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Growing cities, greener cities

Europe is highly urbanised, with the majority of citizens living in cities that are evolving in response to changing societal needs. European cities are facing challenges such as pollution, congestion and impaired mobility, personal safety concerns and economic inequality. These pressures accentuate the need for investment in economic and environmental sustainability to become future-ready and to improve citizens' quality of life.

Among the many factors driving urban change, two have become particularly relevant:

The increasing focus on climate impact and the need to meet ambitious targets, for example the EU's goal of 100 climate-neutral European cities by 2030, outlined in the Mission Board for climate-neutral and smart cities.

More recently, the reshaping of work and learning as a result of COVID-19 has brought into sharp focus the need for adaptability and reliable technological solutions, and the need for governments to use data to make decisions that protect and enhance citizens' lives.

In this context, the digitalisation of cities, underpinned by emerging technologies such as 5G, IoT, edge computing and the further application of Big Data solutions will be key to the transformation of cities to meet these challenges.

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By working together, central and local authorities supported by infrastructure and application providers can help European cities achieve:

A more mobile future

The economic performance of a city is reliant on people and goods being able to move around quickly and efficiently. Connected mobility infrastructure can help cities optimise traffic flows and public transport services to reduce congestion and support citizens' mobility.

1 hour 20mins

European commuters spend over **1hr 20mins** per day getting to and from work.

92%

The average European car is parked 92 percent of the time, taking up much of the **50%** of inner-city land devoted to roads and parking spaces.
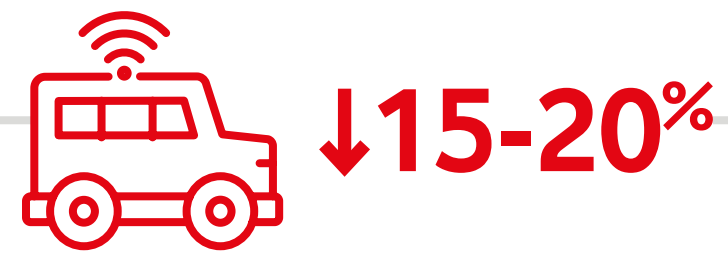
↓15-20%

Smart mobility solutions could reduce commuting times by **15-20%** on average, or approximately **15-20mins** per day, for the average commuter depending on the development of public transit systems.
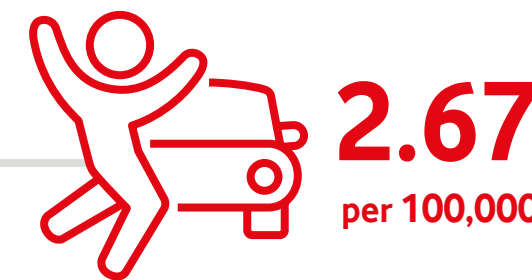
A safer society

By integrating mobility and security systems, cities can improve traffic flow for emergency response, increase driver and pedestrian safety, and optimise security management through better resource allocation.

583,000 assaults 5m thefts

In 2018, there were **583,000** assaults and more than **5m** non-violent and violent thefts across the EU27.

2.67 per 100,000

Traffic fatalities averaged **2.67 per 100,000** people across 16 EU capitals in 2018.

