

# 'Fit for the Future' Cities

How technology can accelerate sustainable change



# CONTENTS

	Foreword	03
	Executive summary	05
<b>01</b>	How can smart solutions address the challenges facing cities?	12
<b>02</b>	How are cities embracing smart solutions today?	35
<b>03</b>	How does your city's profile affect your journey?	55
<b>04</b>	How can policy makers support the transition to a smart city?	65
<b>05</b>	Starting your journey to become a smart and sustainable city	73
	Appendix	87

# FOREWORD

It is estimated that today, 56% of the world's population lives in cities, and by 2050 the urban population will more than double its current size<sup>1</sup>. Within the European Union (EU) this proportion is even greater, with 75% of EU citizens currently living in cities<sup>2</sup>. This means cities also play an essential role in achieving the EU's twin green and digital transition, considering that cities alone are responsible for more than 60% of greenhouse gas emissions and 78% of the world's energy consumption<sup>3</sup>. To be successful, Europe must urgently find solutions capable of addressing the challenges posed by increased numbers of urban inhabitants, particularly mobility, housing and climate change.

Smart cities have a significant role to play in creating the more ecologically and economically sustainable Europe our planet requires. Smart cities are designed to improve citizens' well-being, create new job opportunities, and enhance sustainability through the efficient use of digital services and tools. The Internet of Things (IoT) is one such technology capable of accelerating smart cities and transforming everything from Europe's roads to its farms and factories. IoT solutions enable smart cities to monitor and reroute traffic around congestion in real time, to automatically schedule repairs for failed infrastructure like street lighting or bridge maintenance, and to intelligently manage energy use and pollution right across the built environment. It can also protect citizens and businesses from crime more effectively and safeguard vulnerable people in their homes. Such benefits have never been more important as the world's increasing urbanisation prompts complex challenges at a social, economic and environmental level.

The ability to build partnerships and align on a national and EU-level to invest in the technologies required to run smart cities will make the difference between success and failure. These are the findings of a new report commissioned by Vodafone and conducted by Opinion Matters, an independent market research company. In this report, 550 city

representatives were consulted across 10 European countries regarding their region's smart-city development, with the goal of fostering progress. Opinion Matters spoke to decision makers and influencers across Spain, Italy, Germany, Romania, Portugal, Czech Republic, UK, Turkey, Greece and Finland to better understand their attitudes towards smart solutions – where they currently are on their digitalisation journey, whether they value the use of connected technology, and, crucially, to help us uncover the roadblocks standing in the way of progress.

What rings loud and clear from these findings is the broad support for such digital solutions across Europe. In fact, many decision makers are already taking action:

- 88% of cities have already started their digital transformation journey.
- 72% believe that smart initiatives have been successful in meeting policy objectives.
- 7 out of 10 cities plan to invest in smart solutions in the future.
- 52% of cities planning to invest in smart solutions intend to spend between €2 million and €10 million.

However, whilst the majority have welcomed the challenge of digitalising their cities, there is still a way to go in achieving the European Commission's ambitious mission of 100 climate-neutral and smart cities by 2030<sup>4</sup>. Reaching a level of digital maturity will require strategic planning, execution and alignment. In addition, adequate funding and infrastructure are needed, and legislative and policy barriers must be addressed. Highly complex procurement processes will need to be simplified and learning opportunities provided, in order to address the privacy and safety concerns of those decision makers able to influence the digitalisation of Europe's cities.

These are some of the reasons why, if Malaga is chosen to organise the 2027 international exhibition, "The Urban Era: Towards the Sustainable City", the event will focus on the innovative solutions capable of creating truly smart cities. It will help build a dialogue around the new challenges faced due to urban growth. It will also provide a platform for companies to showcase the innovative products and services they're creating today, to address the sustainability challenges faced now, and in the future. We hope these efforts will further accelerate the adoption of smart city technology in Europe and improve the quality of life of citizens.

We believe that together, both the public and private sectors can accelerate change in these areas. And we hope that by providing a number of recommendations and information on the benefits and capabilities of IoT solutions, such a partnership can help all cities across the continent become truly smart front runners.



**Joakim Reiter**

Chief External Affairs Officer, Vodafone Group and former member of EU Mission Board for Smart and Climate Neutral Cities



**Francisco de la Torre Prados**

Mayor of Málaga

<sup>1</sup>According to the World Bank. See here: <https://www.worldbank.org/en/topic/urbandevelopment/overview>

<sup>2</sup>World Bank: Urban population (% of total population) – European Union, (accessed on 2022).

<sup>3</sup>United Nations: Generating power – Climate Action (accessed on 2022)

<sup>4</sup>See here: [https://ec.europa.eu/commission/presscorner/detail/en/IP\\_22\\_2591](https://ec.europa.eu/commission/presscorner/detail/en/IP_22_2591)

# EXECUTIVE SUMMARY

Smart city solutions can help to address a variety of complex challenges that cities are facing and EU support for this digital transition can help transform them into much greener and smarter hubs to live in.

We've conducted a large survey in 10 European countries to understand how cities are embracing change and adopting smart city solutions.



1

# HOW CAN SMART SOLUTIONS ADDRESS THE CHALLENGES FACING CITIES?

The EU's vision is for a green and digital transition for cities, and it's promoting a variety of initiatives to enable this transformation. Smart city solutions will make Europe's cities a better place to live and work in, by:



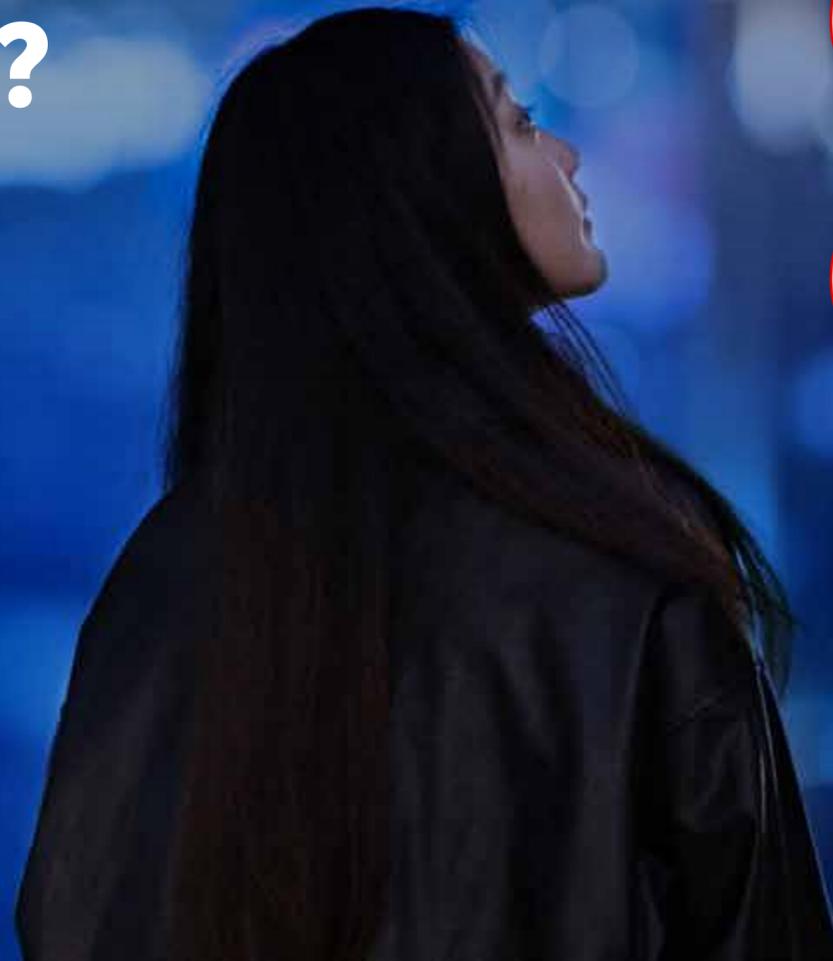
Enhancing citizens' well-being and quality of life



Attracting businesses and boosting inclusive growth and employment



Reducing carbon emissions, pollution, and levels of waste production



2

# HOW ARE CITIES EMBRACING SMART SOLUTIONS TODAY?

A survey of 550 city representatives from 10 European countries, combined with nine in-depth interviews with city representatives and smart city experts, showed that:



72%

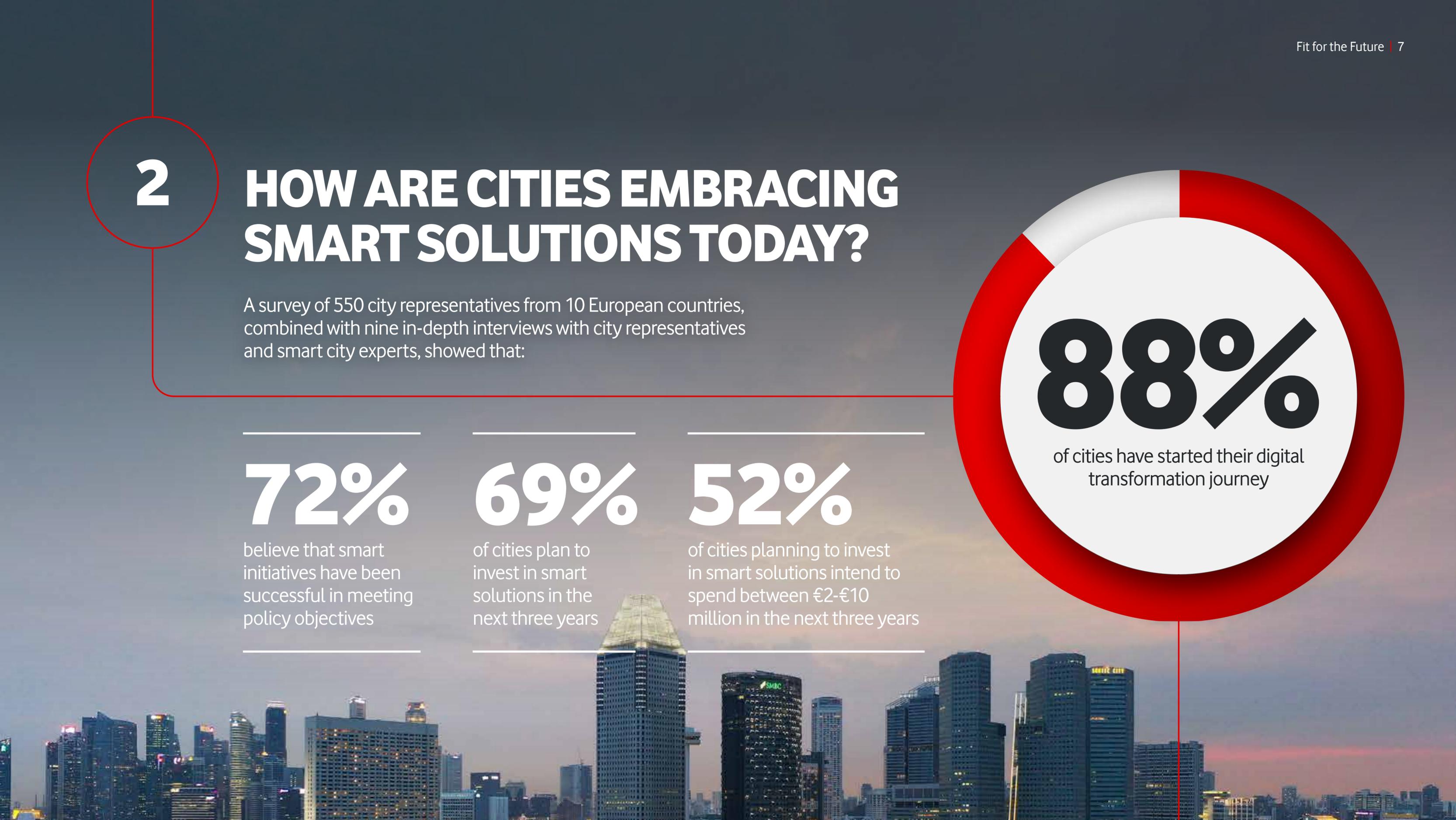
believe that smart initiatives have been successful in meeting policy objectives

