoT and supports all kinds of other use cases. To give the required control and centralized management of network resources, a software-defined approach is also advisable.

Smart city planners can use “digital twins” that model smart cities to establish what network works best for each use case. Digital twinning means creating a digital replica or representation of a system, process or place that replicates its real-world behavior, providing a real-time collection of data, models and algorithms that enable better real-time analysis of assets as well as the possibility to make simulations of potential scenarios. This can be helpful when a city wants to observe the impact of hosting a large-scale sports or cultural event: on traffic, on the flow of movement of people, on energy usage and more.

How smart city infrastructure solutions deliver results



Networked street lighting: 50-60% reductions in operations and energy costs, 6-year ROI



Connected trash bins: 40-80% cost reductions



Smart parking: vehicle miles per day reduced by 30-40%, with a 30% reduction in emissions



Smart buildings: 20% energy consumption reduction

Urban operations: making it all work

Smart cities can help address operational challenges, including high costs, limited degrees of public expenditure, the need to manage daily operations efficiently and ever-growing volume and complexity of data.

Making such a multifaceted undertaking all come together and work is no easy task. Cities are increasingly complex, with more waste to collect, more populated areas to secure, more services to provide and more infrastructures to maintain – adding up to higher operating costs. Alongside that, cities are often constrained by a lack of adequate funding and limited public spending plans, which puts them under pressure to manage daily operations more efficiently. Further to this, smart cities will have ever more connected devices and objects, producing a bigger volume of data to manage.

What is needed is an integrated open data platform that brings all this data from the millions of data-generating sources together under one umbrella and enables its analysis and exploitation. Cities that deploy smart platforms to manage data from water supply companies, energy providers, road and traffic authorities and more enable themselves to operate smarter, more efficient urban operations overall.

This goes hand in hand with managing the data appropriately and ensuring it is secured correctly. Defining the right governance is key to producing the expected gains efficiency and new revenue streams.

All about the ecosystem

Running a smart city effectively means having the right planning, strategy and partners in place to maximize your chances of success. Getting your ecosystem right from day one is the best way to achieve results and sustainability.

The ecosystem comprises the city itself, the project owners whose responsibility it is to define and plan the smart city project and who must also find the funding to finance it. There are real estate organizations like architects, building contractors, construction companies, controllers of districts and public spaces, and city operating entities that are responsible for street furniture, lighting, traffic lights and transportation.

It also includes technology providers like telecoms companies and vendors, hardware and software manufacturers who develop turnkey mobility, energy, security, building and infrastructure solutions, plus also start-ups and disruptors able to bring local level talent and digital innovation to the table.

The aforementioned MSI approach will help in managing this complex ecosystem, and ensure the resulting dynamic matches the initial business case set up. It will provide city managers with a single point of contact to drive adjustments and changes where needed.

The importance of open data

This wide range of stakeholders need to work collaboratively to optimize smart city operations and to ensure that everything works. A key operational goal is to break down silos between the different stakeholders, systems and data. Smart cities need systems and services that are interoperable and secure, so as to provide tangible benefits on the operational side.



Charles de Gaulle and Orly: sharing data to make smarter airports

Breaking down silos can refer to sharing data between two or more entities: for example, Orange has worked with the two major airports in Paris, Charles de Gaulle and Orly, on their transportation systems to analyze traffic flows between the two, anticipate peaks, plan stops and destinations for passengers and adapt timetables. Real-time population movement analysis, measurement of travel times and monitoring and analyzing the ratio between travelers and airport workers all helps drive efficiencies. The airports have seen improvements in performance of transport networks, and been able to implement new routes and better organize timetables.

Connecting data sets and systems through APIs

Application programming interfaces (API) play an important role in delivering services to citizens. For example, one smart city developer offers an all-in-one tool that treats the building like an iPhone. This ensures that tenants have access to new smart services and solutions like an end-user has access to apps, which can be upgraded or enriched over time. Tenants and other third-party developers are given access to open data sets and APIs and encourage to build their own apps and services. This progressive type of smart building solution could be the future of smart city buildings.