↓30-40%

Smart security features overlaid with smart mobility features in cities could help reduce crime by **30-40%**, shorten response times for emergency services by **20-35%**, and save **30-300** lives per year in a city of 5 million.
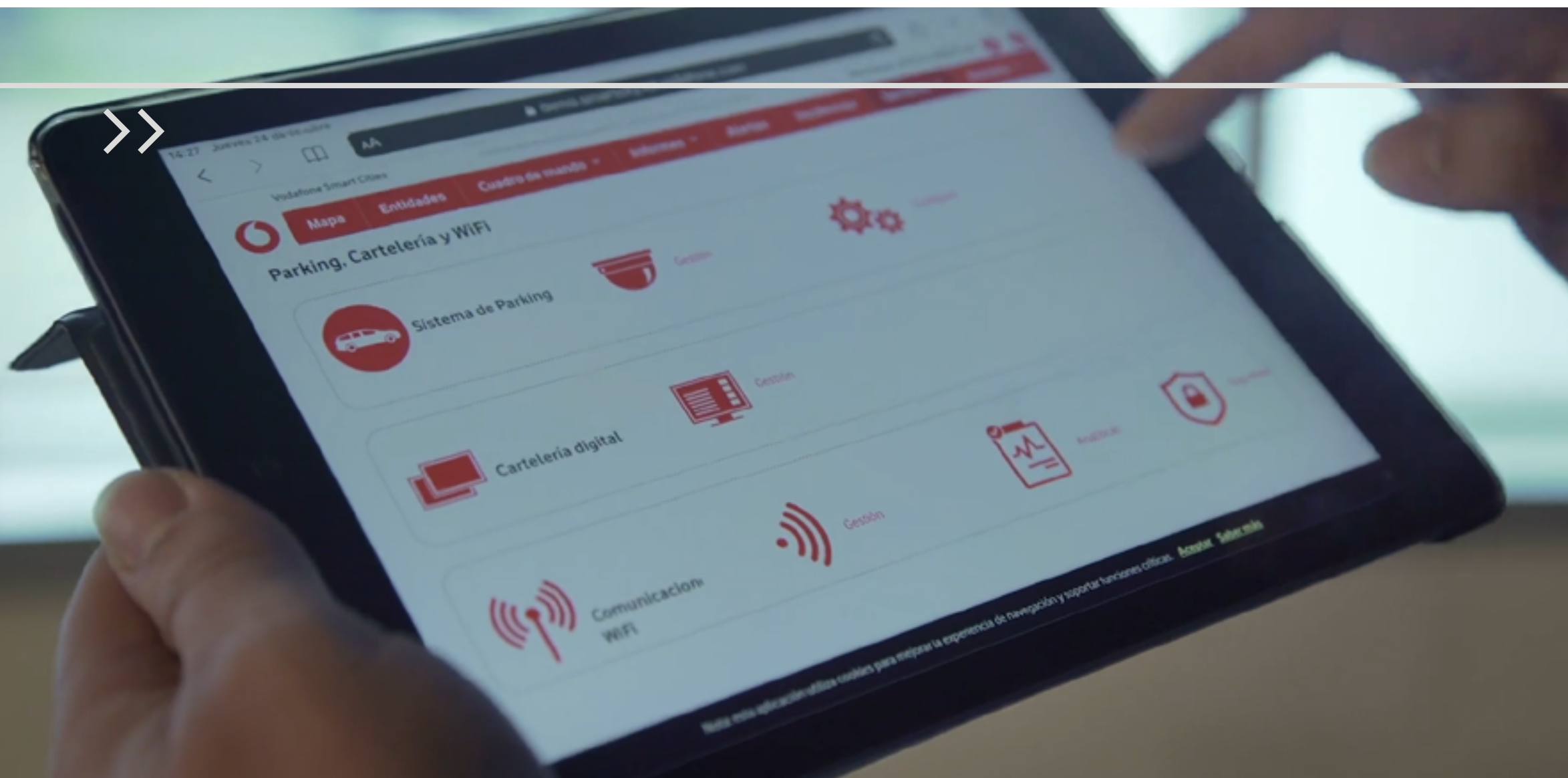
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Smart cities

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A healthier
environment for all

Overall, by managing congestion, emissions, and pollution levels with smart environmental and waste sensors, cities can help improve citizens' quality of life and make cities more attractive places to live and work in.

90%

90% of European urban citizens are exposed to pollutants at concentrations higher than safe levels, with up to a third of new cases of childhood asthma in Europe potentially caused by air pollution.
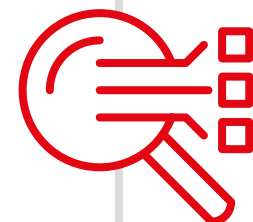
8 months

Particulate matter in the air also reduces European life expectancies by **8 months** on average.

11.1m tons

Across 15 EU capitals, **11.1m tonnes** of municipal waste was generated 2017, an average of 738k tonnes of waste per city, or **576kg** per person per year.[1]

8-15% months

Air quality improvements from smart environmental management could reduce disease risk by **8-15%**, while smart monitoring, leakage protection and control could reduce solid waste by **30-130 kg** per person, per year, and water consumption by **25-80 litres** per person, per day.

[1] Data (based on availability) for: Berlin, Bratislava, Brussels, Budapest, Helsinki, Lisbon, Ljubljana, Madrid, Riga, Rome, Stockholm, Tallinn, Valletta, Vilnius, Zagreb, Sofia

A more energy efficient future

More optimised mobility flows, paired with the shift to renewables and smarter management of energy demand, can help cities become more energy efficient, reducing overall energy use and greenhouse gas emissions.