69%

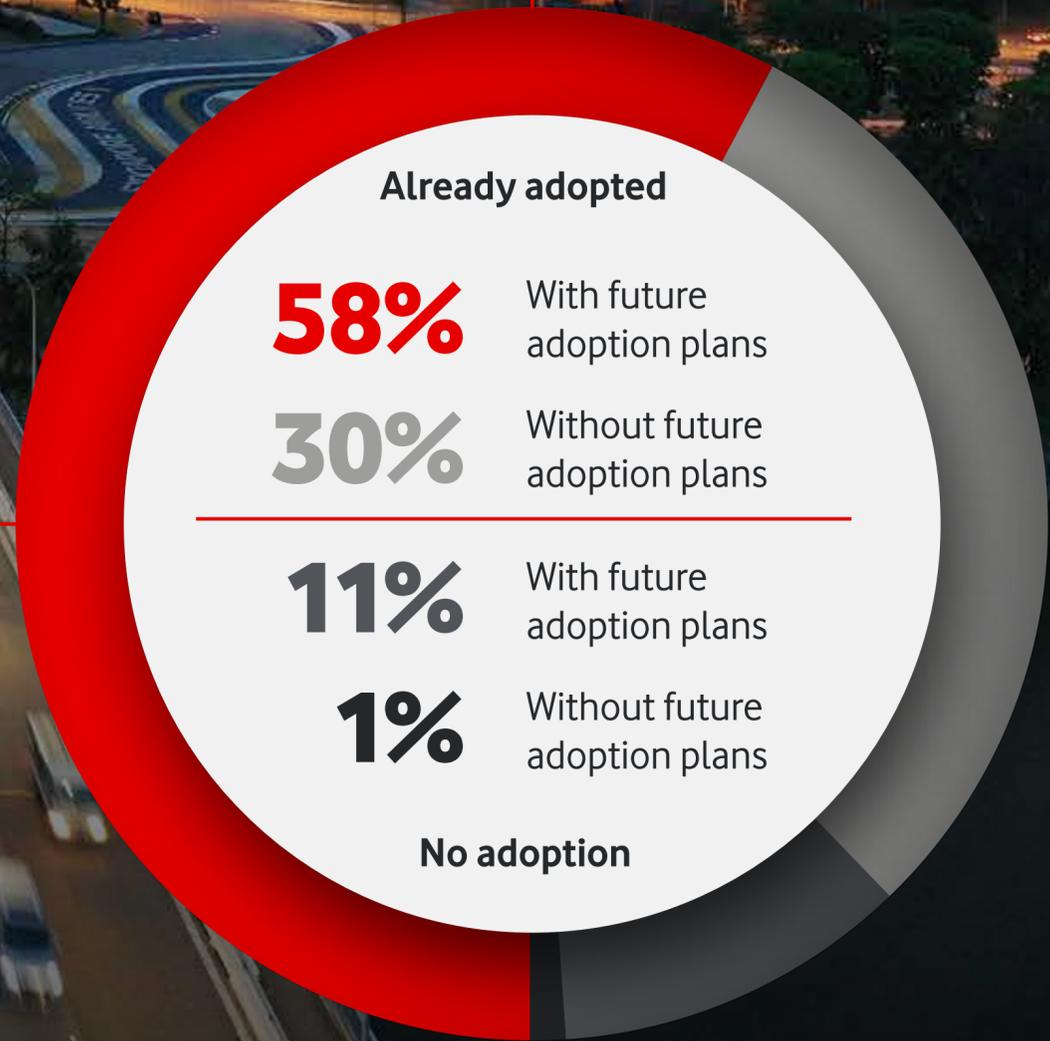
of cities plan to invest in smart solutions in the next three years

52%

of cities planning to invest in smart solutions intend to spend between €2-€10 million in the next three years



# DISTRIBUTION OF SMART CITY SOLUTIONS ADOPTION



## 3

## HOW DOES YOUR CITY'S PROFILE AFFECT YOUR JOURNEY?

We've identified five city profiles, based on the level of digital maturity, current adoption of smart city solutions, infrastructure capacity, strategic vision and technical skills. Cities will need to plan their transformation according to their profile.



### New Explorer

Cities eager to start the transformation, but with a low level of technological maturity, lacking a structured strategy, and with limited access to funding.



### Pathfinder

Cities looking for a path to follow that have adopted some smart solutions but with an unbalanced development level across clusters and the lack of a clearly defined strategy.



### Foundational Architect

With few smart solutions implemented, these have started by defining a clear strategy aligned with their priorities and have invested in a solid digital infrastructure. They are set to adopt more solutions.



### Integration Seeker

Having implemented important smart solutions, these cities lack a common platform for integrating them.



### Front-Runner

Technologically mature cities, leveraging technology to achieve policy objectives, eager to invest in innovative solutions and involved in international networks.

## 4

## HOW CAN POLICY MAKERS SUPPORT THE TRANSITION TO A SMART CITY?

While cities themselves must play a key role, it's crucial that there's coordination and alignment between stakeholders (for example intergovernmental organisations, national governments and the private sector) to ensure successful transition. Some steps have been taken to accelerate smart city development. However, effective deployment still depends on further actions in some areas.



### Promote

improved  
governance



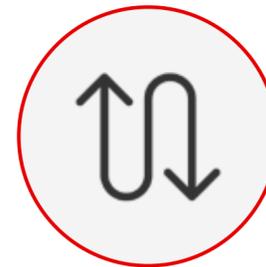
### Facilitate

data-sharing  
and security



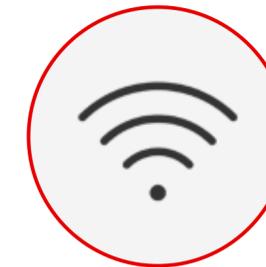
### Demonstrate

value



### Improve

digital literacy  
and increase workforce  
digital training



### Facilitate

widespread availability  
of high-quality  
connectivity



### Funding

5

## STARTING YOUR JOURNEY TO BECOME A SMART AND SUSTAINABLE CITY

Building a smart city eco-system shouldn't be underestimated. City leaders must think big and push boundaries by planning for the future. Developing a clear vision and strategy, supported by a clearly defined governance model, is critical to the digitalisation of your city. However, the first step is understanding where you are on your journey – you need to know your city archetype so you can plan effectively.

We know that creating a sustainable, resilient city isn't easy. It requires a structured approach. We've provided a simple framework you can use to help understand what you need to do, identify key focus points and help deliver on your smart city plans aligned to key policy areas.



# 01

## HOW CAN SMART SOLUTIONS ADDRESS CHALLENGES FACING CITIES?

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WHAT IS A SMART AND SUSTAINABLE CITY?

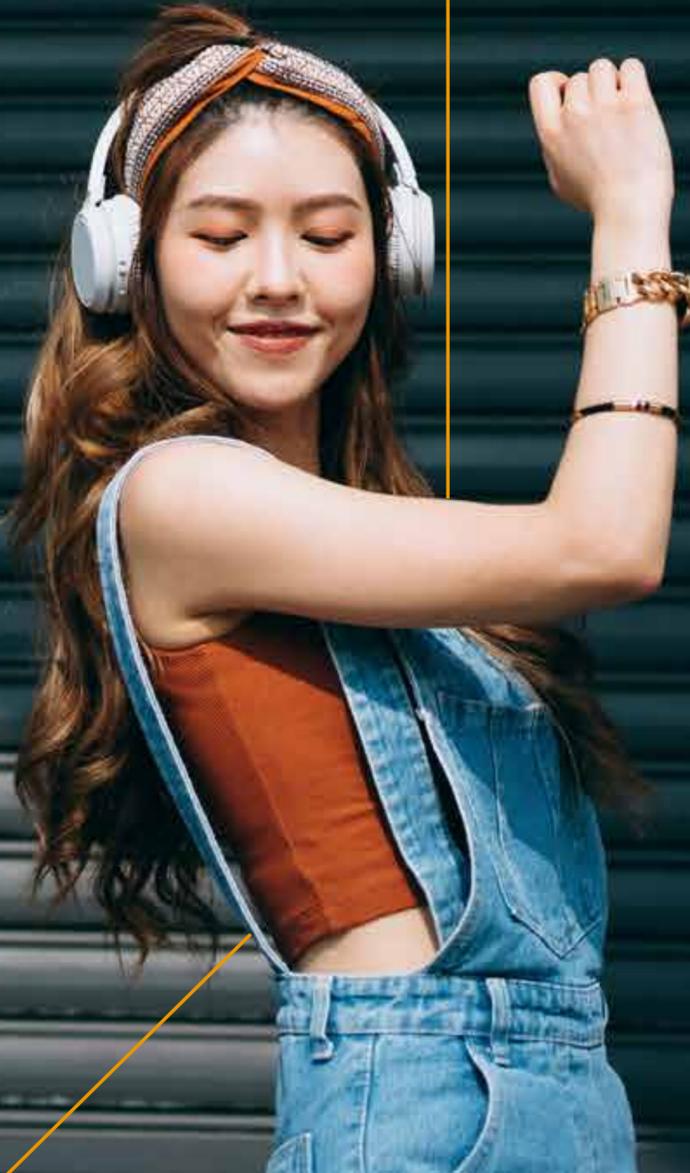
# SMART AND SUSTAINABLE CITIES ARE INTELLIGENT, GREEN, AND HUMAN-CENTRIC PLACES

Our definition of smart and sustainable cities aligns with the United Nations Economic Commission for Europe (UNECE)<sup>[2]</sup> and the European Commission<sup>[3]</sup>.

**Smart and sustainable cities are green, digital, and resilient hubs designed to inspire economic growth and improve citizens' well-being through the efficient delivery of digital services that increase the quality of urban life.**

In 2020, around 56%<sup>[4]</sup> of the world's population lived in urban areas, and the UN expects this to reach 68% by 2050<sup>[5]</sup>. Across the EU, the proportion is 75%<sup>[6]</sup>. Globally, cities are responsible for more than 60%<sup>[7]</sup> of greenhouse gas emissions and 78% of the world's energy consumption. Clearly, they'll have a vital role in the transition to becoming 'green and digital'.

So, as we can expect, smart and sustainable solutions are an investment priority for the EU.



“The green transition is making its way all over Europe right now. But there’s always a need for trailblazers, who set themselves even higher goals.”

**Ursula von der Leyen,**  
President of the  
European Commission<sup>[1]</sup>

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# WHAT IS A SMART AND SUSTAINABLE CITY

To build a digitally enabled and green urban environment, three components must be in place: Technology, People, and Data

## Technology

Technology will be the driving force behind the smart transformation.



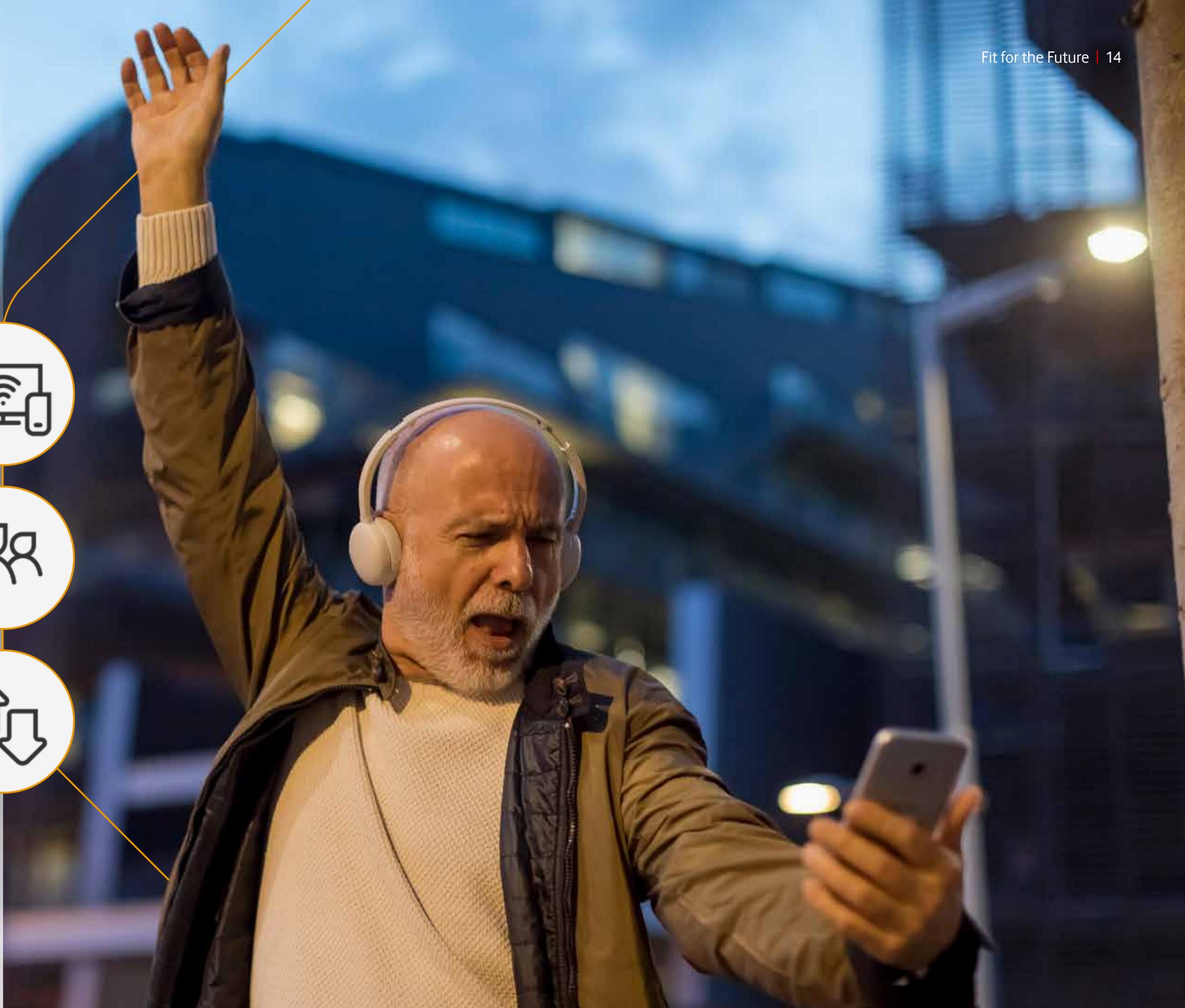
## People

Smart and sustainable cities must be human-centric, bringing benefits to their people.



## Data

Data is a key enabler for innovation, efficiency, competitiveness, and for promoting transparency in city management.



MACRO-ENVIRONMENTAL CONTEXT  
AND OPPORTUNITIES FOR CITIES

# Rapid urban growth can trigger complex challenges that have a wide impact on lives

As cities continue to grow and evolve, there are three key dimensions to the challenges that must be addressed<sup>[8]</sup>:

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**SOCIAL**



**ECONOMIC**



**ENVIRONMENTAL**

Note: Based on Deloitte's report: [Urban Future with a Purpose](#)

Most cities face these challenges, but how they address them depends on their priorities and needs, level of technological development and digital maturity.

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Note: Digital maturity, in the context of this report, refers to a city's status and progress about their digital transformation, including factors such as a defined strategy, internal capabilities, available resources and infrastructure.



# SOCIAL CHALLENGES

## Cities are vibrant ecosystems, but the challenges they face puts significant pressure on their resources

An ageing population, socio-economic inequality, and inadequate accessibility and mobility systems are among the most prominent social challenges faced by cities. Addressing these challenges requires a rethink of urban planning and intervention.