Improving citizen services with the help of Data Analytics

Data analytics is essential to drive a continuous improvement of services and to find new, more effective ways of providing services using digital technologies. In France, the Compagnie du Mont Blanc and the Chamonix Tourist Office have employed data analytics tools to analyze millions of data points from visitor smartphones to understand customer habits and wants. Through this data analysis they are able to accurately adjust marketing strategy, optimize incoming and outgoing flow of visitors in train stations and improve overall operational efficiency.

System of systems thinking can apply here again, and the ecosystem should look at urban operations as an interconnected network in which partners, vendors and city entities all work together to achieve success.

Urban operations: making it all work

Technology enablers

Technologies that will play key roles in urban operations include:



Big data: in conjunction with data analytics tools, big data will be vital in developing and implementing systems and services that give an ongoing enhanced user experience to residents, visitors and workers



AI: will be fundamental to smart cities and systems of systems thinking. For example, in cognitive buildings, where intelligent technology now exists to make the surrounding smart city environment interact with you, where technology can react and respond to the behavior of people nearby. AI will also be significant in enhancing building and service utilization and interaction, since it is able to learn from users' habits



Blockchain: the decentralized ledger technology offers the potential for improved operations in real estate companies in smart cities, for example for smart contracts. Dubai, where smart city projects are to the fore, already have this as a nationwide implementation for example



Cloud: essential for sharing data among all stakeholders in the smart city, particularly important to systems of systems thinking



Cybersecurity: to prevent hacks of the IoT network and devices, keep control on the privacy and integrity of the data generated, including being compliant to applicable regulations such as GDPR



Open Data: National Address Base

A good example of an open data scheme for smart cities is France's National Address Base, an open source database headed by the General Secretariat for Modernization of Public Action (SGMAP). It is a collaborative initiative that uses open data from civil services and state agencies across France, including IGN, La Poste, Etalab, and OpenStreetMap France, and also invites citizens to contribute more accurate location data to help improve emergency response times, facilitate more efficient public/private partnerships and enable enhanced spatial analysis of under-utilized areas.



Quality of life: the city is the experience

Smart cities can make cities a great place to live and work while also making them attractive to inward investment, business and visitors. It allows authorities to address challenges such as transport congestion and environmental issues like rising air pollution.

Improving daily life for everybody is the driving force behind many smart city developments, and there are fundamental areas where city operators can make noticeable and measurable gains.

The government of Gujarat in India chose to work with Orange to install smart public safety and security infrastructure throughout 140 cities as part of its “Safe and Secure Gujarat” initiative. The project will incorporate surveillance and intelligent traffic management systems designed to reduce crime and traffic violations and in addition to computing infrastructure, storage, network, applications and IT security at state command control centers, will also include high-end IP surveillance cameras running on video management system equipped with video analytics, auto number plate recognition (ANPR), traffic signal violation and speed detection systems.

Reducing traffic congestion is another key target. Smart traffic lights offer a solution that in Pittsburgh, USA, has proven to reduce travel times by up to 25%⁵.

Smart traffic lights work by “talking” to one another, with intersections controlling their own local traffic by watching the approaching traffic through video cameras and radars, then building a model of that traffic. In real-time, intersections construct a timing plan for allocating the green light in order to move the traffic in the most efficient way possible.

In addition to reducing travel times, smart traffic flow solutions that utilize IoT sensors can also impact the environment positively and help lower pollution levels. In Las Vegas, sensors installed around intersections read carbon dioxide content in the air and apparent traffic patterns, then determine whether it is beneficial to make the light cycle shorter so cars are not idling and generating harmful fumes unnecessarily.

Public transport is another area where digital solutions can have a big impact. In New York, smart technologies save commuters almost 15 minutes per day on average. In developing cities with more arduous commutes, that could be as much as 20 to 30 minutes every day⁶.



Citizen engagement

Research shows 51% of citizens say they want more digital interaction with public bodies⁷, making citizen engagement both a goal of smart cities and also a way in which they can enhance daily life for residents.