72%

Cities account for the majority of overall energy use and **72%** of greenhouse gas emissions.

40%

Buildings (i.e. offices and dwellings) on their own account for **40%** of total energy used, and **36%** of greenhouse gas emissions in Europe.

75%

This is exacerbated by the **75%** of the European building stock that is energy inefficient.

5-10%

Upcoming research by Vodafone UK and WPI Economics finds that integrating smart technology into buildings could reduce building emissions by **5-10%**.

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benefits of an integrated, smart cities platform

Together, these opportunities point to a future for 'smarter' cities that are more efficient, sustainable, and adaptable. To achieve these benefits, it is not enough for cities to be connected; cities need to be holistically 'smart'. Cities will need to be able to use a variety of data gathered from different sources and sensors to improve services, ensure seamless integration of different city services, and evolve with citizens' changing demands.

The need for a centralised data structure has been made especially clear by the COVID-19 experience. For example, to respond to the rapid shifts in citizen flows and demands on public services, a centralised view of the data available was needed so that officials and market participants could digest the data, generate critical insights, make decisions quickly and take action. This need is likely to become more pressing with the expected evolution of European **post-pandemic structures**, and the need to continue to respond to the threat of climate change.

A single, shared and flexible platform, integrating and optimising usage of data from multiple sources, can deliver benefits to cities such as:

Optimising city services
by structuring data from different sources, such as mobility, transport and environmental data. This can also enable new ways of utilising city resources, for example re-routing traffic during school break times to reduce the air pollution exposure for children.

Enabling real-time insights that help cities
become smarter in managing resources and develop more sustainable municipal services by overlaying Big Data analytics capabilities across different types of data.
This capability can unlock important insights for cities that improve services, for example whether cities' EV fleet usage and parking could be optimised to store **surplus renewable energy**.

Helsinki aims to make it unnecessary for city residents to own a private car by 2025.

The city has developed an app called Whim that allows residents to plan and pay for all modes of public and private transport in one place. The app recommends how best to reach a destination based on real-time conditions throughout the network, taking account of all possible options and user's own preferences.
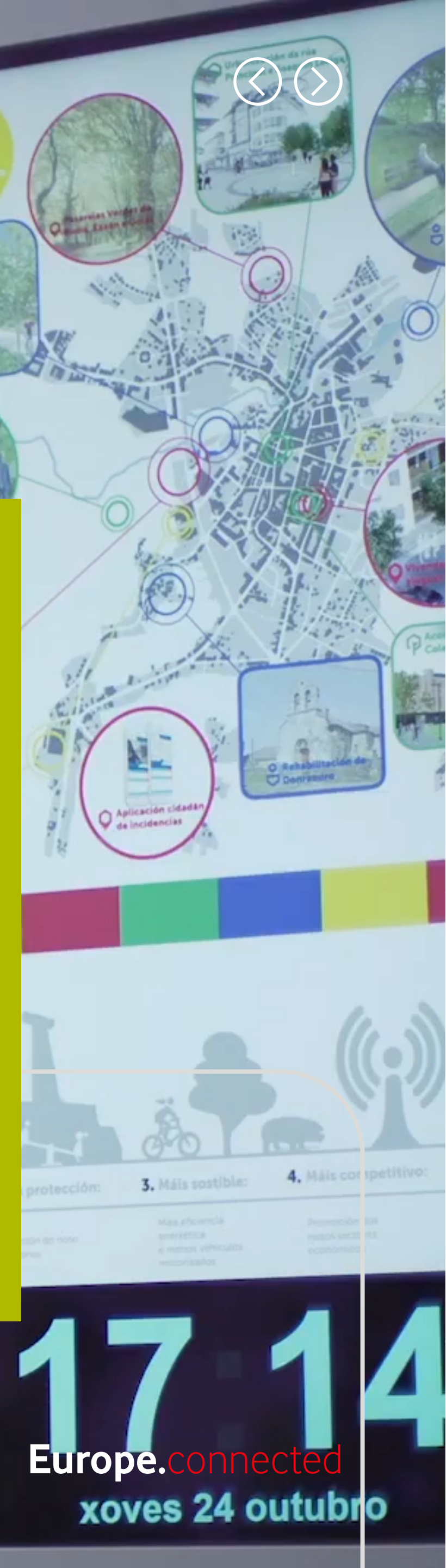
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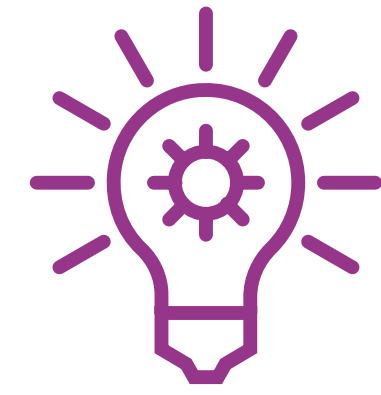Opportunity