## Ageing population and urbanisation

The demographic structure of society is changing, with an ageing population and increasing urbanisation. This is increasing the pressures on cities' infrastructure and resources, and has implications for city organisation.

**81** Years

"Life expectancy rose to 81 years in 2018 from 69.9 years in the 1960-1965 period" (2021) <sup>[9]</sup>  
"Europe's level of urbanization is expected to increase to 83.7% in 2050" (2018) <sup>[10]</sup>

## Urban segregation and inequality

The segregation of social groups within cities creates inequalities and restricts social cohesion.

**41%** Risk of Poverty

"In 2020, the risk of poverty or social exclusion was 41% for people living in urban areas" (2021) <sup>[11]</sup>

## Accessibility and mobility

Inadequate transport systems and rising car ownership lead to greater congestion on the roads and limits accessibility for under-privileged groups. This has a worsening effect on social inequality and affects productivity in the economy.

**1%** of GDP

"The annual economic damage (...) of road congestion in Europe is estimated to be (...) more than 1% of the GDP of the European Union" (2020) <sup>[12]</sup>

Note: Based on Deloitte's report: [Urban Future with a Purpose](#)





# ECONOMIC

## The increasing pressure on cities' resources creates further economic challenges across housing, digitalisation, security and finance

Cities are engines of economic growth with more than 80% of global GDP generated in urban areas<sup>[13]</sup>. However, economic challenges need to be addressed to encourage inclusive growth.

### Affordable housing

Increasing urbanisation puts additional pressure on an already stretched housing market, leading to rising property prices, and a shortage of affordable housing.

**17%**  
in overcrowded homes

10% of the EU population experience housing cost overburden<sup>[14]</sup> and over 17% of Europeans live in overcrowded homes (2022)<sup>[15]</sup>

### Digitalisation and cybersecurity

The digital transformation of cities creates new cyber threats that may put at risk underlying technological and critical infrastructure, and the effective delivery of public services.

**304**  
malicious attacks

"304 significant malicious attacks against 'critical sectors' in 2020, more than double the 146 recorded the year before." (2021)<sup>[16]</sup>

### Financial constraints

A lack of financial resources for investment prevents cities from addressing current and future needs and demands.

**LOWER**  
infrastructure investment

"In the wake of the global financial crisis, infrastructure investment as a share of EU gross domestic product has been on a declining trend, picking up only in 2018."<sup>[17]</sup> "The European Union put together a recovery package worth almost 2 trillion euros (...) Massive resources will soon be available to foster a green recovery inside our cities." (2020)<sup>[18]</sup>

Note: Based on Deloitte's report: [Urban Future with a Purpose](#)



# ENVIRONMENTAL

## Cities are responsible for an increasingly large environmental footprint, and are facing further issues including climate change, pollution and wasteful usage of resources

The increasing demands of cities may lead to a non-sustainable deployment of resources. This would affect the quality of life, well-being and health of their populations, and could also lead to wider and long-lasting impacts.

### Climate change and energy consumption

Global warming exposes cities to greater risk of extreme weather events. High levels of energy consumption in urban areas are contributing to the problem, and energy demand continues surpassing sustainable supply.

**70%**  
Greenhouse gas emissions

“Cities are responsible for about 75% of the world’s energy consumption and over 70% of global greenhouse gas (GHG) emissions.” (2021) <sup>[19]</sup>

### Waste management

The increasing generation of waste calls for more efficient and effective waste management systems for cities.

**505**  
kg on average

“The global production of waste is set to increase by 70% by mid-century. Half of this waste is produced within cities.” <sup>[20]</sup>  
“People in the EU generated an average of 505 kilograms of waste in 2020, up nearly 10% since 1995, with around 23% ending up at a landfill” (2021) <sup>[21]</sup>

### Air pollution

Poor air quality affects individuals’ health and wellbeing, and has an economic and environmental impact.

**6-9**  
million premature deaths

“Every year, over 350,000 people [in the EU] die prematurely due to disease related to air pollution” (2021) <sup>[22]</sup>  
“Outdoor air pollution could cause 6 to 9 million premature deaths a year by 2060 and cost 1% of global GDP” (2021) <sup>[23]</sup>



MACRO-ENVIRONMENTAL CONTEXT  
AND OPPORTUNITIES FOR CITIES

# BY ADOPTING INTEGRATED SMART AND INNOVATIVE SOLUTIONS, CITIES AND COMMUNITIES BECOME...

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**INCLUSIVE**



**DIGITAL**



**GREEN**

There is an opportunity for a long-lasting sustainable transformation in which smart city solutions can play a crucial role.

## BENEFITS OF SMART SOLUTIONS FOR CITIES AND COMMUNITIES

Smart city solutions play a pivotal role in helping cities address their most critical challenges

Smart and sustainable cities can lead to a total transformation by more effectively addressing the challenges they face. The solutions provided by smart and sustainable cities can be grouped into seven categories or clusters.

Climate technologies have the potential to achieve 90% of the target for reductions in emissions that are needed to stabilise the climate by 2050<sup>[24]</sup>, showing the massive impact that smart solutions can have on the environment.



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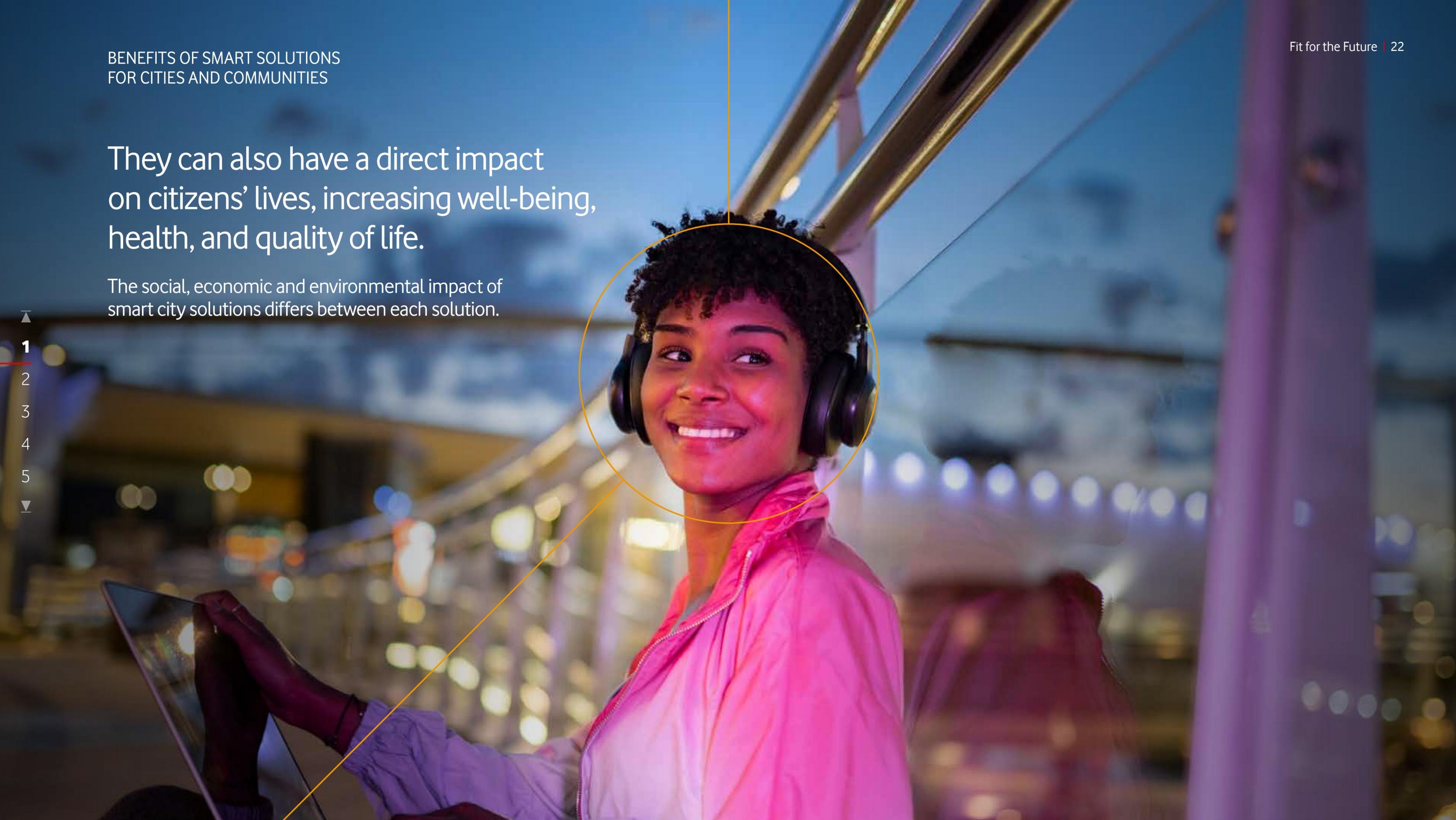
Note: Based on Deloitte's framework, Smart cities of the future

BENEFITS OF SMART SOLUTIONS  
FOR CITIES AND COMMUNITIES

They can also have a direct impact  
on citizens' lives, increasing well-being,  
health, and quality of life.

The social, economic and environmental impact of  
smart city solutions differs between each solution.

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BENEFITS OF SMART SOLUTIONS FOR CITIES AND COMMUNITIES



# SOCIAL



### Mobility

Smart solutions can increase passenger satisfaction and reduce time spent commuting



### Safety & security

Smart solutions improve well-being, reduce anxiety and increase citizen engagement



### Energy & environment

Solutions improve the health and well-being of people in cities



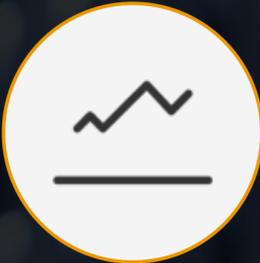
### Government & education

Reduced government bureaucracy



### Living & health

Improvements in health, well-being and overall quality of life, and reduced rates of disease



### Economy

Smart solutions can help achieve more inclusive growth



### Horizontal services

Interconnectivity and integration of data services enable better responses to cities' problems



# SOCIAL



Public transit initiatives resulted in “38% increased passenger satisfaction and 29% increased public transport usage” [25]



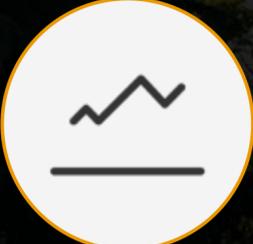
Detroit reducing violent crime by “Smarter surveillance contributed to over 50%” [26]



Deploying public health initiatives: “36% increased citizen health and well-being. 27% decreased mortality & morbidity” [27]



“45% increased citizen health and well-being” after implementation of waste and environmental initiatives [28]



# ECONOMIC

Smart and sustainable solutions can have an important role in enhancing business opportunities, fostering inclusive growth and creating added value, as well as increasing employment and productivity.



### Mobility

Better access to employment opportunities and productivity



### Safety & security

Attracts new businesses and enhances the city's reputation



### Energy & environment

Positive return on investment in smart environmental initiatives



### Government & education

Reduction in time to obtain permits, licensing and business approvals



### Living & health

Tech solutions can translate into savings in the public healthcare sector



### Economy

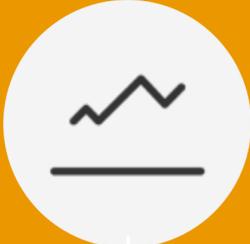
Benefits include increased competitiveness and higher productivity



### Horizontal services

Positive return on investment in digital infrastructure and networks

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# ECONOMIC

44%

of leader cities monetise value from data”<sup>[29]</sup>

Note: Categorization according to ESI Thought Lab, with leader cities being defined as those “ahead of most peers in interconnecting urban ecosystem and seeing significant economic, business and social benefits”.

33%

Public Safety initiatives led to a 33% increase in new businesses <sup>[30]</sup>

28% +

“Digital administrative citizen services can reduce the time spent interacting with government from 28% - 61%” <sup>[31]</sup>

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# ENVIRONMENTAL

Cities can adopt smart solutions to reduce pollution, energy consumption and waste production, using technology and data to manage resources more efficiently



### Mobility

Smart solutions can help achieve more efficient and sustainable mobility networks



### Safety & security

Increasing safety focused solutions such as smart lighting



### Energy & environment

Solutions can reduce pollution, fewer greenhouse gas (GHG) emissions and waste production



### Government & education

Digitalisation of governmental services can contribute to the green transition



### Living & health

More efficient use of health services contributes to sustainability



### Economy

Smart solutions foster competitiveness and can support the green transitions



### Horizontal services

Digital transition interconnected with the green transition



# ENVIRONMENTAL

Energy and electricity initiatives can prompt:<sup>[32]</sup>



reduced energy consumption



increased renewable energy usage

“Smart city solutions such as air quality monitoring, and electricity, water, and waste tracking can produce results such as: <sup>[33]</sup>

**10-15%**

fewer GHG emissions

**30-130KG**

less solid waste per person per year

**25-80L**

litres of water saved per person per day

THE EU'S COMMITMENT TO CREATING  
SMART AND SUSTAINABLE CITIES

# In its commitment to a green and digital transition, the EU has put forward various initiatives, combining funding, financing and support to help build the smart and sustainable cities of the future

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The EU is pushing for a more inclusive, digital and green society. Its stated ambition and general targets set the tone for a twin green and digital transition.

They aim to create more competitive, technological and resilient economies, whilst also achieving sustainability goals, and smart city solutions are a key part of their strategy.



# EUROPEAN GREEN DEAL

The EU is committed to become the first climate neutral continent by 2050. The European Green Deal sets out the vision for this green transition.