Citizen engagement is not only about getting people to buy into the project and to begin using services. It can also give city officials the tools they need to manage relationships with citizens better, to encourage voting and participation and more. They can use digital solutions to create polls for citizens to find out about what types of services they want to see, or how they want the city to use its budgets. Smart digital solutions that can drive citizen engagement

include citizen applications, e-government tools, voting and polling tools and more besides. Orange worked with the French ski resort of Montgenèvre to digitally transform the mountain experience for visitors and residents and to drive economic development and tourism. Increased engagement was achieved by developing a mobile app offering numerous micro-services with real-time information about the resort, underpinned by real-time data analysis of visitor demands. Awareness of activities and events and overall engagement were boosted.

That interactivity can be powered by solutions like AI, machine learning and chatbots, which can be used to engage citizens with their

city environment. Similarly, quality of life and citizen engagement can be enhanced through open data, using Software as a Service (SaaS) platforms hosted in the cloud to enable government bodies to collect, aggregate, store, transform and visualize data, which they can use to develop new services. This data can also be shared with citizens to allow them to contribute to the city's development in an open, controlled and sustainable way. According to Gartner, citizen engagement and the enhancement of services and experience will be “critical” to smart cities' success⁸.

Smart building solutions

Very similar solutions and challenges to the above apply in the compact environment of a building. Their effect can actually be more pronounced as the environment is more homogeneous and less complex, allowing for better returns on investment.

- IoT sensors monitoring temperature, air quality, room occupancy, utilization rate of facilities such as bathrooms, restaurants and meeting rooms
- Building management systems (BMS)
- Hypervisor platform
- Geolocation services
- Mobile app to enhance user experience
- Incident detection by users rather than by facilities teams
- Site better embedded in its immediate vicinity, improved links with neighborhood

Stakeholders and funding

There are multiple different stakeholders involved in a smart city ecosystem, from the building industry to the telecoms industry, and cities need to ensure they have the right people in place. Smart cities should consider employing a digital director, like a CDO, charged with leading and developing digital strategy, and with clear decision-making authority to streamline planning and build key relationships.

A policy of Open Innovation with citizens, to drive and encourage their digitization, is advantageous and makes it easy for the larger smart city ecosystem to tap into.

Many smart cities projects use public/private partnerships (PPP) for financing. In fact, with just 16% of cities presently able to self-fund required infrastructure projects⁹, PPPs look like being the way forward. Another alternative is the concession model, where one actor leases to the city under an OPEX model.

Action plan: next steps

Maximizing the chances of success for your smart city project naturally depends on your position and role within the ecosystem, and it is vital to remember that you cannot achieve success all by yourself. A useful set of first principles includes:

- 1** Identify the right ecosystem of smart city partners and stakeholders around you
- 2** Source appropriate funding: PPP may be the best way forward for your project
- 3** Consider working with an MSI to leverage their expertise in managing multiple suppliers across different disciplines
- 4** Put a defined strategy and plan in place, complete with your business case including savings and new revenue streams generated by technologies deployed
- 5** Consider appointing a CDO to act as your smart city project champion
- 6** Share the pains and benefits: there are many networks of urban actors that are very helpful in sharing experiences, dos and don'ts
- 7** Define what your data strategy is and what governance you want to put in place, including the question of data privacy



Why Orange?

Our end-to-end approach and integrator expertise ensure you have the right partner

Our experts have many years of operational experience, innovation expertise and market best practices and can help you define, drive and implement your digital strategy. They will work with you to deploy and manage your equipment and complex multi-vendor projects effectively and efficiently.



Consulting

Define the scope of your project: from strategy and roadmap to delivery



Design

Select the right ICT technologies to support your Smart City project



Build

Implement, integrate and deliver with the right ecosystem of partners, vendors and local suppliers



Operate

Operate the solutions and measure results

Whether you need state-of-the-art solutions and innovative digital services for greenfield projects or support in developing sustainable smart areas and districts in brownfield locations, we can support you every step of the way in planning and executing your smart city initiatives, all underpinned by world class cybersecurity.

Through well-designed and orchestrated projects, citizens are happier, urban operations are more efficient and sustainable, and the city is more attractive to businesses, new residents and tourists alike.

Find out more about how Orange Business Services can help with your smart city transformation by visiting:
<https://www.orange-business.com/en/industries/smart-cities>

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