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challenges to effective smart city strategies

Responding to these opportunities, many cities have sought to make various key systems 'smarter'. For example, cities have looked to install smart meters in public buildings and connect energy assets, such as solar panels on street lights, to the electricity grid. This is in addition to legacy municipal systems, such as traffic management systems. However, as these solutions have often been developed in response to then-vital needs, they have come at the expense of interoperability, with the consequence being a set of silo-ed municipal technology systems and services.

This lack of integration between legacy systems and first generation smart city solutions is a key challenge to making cities truly 'smart'. The data collected from specific platforms and systems remain within the original value chains, with limited sharing of data between platforms inhibiting the ability to unlock many of the opportunities from a smarter use of data.

To unlock this value, data needs to be shared between different systems; sensors and data need to interoperate and communicate together. However, integration on this scale remains challenging for many cities, even more so for larger and older cities, which have more legacy systems and infrastructure, are more complex, and are more likely to be characterised by silos.

According to a Deloitte report commissioned by Vodafone, only **43% of the potential value** from data sharing within city supply chains is currently being realised (e.g. city waste data shared with waste removal suppliers).

Similarly, only **25% of the potential value** from data sharing across different city services is currently being realised (e.g. transport data shared with energy management services).

In this context, Vodafone is working with many cities across Europe to provide a range of infrastructure, IoT and data solutions that deliver an integrated data platform to address these challenges. Acting as a close partner with municipal governments, Vodafone's data platform helps to make these cities smarter by integrating different services and potentially enabling municipal authorities to generate income that provides a sustainable economic basis for continued investment in smart city platforms.

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Spain in numbers

2nd: Spain's DESI 2020 rank for Digital Public Services

90%: Spain's score on the Open Data indicator, compared to the EU average score of 66%

Sevilla in numbers

Metropolitan area population of **1.5m**, growing by **11%** from 2010 to 2019

4th largest city in Spain, and the **30th** largest in the EU

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context

As the largest economic and urban centre in Andalucía, growth in Sevilla's metro area is inevitably linked to use and pressure on public services in the city proper. The city has invested in new solutions for specific municipal services to meet needs, particularly video surveillance and lighting. However, while these solutions improve the provision of public services, they were not built as part of an integrated 'smart city' strategy and platform, instead operating to date as discrete systems within their respective value chains.

Given its needs as a growing metropolitan area and economic centre, Sevilla received €19m in EU funding to implement solutions promoting integrated and sustainable urban development. The requirements for the solution were:
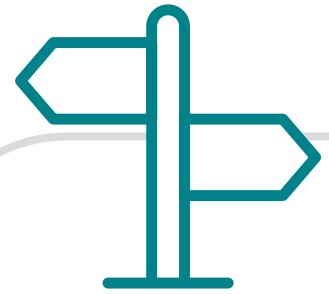
Flexibility to support different types of data produced by different public services ('verticals').
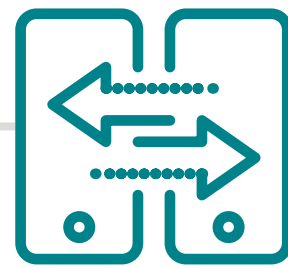
Ability to **integrate** with existing solutions to optimise the investments, in particular video surveillance and lighting.
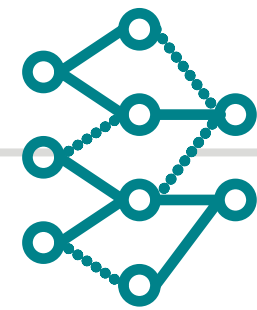
Analytically advanced to enable the integration and analysis of multiple datasets to drive optimisation of services, such as monitoring visitor flows and security during special events in the city.