This vision is evident in various strategies, action plans and financing and funding initiatives, from the Renovation Wave and the Smart and Sustainable Mobility Strategy to research and innovation grants in Horizon Europe. The goal is to promote a wide-ranging transformation in sectors such as mobility, energy production, climate change adaptation, building efficiency and energy poverty. These programmes allocate funding and financing opportunities to countries and cities, as well as platforms to support the transition.

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THE EU'S COMMITMENT TO CREATING  
SMART AND SUSTAINABLE CITIES

# EU DIGITAL STRATEGY

The EU Digital Strategy guides the digital transition, with initiatives to boost the adoption of tech solutions “that work for people”<sup>[36]</sup>; increase the efficiency, fairness and digitalisation of economies, and stimulate the creation of an “open, democratic and sustainable society”<sup>[37]</sup>. Cities are at the centre of this transformation.

The EU wants to create a joint governance framework to implement the digital transformation. It aims to facilitate multi-country projects, address critical capabilities and insufficiencies, and support an increasingly interconnected and interoperable digital single market. The strategy should also promote a human-centred digital agenda and ensure that digital players act responsibly, protecting citizens' rights.

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THE EU'S COMMITMENT TO CREATING SMART AND SUSTAINABLE CITIES

EXAMPLES OF INITIATIVES TARGETING CITIES

European Green Deal



EU Strategy on Adaptation to Climate Change



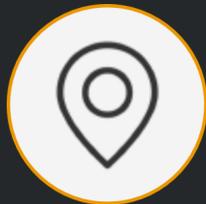
Smart and Sustainable Mobility Strategy



Renovation Wave



Zero Pollution Action Plan



Horizon Europe

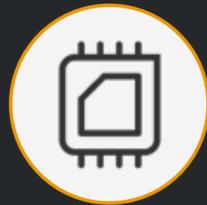
EU Digital Strategy



EU Digital Compass



EU Path to the Digital Decade



Digital Europe Programme



Smart Cities Marketplace



Intelligent Cities' Challenge

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EU TARGETS BY 2030 [34] [35]

Cut GHG emissions by at least 55% (vs. 1990)

Create 160.000 green jobs in the construction sector

Renovate 35 million buildings

40% of EU's energy mix from renewable sources

Zero emissions from new cars by 2035

Offer 100% of key Public Services online

Employ 20 million ICT specialists

Have 100 climate-neutral smart cities

EU funds for climate actions are 1/3 of world's total funding (2021)

THE EU'S COMMITMENT TO CREATING SMART AND SUSTAINABLE CITIES

# The EU's '100 Climate-Neutral and Smart Cities'<sup>[38]</sup> Mission' places cities at the heart of the green and digital transformation

Home to 75% of the EU population, cities are important innovation and creativity hubs that can apply effective solutions to improve sustainability. Aiming to maximise opportunities, the EU is set to create 100 climate-neutral and smart cities by 2030, inspiring all others to follow by 2050.

This is one of the 5 missions in the Horizon Europe programme, which “incorporates research and innovation missions to increase the effectiveness of funding by pursuing clearly defined targets”.<sup>[39]</sup>

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### Benefits for cities

- Tailor-made advice and assistance
- Selected cities benefit from a “mission label” to unlock additional funding and financing opportunities, particularly research and innovation funding opportunities.
- Cities will benefit from a national coordination network to support them.
- Possibility to learn and exchange experiences by networking and participating in pilots.
- Public involvement in decision-making.
- Increase cities' potential to attract investors and skilled workers.



### Key elements

1

#### Mission Platform

The Mission Platform to help cities achieve climate neutrality by 2030 is NetZeroCities, a consortium of 33 partners. This will provide tailor-made investment plans, present innovative city governance models, foster citizens' engagement and create a common framework for monitoring and reporting.

2

#### Climate City Contracts

100 selected cities will agree to a Climate City Contract, in the form of a non-binding Memorandum of Understanding, to design a climate action plan by mid-2022.

3

#### Tailor-made investment plans

The Mission Platform will support cities in designing their tailor-made investment plan for implementing their Climate City Contract, providing financial and technical advisory services to access public and private funding and financing.



### Building blocks for climate neutrality

- Citizens' engagement
- Strong strategic dimension
- Real spatial dimension
- Transparent accountable governance
- Cross-sectoral approach
- Multiple funding sources
- Effectively monitoring progress

THE EU'S COMMITMENT TO CREATING SMART AND SUSTAINABLE CITIES

# 100 selected cities to be Climate-Neutral and Smart

(plus 12 selected cities from countries associated to the Horizon Europe):

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-  Klagenfurt
-  Antwerp  
Brussels capital region  
La Louviere  
Leuven
-  Gabrovo  
Sofia
-  Zagreb
-  Liberec
-  Limassol
-  Tartu
-  Aarhus  
Köpenhamn  
Sonderberg

-  Espoo  
Helsinki  
Lahti  
Lappeenranta  
Tampere  
Turku
-  Angers Loire Metropole  
Bordeaux Metropole  
Dijon Metropole  
Dunkerque  
Grenoble-Alpes Metropole  
Lyon  
Marseille  
Nantes Metropole  
Paris
-  Aachen  
Dortmund  
Dresden  
Frankfurt/Main  
Heidelberg  
Leipzig  
Mannheim  
Munich  
Münster

-  Athens  
Ioannina  
Kalamata  
Kozani  
Thessaloniki  
Trikala
-  Budapest  
Miskolc  
Pecs
-  Cork  
Dublin
-  Bergamo  
Bologna  
Florence  
Milan  
Padova  
Parma  
Prato  
Rome  
Turin

-  Liepaja  
Riga
-  Taurage  
Vilnius
-  Differdange
-  Gozo
-  Amsterdam  
Eindhoven & Helmond  
Groningen  
Rotterdam  
The Hague  
Utrecht
-  Krakow  
Lodz  
Rzeszow  
Warslaw  
Wroclaw
-  Guimarães  
Lisbon  
Porto

-  Bucharest  
Cluj-  
Napoca  
Suceava
-  Bratislava  
Kosice
-  Kranj  
Ljubljana  
Velenje
-  Barcelona  
Madrid  
Seville  
Valencia  
Valladolid  
Victoria-Gasteiz  
Zaragoza
-  Gävle  
Göteborg  
Helsingborg  
Lund  
Malmö  
Stockholm  
Umeå

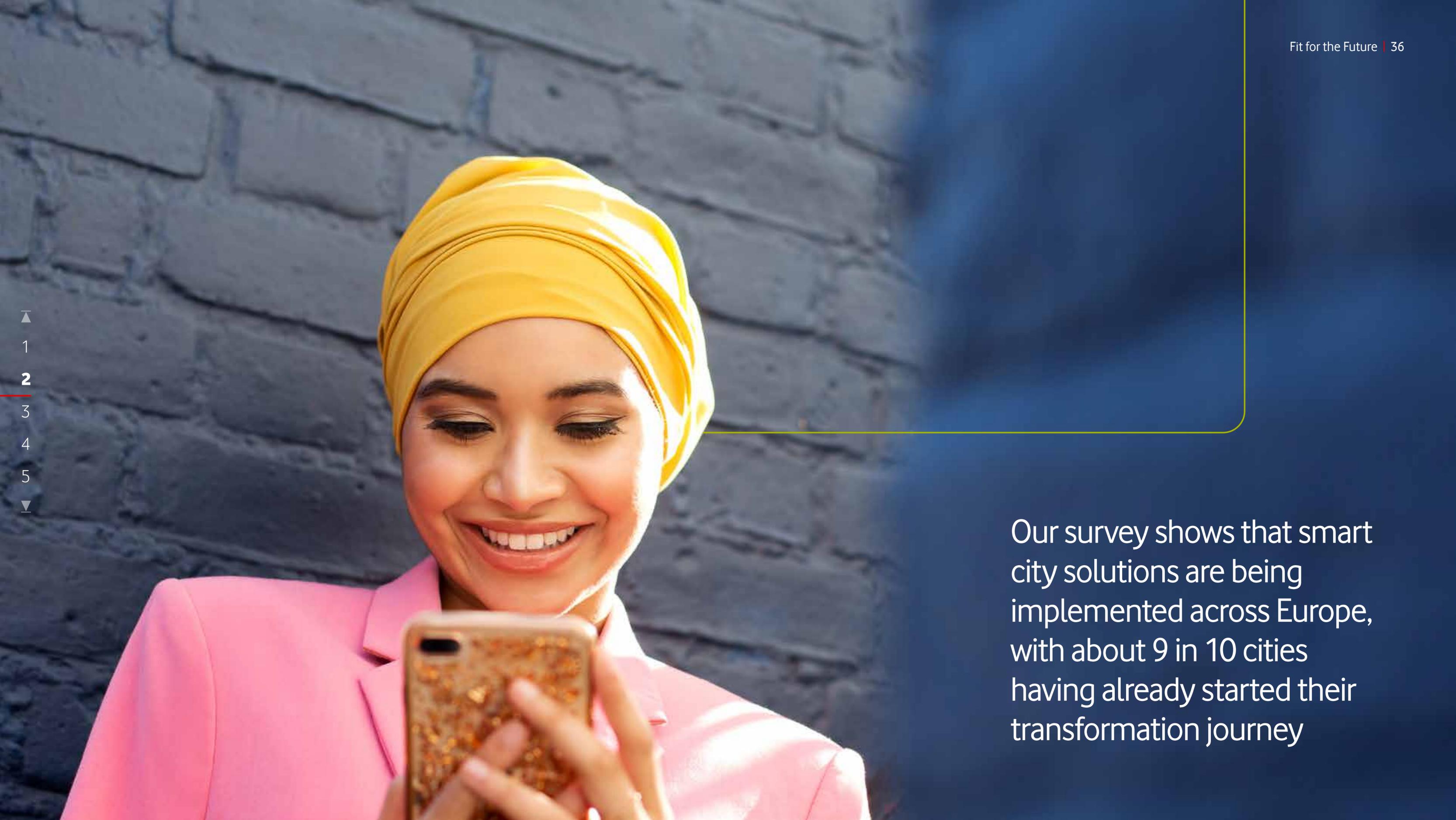
- \*Cities from associated countries:
-  Elbasan
  -  Sarajevo
  -  Reykjavik
  -  Eilat
  -  Podgorcia
  -  Oslo  
Stavanger  
Trondheim
  -  Istanbul  
Izmir
  -  Bristol  
Glasgow

# 02

## HOW ARE CITIES EMBRACING SMART SOLUTIONS TODAY?

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Our survey shows that smart city solutions are being implemented across Europe, with about 9 in 10 cities having already started their transformation journey

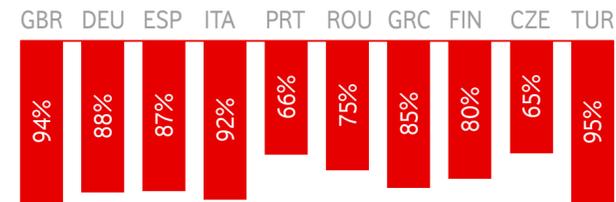
# THE CONCEPT OF THE SMART AND SUSTAINABLE CITY IS GAINING MORE AND MORE INTEREST.

Regardless of their size or digital maturity, cities are recognising the potential of digital technologies to address critical challenges while improving lives.

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of cities have already started their digital transformation journey



of cities with no solutions in place are planning to adopt smart city initiatives in the future



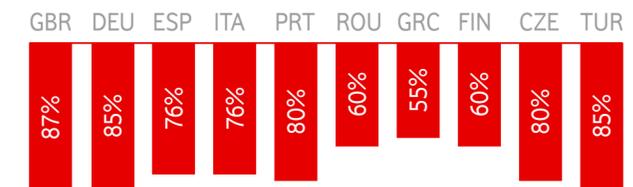
Note: Number of cities per country in the survey vary and may not be adjusted to population size and characteristics Note: Country codes presented according to ISO-3166 Alpha-3



believe that, on average, smart initiatives have been successful to meet each policy objective



consider that smart city solutions are something valued in their local authorities



To understand smart city development in Europe, we carried out extensive research that included a large-scale survey and in-depth interviews with city representatives and experts.

We surveyed 550 city representatives from 10 European countries, with almost half of the respondents have a responsibility for making final decisions on technology and innovation. The information we collected is the basis for the assessment in this report.

Our mixed method approach:



Please see appendix for more information on the research process.

The following pages represent the results from our research.



**SMART SOLUTIONS  
SPAN ACROSS DIFFERENT  
CATEGORIES OR  
CLUSTERS WITH ENERGY  
& ENVIRONMENT, SAFETY  
& SECURITY, AND MOBILITY  
SOLUTIONS BEING THE  
MOST COMMON**

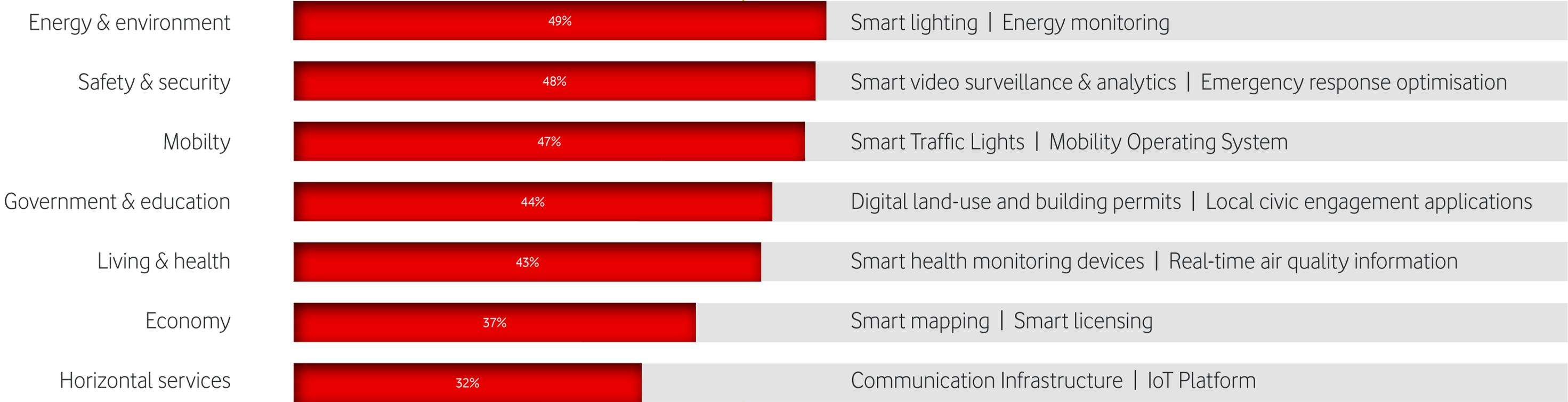
PERCEPTION OF SMART AND SUSTAINABLE CITIES

**This may be explained by higher levels of solution maturity and clearer short-term returns on investment, as well as the political cycles of decision-makers.**

Percentage of cities with solutions adopted, by cluster

Most common smart city solutions adopted

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By implementing these solutions, cities can improve their management and monitoring of public resources, increase the safety for their citizens, improve their mobility networks and reduce their carbon footprint.

PERCEPTION OF SMART AND SUSTAINABLE CITIES

**Around three-quarters of cities are affected by more than one policy driver. Nearly two-thirds of those identify 'Environment' as a policy guideline – in alignment with the EU's vision of a green transition.**

Many respondents (44%) value the various policy drivers equally, with no clear preference for any of them – we call them Generalists. The remaining cities (56%) appear to prefer either one or two policy drivers.

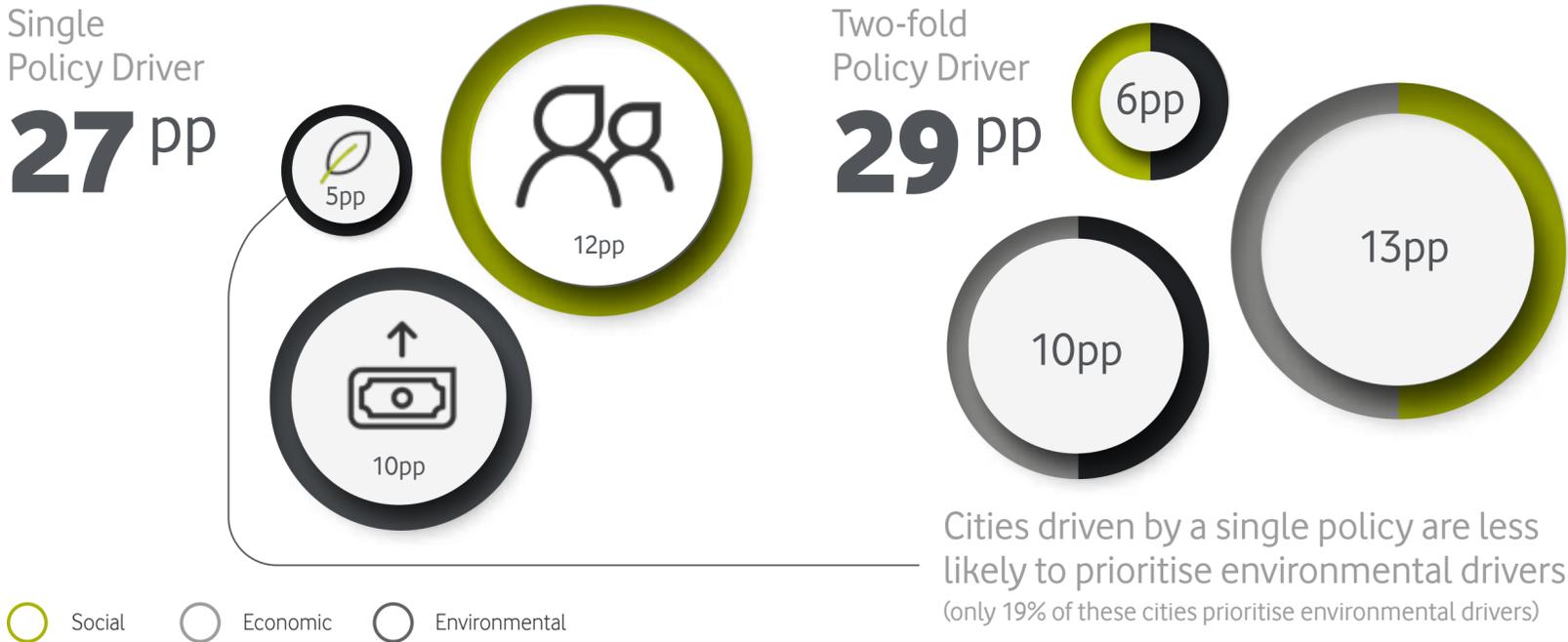
We asked respondents about the importance they attach to five policy priorities when designing their strategy.

Five policy priorities on selection

- Social
  - Social inclusion and Quality of Life
  - Quality of Service Delivery
- Economic
  - Economic Development
  - Reduction in Operating Costs
- Environmental
  - Environmental Targets

# 56% Non-Generalists

# 44% Generalists



Being a Generalist may be the result of either of two different scenarios:

- Cities may lack a structured policy strategy and don't prioritise any policy driver as they lack guidance about which path to follow
- Cities may be designing integrated strategies, recognising the interconnectivity of all the challenges and the importance of considering all issues when implementing policy initiatives

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**Cities highlight lack of funding,  
legislative barriers and  
inadequate infrastructure  
as main barriers**

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## BARRIERS TO ADOPTION

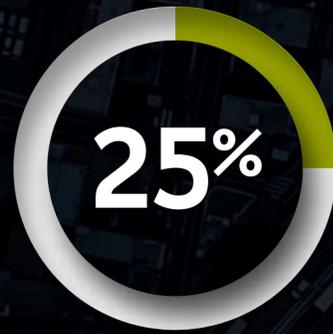
An understanding of the barriers faced by cities for adopting smart solutions can help decision makers to design strategies to overcome them.

Lack of funding, legislative barriers and inadequate infrastructure were cited as the main barriers faced by cities. Underlying these barriers is the “fragmentation of responsibilities”<sup>[40]</sup> – overcoming barriers often requires interventions at different geographic levels and multi-organisation coordination, between city councils, national governments and intergovernmental bodies (as the EU).

Cities recognise the need for better access to funding for infrastructure investments, and that legislative and regulatory changes are needed, at national and European level. Cities also highlight the importance of facilitating procurement procedures, improving digital skills of their citizens and addressing privacy and safety concerns.



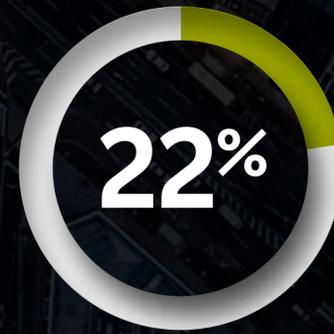
Lack of funding



Legislative barriers



Lack of adequate infrastructure



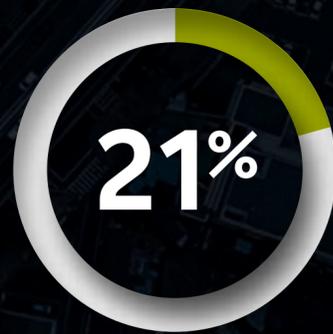
Privacy & safety concerns



High complexity of procurement procedures



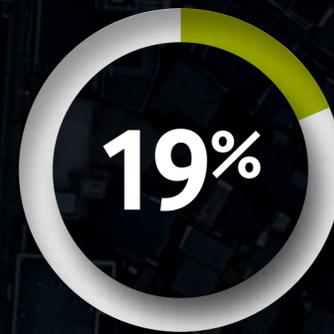
Lack of strategy



Lack of digital skills of people



Challenges in integration with existing systems



Lack of suitable offers in the market



Lack of internal capability and skills

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BARRIERS TO ADOPTION

# Lack of funding or restricting the adoption of smart solutions is a key issue for cities that haven't yet introduced any solution, as well as for smaller cities

Lack of funding is the most commonly-cited barrier to the implementation of smart tech solutions, by both cities that have adopted smart tech solutions and cities that have not. Additionally, cities quoting funding as a barrier tend to spend less on smart solutions.



of cities that haven't adopted any smart solution identify funding as a key barrier. In the case of cities that have implemented smart solutions, 29% identify funding as a key barrier.



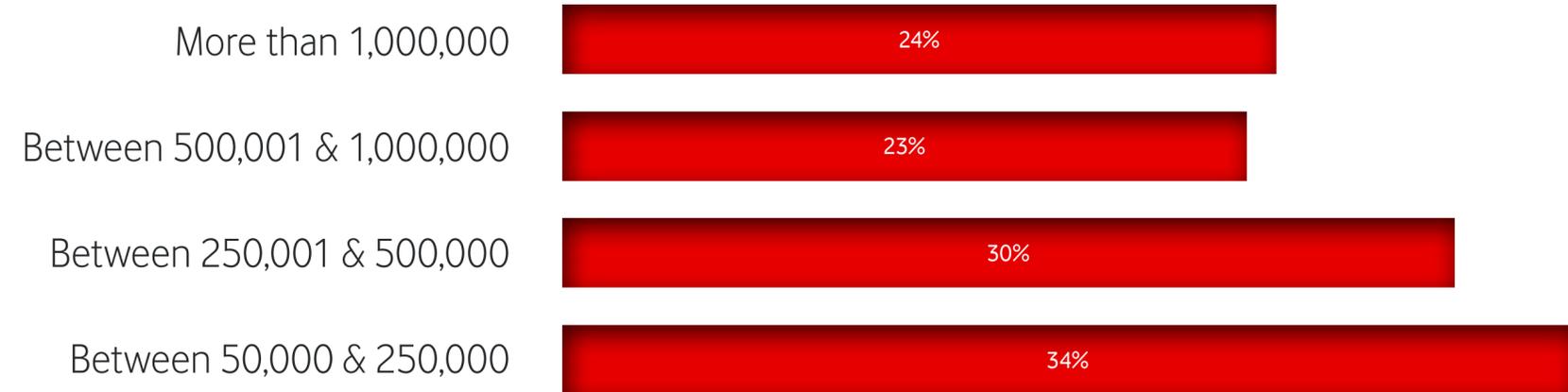
Cities that haven't started to adopt smart solutions may be prevented or restricted by a lack of funding.

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Funding

## Lack of funding as a key barrier, by city size



Legislative, regulatory or policy barriers



Lack of adequate infrastructure

The smaller the city, the more “lack of funding” is identified as a key barrier. Limited information and low integration in regional networks may help explain this.

### Country Spotlight

# 24%

of Italian cities report lack of funding as a key barrier. (This is the lowest percentage amongst countries in the survey.)



BARRIERS TO ADOPTION

# Legislative, regulatory or policy issues are reported as a barrier by one-quarter of cities: the percentage is higher for larger cities and cities that have started to adopt smart tech solutions and plan to continue

Cities in our survey mentioned legislative, regulatory or policy issues in regional, national and European laws and regulations as a constraint on their development, in terms of data policy, mobility and privacy. Addressing this requires coordination between cities, governments, and intergovernmental organisations to harmonise legislation and regulations.



of cities that have adopted smart tech solutions and plan to continue cite legislative barriers as a key topic. This compares with 22% of cities that haven't yet started to add smart solutions.



Cities that have started the journey may be more aware of the regulatory and legislative barriers to action.

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Funding

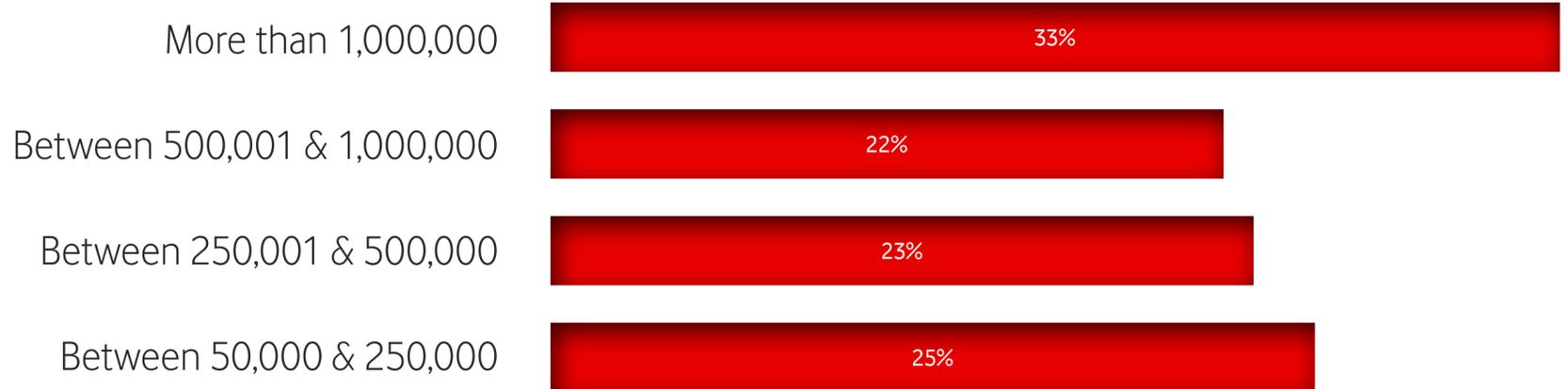


Legislative, regulatory or policy barriers



Lack of adequate infrastructure

## Legislative, regulatory or policy barriers as a key barrier, by city size



Many of the larger cities are in countries where legislative barriers are considered a significant constraint, such as Italy, Turkey and Spain.