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Vodafone is working with the Sevilla municipal government to integrate the Vodafone Smart Cities Platform, creating a single platform to monitor a wide range of its services. The Platform builds on existing systems to develop smart 'vertical' services, utilising Big Data capabilities enabled by ThingWorx Analytics.

The Platform is designed to provide transparency to public bodies, and by combining analytical capabilities with the integration of multiple data sources, it enables efficiency improvements and higher quality municipal services:

Energy
Using mobility data in different areas to adapt lighting needs, optimising energy usage to demand patterns and improving efficiency.

Mobility
Using citizen mobility data to identify required changes to bus frequencies or stops, making the most of limited public transport resources.

Environment
Using water consumption data and patterns to predict breakdowns / faults, ensuring efficient and effective continuity of services.

Security
Using security cameras to monitor capacities in public areas, allowing cities to better manage social distancing for COVID-19.

The Platform has delivered improvements to Sevilla's municipal services through solutions, such as the Security Vertical service, which monitors visitor flows and, by integrating different sources of data with analytical capabilities, allows for the prediction of critical events. The Platform is also deploying a number of other pilot project verticals, for example in smart management of parking, watering, waste collection, energy, and air quality.

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a fraction of the opportunity for Europe

Integrated smart city systems such as Vodafone's Smart Cities Platform enable cities to better manage a range of municipal systems and services holistically. This provides visibility of data from different sources on one platform and enables the overlay of this with Big Data capabilities, highlighting real-time insights and opportunities for further improvement in services.

To illustrate the benefits of integrated systems, it is helpful to focus on a key impact: the ability to manage cities' energy use based on a variety of data inputs by optimising mobility and avoiding energy waste.

This is particularly pertinent, as it can help to make European cities and, by extension, Europe, become greener and more sustainable for the future, while making progress toward Europe's emissions reduction targets.

Using estimates of energy usage savings in an **EU-funded project to implement smart energy and mobility solutions and an urban data platform in Munich**, it is possible to illustrate the potential impact if this were to be extended to the 80 most populous EU cities (roughly corresponding to 100m people). Depending on the area covered, the levels of energy usage savings can be significant and help Europe to move further towards its climate objectives.

It is worth noting that **these estimates represent only a small fraction of the full prize to be generated by smart cities**, and do not include additional benefits from time saved, maintenance cost efficiencies, and productivity gains from the integration of more smart solutions. Extending this concept to other European communities, including towns and villages, could mean even greater benefits to the environment from a sustainable and future-ready digital society.

Implementing a city data platform paired with smart energy and mobility solutions across the top 80 EU cities by population could yield:[1]

Annual energy[2] savings that are roughly one third the total electricity usage of Ireland or Denmark in 2018, and at 10.2 terawatt-hours - more than the total annual electricity used by countries such as Cyprus, Latvia, and Estonia.

A reduced cost to cities of €876m per year, in addition to further benefits such as maintenance cost efficiencies and time saved and productivity gains for citizens and businesses.
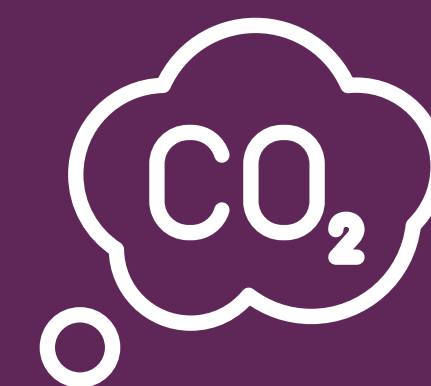
1,716 thousands tonnes less CO_2 emissions per year, equivalent to **2.1%** of the annual emissions reduction needed to meet the EU's 2030 targets.

[1]The illustrative estimation extends estimates from an **EU-funded smart city project in a portion of Munich**, applying a conservatively-scaled (50%) estimate for energy saved per m[2] to a portion (80%) of the land area for the top 80 EU cities by population (based on available data from Eurostat). Energy costs are estimated based on average 2019H2 non-household **gas** and **electricity** costs and **consumer oil and petroleum product** costs in Europe and the **average fuel mix for final energy consumption in the EU27**. CO_2 emissions estimates are based on a combination of the average fuel mix in Europe and **standard conversion factors by fuel type** (with emissions reductions estimated for the energy saved from fossil fuels only).

[2]This includes total energy consumed by end users, both across electricity, heating, and transport, and excludes energy used by the energy sector itself.

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