### Country Spotlight

Only **5%**

of Finnish cities cite legislative barriers as a critical issue. This is the lowest percentage among countries in the survey.



BARRIERS TO ADOPTION

# Lack of adequate infrastructure is the third most important barrier and is especially important for larger cities with more than 1 million people

Developing high-quality digital connectivity infrastructures is critical, specifically for fixed and mobile (5G) “networks and telecoms systems, data storage and processing centres, data privacy centres”<sup>[41]</sup>. As such, the collaboration of regional and national governmental bodies is needed, and funding required.



of cities that have introduced smart tech solutions and plan to continue implementing them state a lack of an adequate infrastructure is a key barrier. This compares with 16% of cities that haven't yet started their smart city journey.



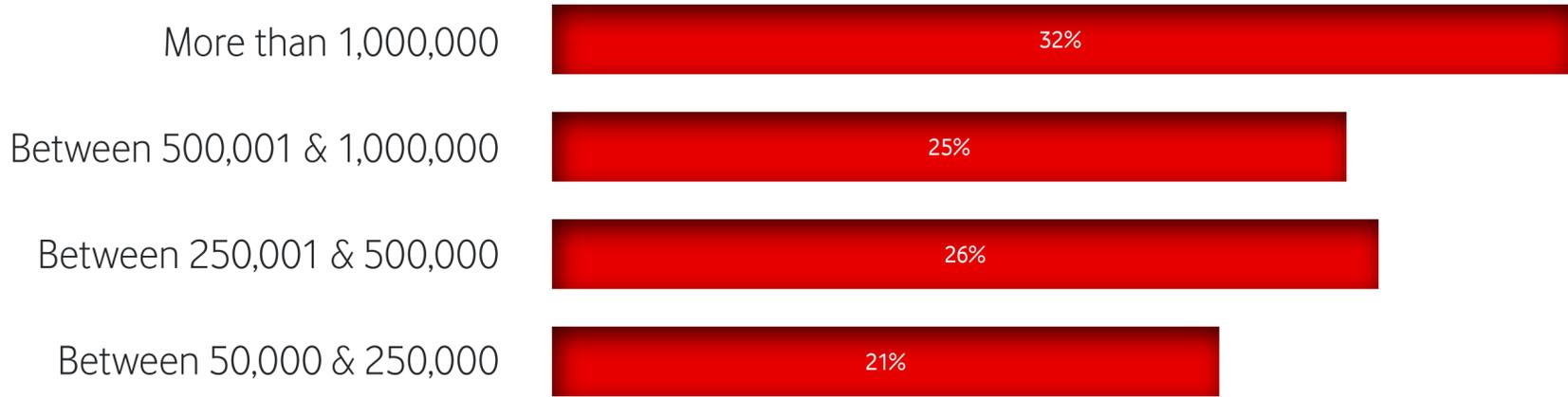
Cities that haven't started adoption of smart tech may not be aware of the importance of an adequate infrastructure for building a smart and sustainable city.

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Funding

### Lack of funding as a key barrier, by city size



Legislative, regulatory or policy barriers



Lack of adequate infrastructure

The larger the city, the more the lack of adequate digital and technical infrastructure is seen as a barrier.

### EU Spotlight

An extensive 5G network is crucial for a high-quality digital infrastructure. Some countries are lagging behind with its implementation.

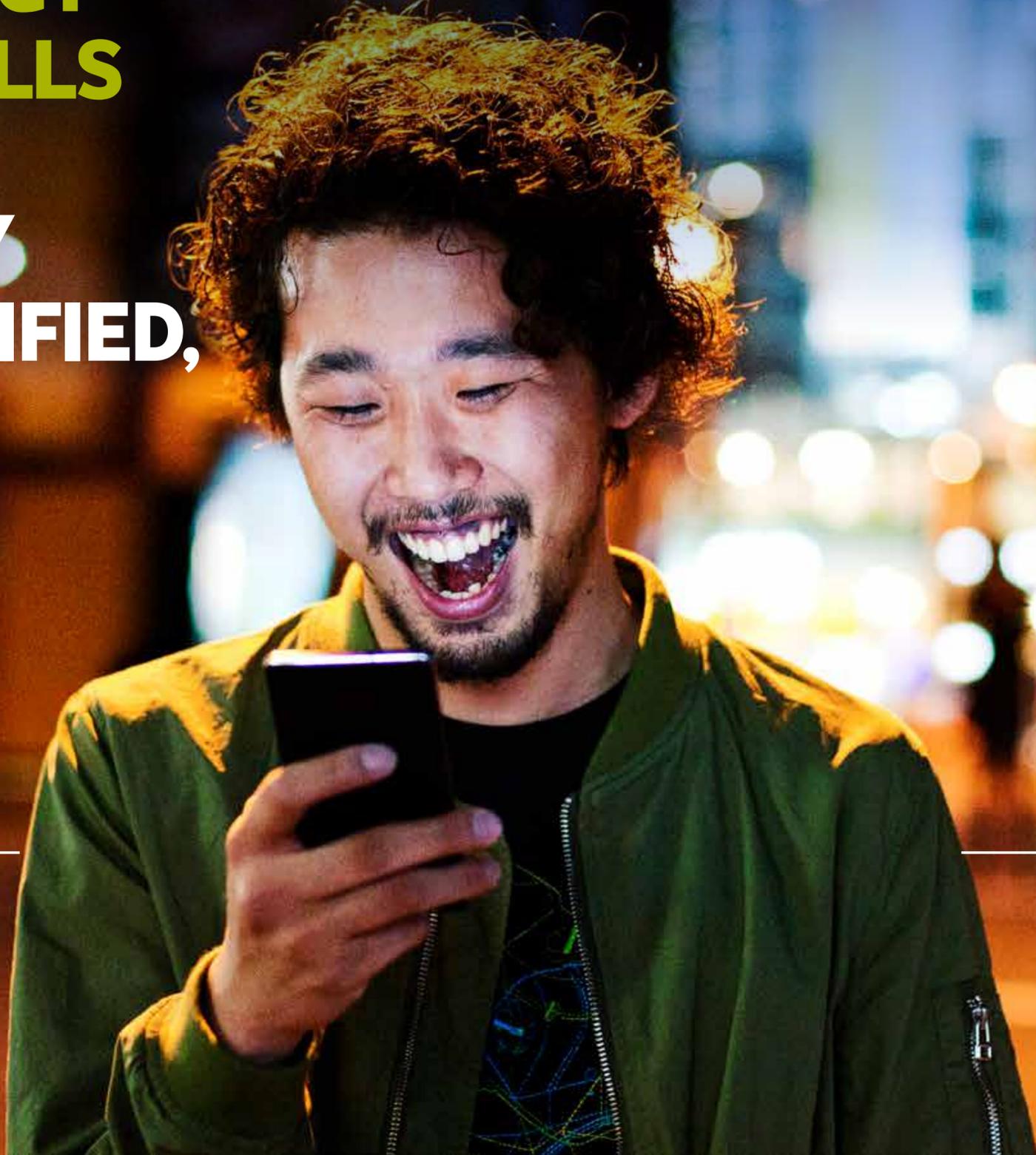
For example, Romania's 5G coverage in 2021 was only around 25%, far below the EU average of 66%. Member States' RRF investment plans in digital infrastructures, costing around €18 billion, may not be sufficient to achieve the EU's digital transformation targets.<sup>[42]</sup>



BARRIERS  
TO ADOPTION

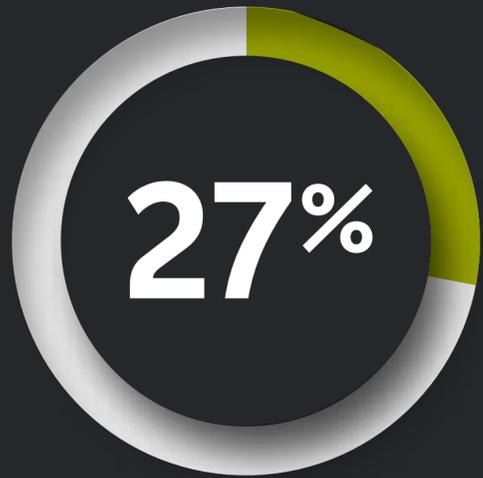
**LACK OF STRATEGY  
AND DIGITAL SKILLS  
ARE AMONG THE  
ADDITIONAL KEY  
BARRIERS IDENTIFIED,  
ESPECIALLY IN  
SMALLER CITIES**

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BARRIERS TO ADOPTION

Smaller cities in our survey reported, more frequently than larger cities, a lack of a strategy for the implementation of smart solutions and development of smart cities. Smaller cities also appear to be more restrained by limited digital skills and technological literacy of their citizens.



of cities that haven't started their digital transformation journey report lack of strategy as a key barrier. This is more than double the cities that have started implementation (12%).

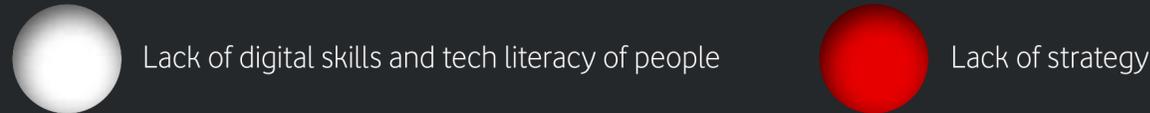
Not having a strategy seems to be an important obstacle when it comes to starting to adopt smart solutions. Cities may need help with developing a strategy, as a guide to start them on their journey.

EU Spotlight

The lack of digital skills is a problem across most European countries. According to the most recent DESI report, only 56% of citizens in the EU have at least basic digital skills. The percentage is much lower in certain countries such as Romania (28%), Italy (46%) and Germany (49%).



Lack of funding as a key barrier, by city size



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PROCUREMENT & FUNDING MECHANISMS

**Procurement is seen as a bureaucratic, complex and time-consuming process. Leading cities who are already implementing solutions are currently developing more innovative procurement procedures**

Procurement is seen as a major barrier to adoption. The EU is making funding available for improving cities' procurement systems, promoting increased cooperation between cities, nations, and organisations, and higher transparency.

**How do cities procure smart city projects?**

Leading cities are more likely to use innovative procurement solutions and establish partnerships for the implementation of smart solutions: agility and flexibility in their business models is an important factor for them. In cities that are at more advanced stages of the journey, private companies are also more likely to have a role in developing and maintaining improvements in procurement.



of respondents cited the complexity of the procurement process as one of the main barriers to implementing smart city solutions.

**Challenges with procurement**

Overall, this is how cities selecting procurement as a barrier see the process:

-  Bureaucratic 43%
-  Complex 39%
-  Time-consuming 39%

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**EU Spotlight**

The EU is focused on digitalising procurement processes, and on making buyers in the public sector more professional, increasing access to supply markets and promoting the adoption of green and ethical procurement.



Public-private partnership



Public procurement for innovative solutions



Operating contracts



Licensing



Privatisation

Experts suggest that current public procurement procedures don't incentivise collaborative approaches. This is a critical feature for the creation of smart and sustainable cities and one of the pillars of the EU's procurement strategy.

PROCUREMENT & FUNDING MECHANISMS

# Regional or national funds and public-private partnerships have been the most important funding mechanisms in the past three years

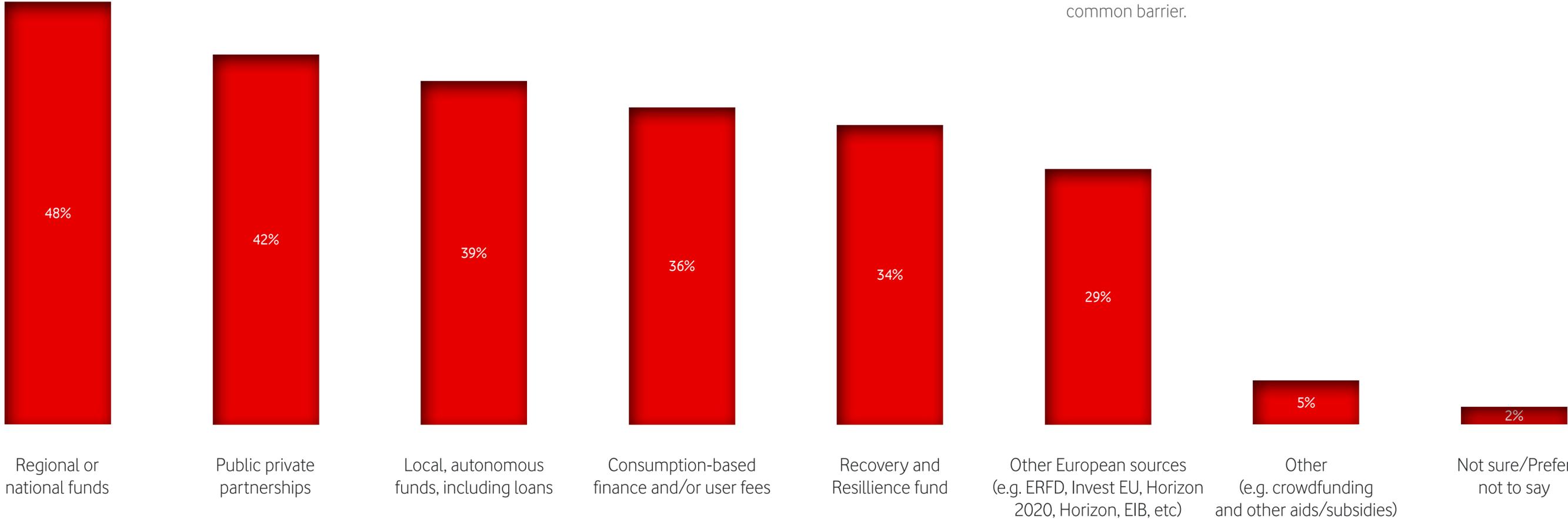
Cities with more advanced digital transformations tend to spend more on smart city solutions. Recognising the importance of funding, the EU has put forward programmes aimed at funding and supporting the implementation of smart and sustainable solutions.

Regardless of population size, external funding is important for most cities to make smart city investments and to meet the European Union objectives. Larger cities rely more on the Recovery and Resilience Fund than cities with less than 250,000 inhabitants. Cities with more than 1 million inhabitants rely more than other cities on funding from regional or national funds and other European sources.



Public-private partnerships are an important source of funding for smart city investments in most countries. However, collaborating with private partners tends to be seen as complex (41%), bureaucratic (38%) and time-consuming (36%).

40% of the countries in the survey identified funding as the most common barrier.



Note: For further information on EU programmes, funding opportunities and procurement practices, see page 115.



KEY ENABLERS

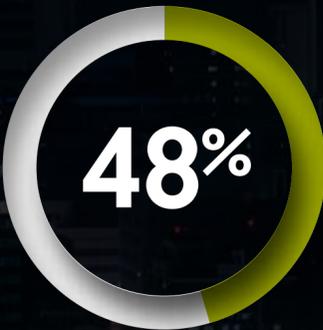
Smart city transformation is seen as a “complex and multidimensional process” [43]. It requires investment in cities’ capability, governance and public engagement, allied with a strong technological component.

Around 92% of cities have implemented at least one of these four enablers for digital transformation shown below. Almost half of the cities report to have training programmes and digital empowerment activities and/or people engagement platforms and applications.



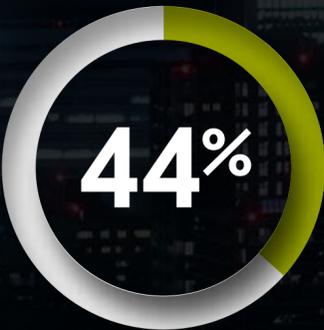
Training Programmes and Digital Empowerment Activities

Skills is one of the four vectors of the Digital Compass, which guides the EU’s strategy for the digital transformation. By 2030, the EU wants 80% of adults to have at least basic digital skills.[44] Cities must invest in their capacity to develop the skills needed for the operation of the smart systems and services they implement. Institutional capacity can improve willingness to adopt new technologies and provide adaptation to changes in internal rules and procedures.



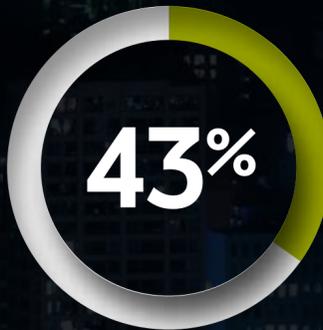
Citizen Engagement Platforms and Apps

Government-community interactions are becoming increasingly digital - technology is changing the way people experience public services and communicate their views. Structural smart city processes put citizens at their centre and involve them in the decision process in a collaborative way. Some cities have been promoting public engagement platforms and apps to empower people and to collaborate with them more efficiently.



Data Management Policies and Practices

Efficient data storage and processing enable data-driven decisions that improve the efficiency and quality of services.[45] Structured data management policies and practices are also key to limiting cyberattacks and data breaches, which are increasing in frequency and scale.[46]



Formally Approved Digital Strategy

A formally-approved digital strategy sets out the vision for a smart digital future and provides a roadmap for the route to follow. In developing digital strategies, local governments identify the needs and capacity of their city to accelerate the transformation process. However, many cities still seem to lack this important requirement for smart city transformation.

Other enablers considered:



Urban Data Platforms



Interoperability practices

PLANS FOR  
FUTURE INVESTMENTS

**THERE'S A CLEAR INDICATION  
OF EXTENSIVE INVESTMENT  
IN THE FUTURE, AND CITIES  
ARE LIKELY TO REMAIN  
FOCUSED ON THE SAME SET  
OF PRIORITIES IN THE NEXT  
THREE YEARS**

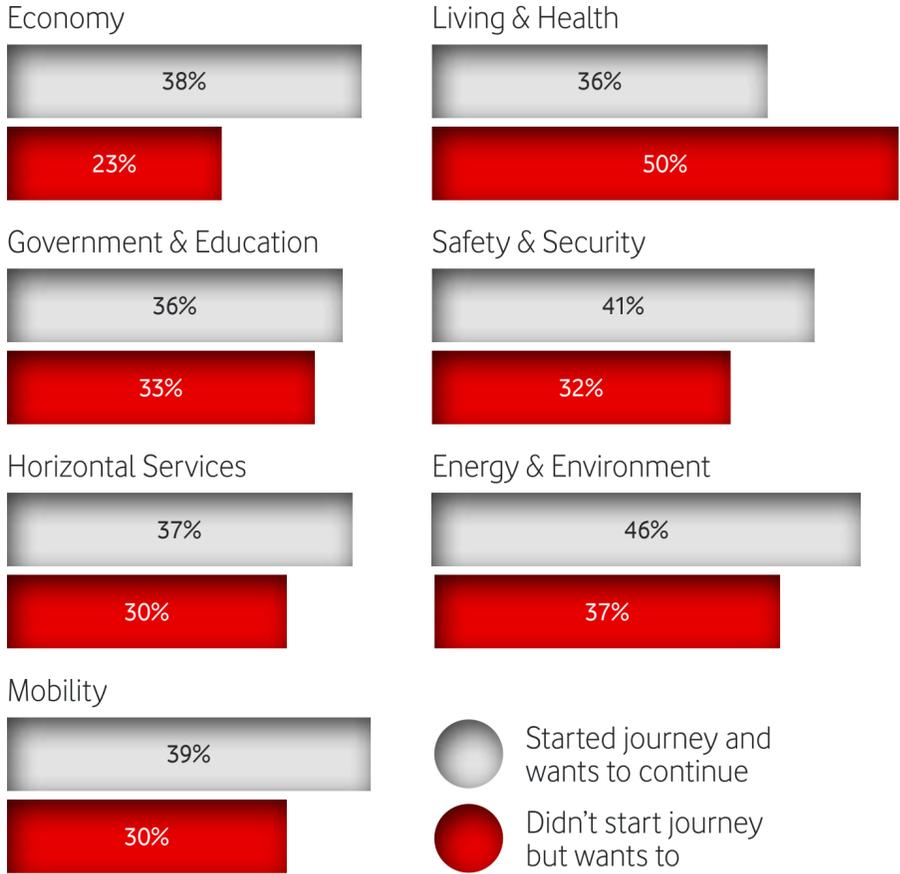
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**Energy & Environment, Living & Health and Safety & Security are the three clusters that cities identify as creating higher value for their communities. This is therefore in alignment with cities' investment plans for the next three years, especially for cities that haven't started the journey, which are increasingly recognising the value of smart city enablement.**



84% have started the journey.

Cities plan to invest in these clusters:



Cities that have started the journey plan mostly to invest in solutions in the clusters of Energy & Environment (46% of cities), Safety & Security (41%), and Mobility (39%). Preferences across different clusters seem to be relatively homogeneous, which reveals diagonal strategies to transform cities crosswise, across several fields, while aligned with cities' policy priorities.

Cities that have not started the journey plan to invest mostly in solutions in the clusters of Living & Health (50%), Energy & Environment (37%) and Government and Education (33%). These cities seem to deeply value Living & Health, disregarding the economic cluster, compared to cities that have started the journey.

16% plan to start the journey in the next three years



of cities with more than 1 million people plan to adopt smart solutions in the Horizontal Services cluster, a higher importance than among other cities (35%).

Country Spotlight

Around **58%**

of German cities plan to adopt smart city initiatives in the next 3 years, slightly below average. Indeed, Germany ranked 18 out of 27 countries in the DESI score on Digital Public Services in 2021.



PLANS FOR FUTURE INVESTMENTS

# The market for smart solutions is growing. 52% of the cities in our survey plan to spend between €2-€10 million on smart and sustainable solutions in the next three years

More developed cities are more likely to spend more on smart city solutions.

## Cities' spending plans on smart city solutions in the next three years



Most cities (52%) plan to spend between €2 and €10 million in the next 3 years.

70% of cities plan to spend up to €10 million. However, for cities that haven't started the journey, spending is likely to be in region of €0,5 million to €5 million.

20% of cities that haven't started their journey but plan to adopt solutions don't know or won't disclose how much they plan to spend. This may relate to an absence of strategy.

The larger the city the more likely it is to look for regional or national funds as a funding option. Plans by cities to use European funding options don't correlate with their size.

Country Spotlight

# 57%

Finnish cities identified the Recovery and Resilience Fund as the most important funding option, which is in the plans of 57% of cities.



## Funding options that cities plan to employ in the next three years



Note: For the Recovery and Resilience Fund and other European sources, figures only include EU countries

# 03

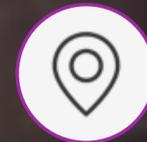
## HOW DOES YOUR CITY'S PROFILE AFFECT YOUR JOURNEY?

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We see cities spread across five different profiles... each reflecting their digital maturity levels and their drive to become smart and sustainable

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### NEW EXPLORER

“I am eager to start my digital transformation journey.”



### PATHFINDER

“I have some solutions in place, but I struggle to make sense of the technological options and align them to a long-term direction.”



### FOUNDATIONAL ARCHITECT

“I have started with the building blocks, have put all the infrastructure in place and I’m now pretty much ready to go.”



### INTEGRATION SEEKER

“Integrating solutions would help me create synergies and further maximise the benefits of the solutions in place.”



### FRONT-RUNNER

“I want to be at the forefront and be prepared for the future challenges, with the city acting as a platform.”

## UNDERSTANDING CITY PROFILES AND MATURITY LEVELS

**Each profile is based on our analysis of five crucial pillars for an effective digital transformation**

The profiles are archetypes of cities that result from a combination of criteria and are based on answers in our survey. Survey questions were mapped to each pillar and given a specific weight in the analysis. Each pillar was rated from one to six, with each red line below representing a one-point increase.

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Note: Further details on the methodology adopted are presented in page 93.

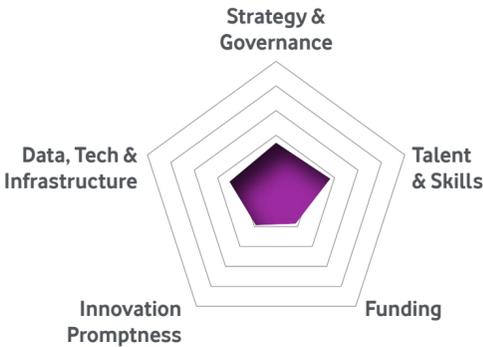
UNDERSTANDING CITY PROFILES AND MATURITY LEVELS

# From New Explorers to Front-Runners, these profiles reflect the maturity level of each city in its digital transformation journey

The identification of profiles helps cities to analyse their strengths and areas for development; different levels of maturity demand different actions and investment approaches.

## New Explorer

Cities beginning to align their political priorities with digital advancements. Hence, they're eager to start their journey and start adopting smart solutions.

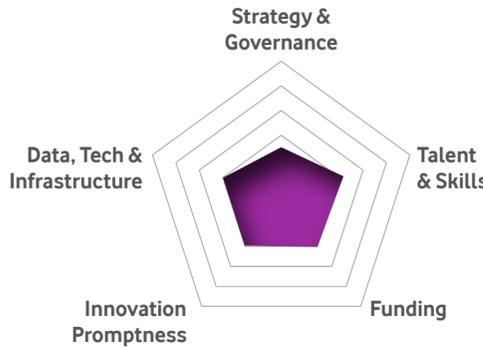


Illustrative example

The city of Badajoz (Spain) already has some projects planned, with the ambition to be listed in sustainability rankings within the next five years.<sup>[47]</sup>

## Pathfinder

Cities looking for a path to follow. They've already implemented some technological solutions but don't have a clear strategy and there's an unbalanced level of development across clusters.

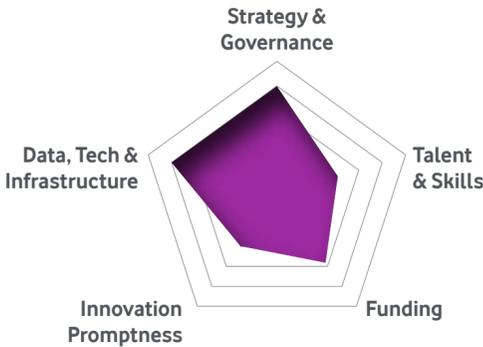


Illustrative example

The Municipality of Marcianise (Italy) has made efforts to draft a strategic digital transformation plan to guide future city projects.<sup>[48]</sup>

## Foundational Architect

Cities that started by defining a clear strategy but with few solutions in place. Past investments were focused on building a solid infrastructure, i.e., command and control or urban data platforms, as a base for future investments in smart city solutions.

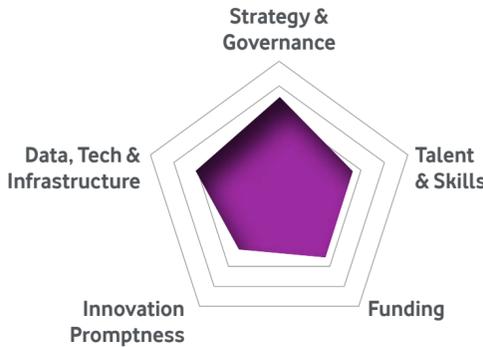


Illustrative example

The city of Munich (Germany) has implemented a "smart city framework strategy" and intends to invest in more smart solutions to improve resource management.<sup>[49]</sup>

## Integration Seeker

Cities that started by defining a clear strategy but with few solutions in place. Past investments were focused on building a solid infrastructure, i.e., command and control or urban data platforms, as a base for future investments in smart city solutions.

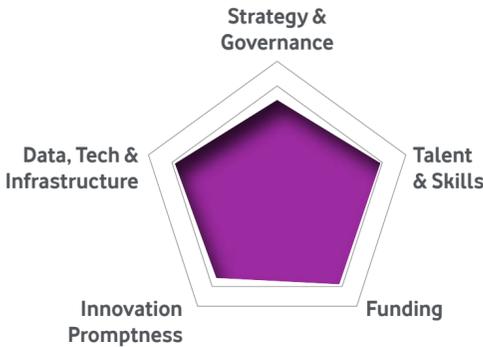


Illustrative example

Porto has a clear smart city strategy, integrated within the municipality's policy goals. It's implemented several solutions and fostered collaboration but lacks an integration platform.<sup>[50]</sup>

## Front-Runner

Technologically mature cities with clear results from adoption of previous smart city solutions. Eager to invest in further innovative solutions, with a balanced development across the five pillars.



Illustrative example

Set to become carbon neutral by 2035, the Helsinki-Uusimaa region (Finland) is investing continually in open labs, promoting innovative and collaborative environments.<sup>[51]</sup>

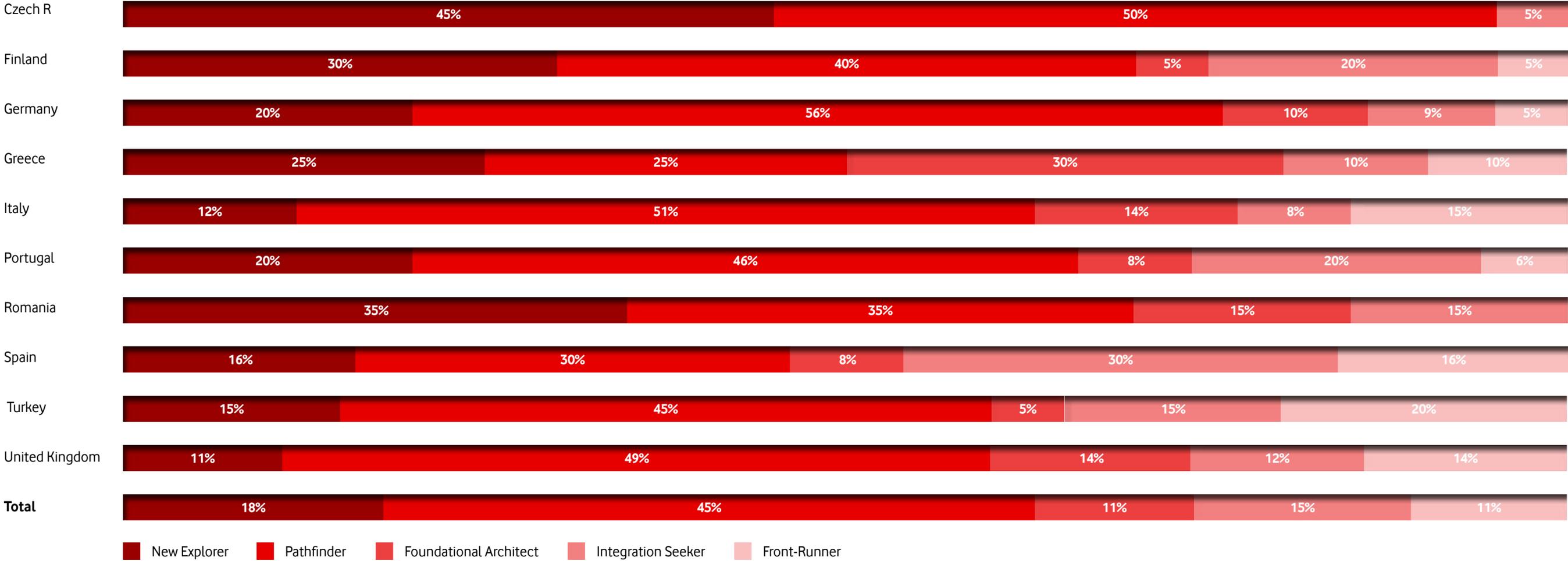


UNDERSTANDING CITY PROFILES AND MATURITY LEVELS

# Pathfinder is the most common profile across countries, but the distribution of profiles varies by country

There are proportionally more New Explorers in Greece, Romania and Czech Republic, and more Front-Runners in the United Kingdom, Spain and Turkey..

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Among the Romanian cities surveyed, none was considered as a Front-Runner. According to DESI scores, Romania ranks last on the indicators related with digital public services and digital skills. These are both important components to support the adoption and promotion of smart city solutions. The same situation was seen in Czech Republic.

Note: Given sample sizes, findings for the smaller markets cannot be deemed statistically significant. Further details on cities distribution per country on appendix (page 95).

## The complexity of barriers tends to increase with digital maturity

Cities at an earlier stage of their transformation journey say they're more restricted by barriers that directly affect their capacity and motivation to adopt smart solutions – namely lack of funding and strategy. As cities progress on their journey to becoming smarter and more sustainable, legislative, regulatory and policy barriers are increasingly important.



New Explorer



Pathfinder



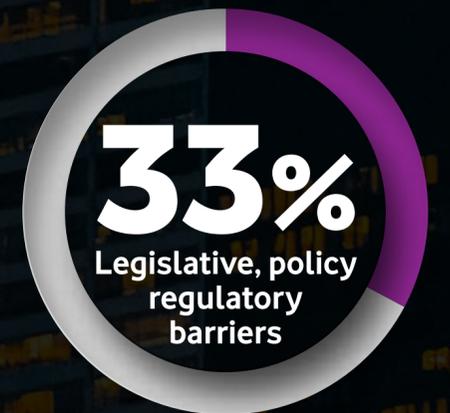
Foundational Architect



Integration Seeker



Front-Runner



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PROFILE LEVEL COMPARISONS

# Regional and national funds are the most important source of funding for all cities, with most advanced cities planning to resort more to the Recovery and Resilience funds

The less progress that cities have made in smart city development, the less they plan to spend on smart city solutions over the next three years. With regard to future sources of funding, regional/national funds are the most important and relevant across all city profiles.

Investment plans in the next three years by city profile (from those planning to invest in smart solutions in the next three years)

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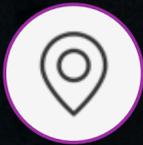


43% of Front-Runner cities plan to invest more than €10 million, compared to 26% for Foundational Architects and Integration Seekers and 17% for New Explorers and Pathfinders. 13% of New Explorers that want to adopt solutions do not know or will not disclose how much they plan to spend.

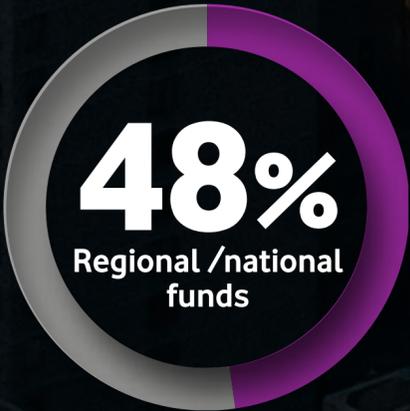
PROFILE LEVEL COMPARISONS

# Sources of funding in the future by city profile (For those that plan to invest in smart solutions in the next three years)

Cities in later stages of development, namely those with Foundational Architect and Front-Runner profiles, plan to resort more to the Recovery and Resilience Funds and public-private partnerships compared to cities at earlier stages of development..



New Explorer



38%  
Local, autonomous funds

38%  
Public-private partnerships



Pathfinder

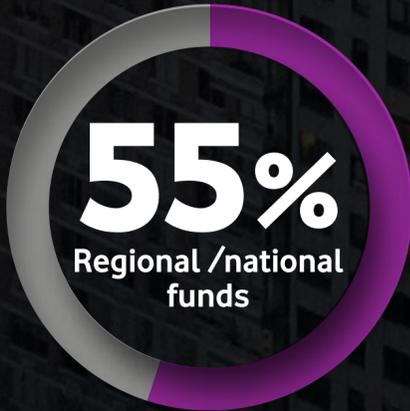


44%  
Regional /national funds

38%  
Consumption-based finance and/or user fees



Foundational Architect

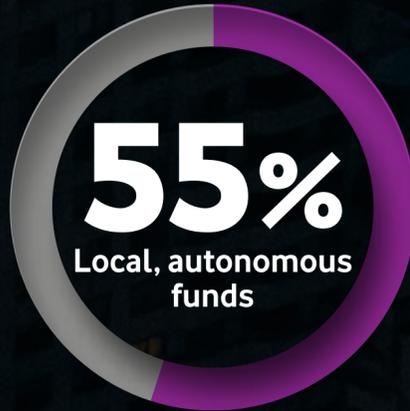


45%  
Recovery and Resilience Funds

43%  
Local, autonomous funds



Integration Seeker



50%  
Regional /national funds

43%  
Public-private partnerships



Front-Runner



52%  
Recovery and Resilience Funds

42%  
Public-private partnerships

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# Future investments and investment priorities vary depending on the stage of smart development that a city has reached

Apart from New Explorers, the percentage of cities planning to invest in smart city solutions in the next three years appears to increase with their digital maturity and smart development. 87% of Front-Runners plan to invest in smart solutions. On average, the more advanced cities plan to invest more on Energy & Environment, Mobility, and Safety & Security, with Foundational Architect focusing more on Horizontal Services solutions. 74% of New Explorers plan to invest.



New Explorer



44%  
Living & Health

34%  
Energy & Environment

33%  
Government & Education



Pathfinder



43%  
Energy & Environment

36%  
Safety & Security

35%  
Government & Education



Foundational Architect



55%  
Horizontal Services

45%  
Safety & Security

40%  
Mobility



Integration Seeker



57%  
Energy & Environment

55%  
Safety & Security

52%  
Economy



Front-Runner



5%  
Energy & Environment

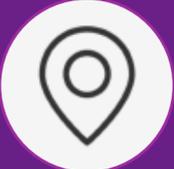
4%  
Mobility

4%  
Safety & Security

Percentage of cities which plan to adopt smart solutions in the next three years and on which clusters (from those planning to invest in solutions)



# CITY PROFILES AND THE KEY STEPS TO FOLLOW ON THAT JOURNEY



## New Explorer

- Design a long-term strategy that sets the vision and a road map based on the city's priorities, resources and successful case studies. Implement the road map.
- Find out about funding opportunities available at local, national and European levels.
- Apply for funding, by understanding the different funding mechanisms available.
- Network with more advanced cities, learning from their experiences and capabilities.



## Pathfinder

- As or the New Explorer, design a long-term strategy that sets the vision and a road map based on city's priorities, resources, and successful case studies. Implement the road map.
- Apply for funding, by understanding the different funding mechanisms available.
- Create a city governance model that is not in silos, to achieve coordination and inclusiveness, by listening to citizens and other stakeholders. Be flexible and adapt to innovative solutions.
- Partner with private providers to develop technological infrastructure and connectivity.



## Foundational Architect

- Create an ecosystem with private partners and academic institutions to accelerate the deployment of solutions.
- Cooperate with regional and national authorities and integrate city networks. Exchange experiences, identify solutions and partner for procurement processes.
- Make use of innovative procurement practices and the platforms made available by the European Union.



## Integration Seeker

- Look for platform providers that ensure the integration of all existing solutions, to create synergies and amplify efficiency gains.
- Apply for funding, by understanding the different funding mechanisms available at the European level.
- Look for alternative funding options, including engagement with private partners.
- Cooperate with and learn from peer cities and private partners, to overcome together the complexity of legislation and procurement procedures.



## Front-Runner

- Adopt pioneering solutions to be a leader in smart city development.
- Cooperate with private entities, to create jointly innovative solutions tailored to the city's specific needs.
- Explore European programmes designed to support more advanced and riskier projects.
- Engage further in alternative business models and innovative funding practices.
- Set governance practices and rules that consider the challenges of privacy, safety, security and ethics.

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recommendations

# 04

## HOW CAN POLICY MAKERS SUPPORT THE TRANSITION TO A SMART CITY?

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## ACCELERATING THE TRANSITION: HOW POLICY MAKERS CAN HELP PAVE THE WAY FOR SMART CITIES OF TOMORROW

### To overcome cities' challenges, there must be collaboration and an 'ecosystem of cooperation' between a wide range of key players

As outlined in this report, cities face several barriers to making progress towards and becoming smart and sustainable. The promotion of an active ecosystem of cooperation and coordination is therefore critical. Numerous steps have been taken by policy makers, particularly by the EU, to coordinate the shift towards inclusive, digital and green communities.

#### Key Players

- Intergovernmental Organisations (e.g., EU)
- Central Governments
- Regional Governments
- Local Governments
- Universities
- Other Public entities
- Private Sector

Coordination and collaboration between key players can be promoted through open labs, partnerships or shared strategies.

#### Examples of initiatives in place



##### EU Vision | Twin Digital and Green Transition

The EU is committed to refocus all their efforts to achieve a truly effective and efficient green and digital twin transition. With one third of the world's public finance coming from the EU and its Member States, coordination among public authorities at European, national and regional levels, as well as with the private sector is seen as crucial.<sup>[52]</sup>



##### EU and National Programmes | Recovery and Resilience Facility

The national Recovery and Resilience Facility (RRF) aim to make European countries and economies more sustainable and resilient, as well as prepared for challenges and opportunities stemming from the twin transition. On their RRF plans, Member States must allocate a minimum of 20% of the investment funds to digital transformation. However, many Member States intend to go beyond that threshold with an average allocation of 26%. Smart cities can be a priority.<sup>[53]</sup>



##### Cities Mission | 100 Climate-Neutral and Smart Cities Mission

The EU is set on transforming European cities into innovation centres, creating drivers of transformation. This mission aims at delivering 100 climate-neutral and smart cities by 2030, alongside providing tailored support and targeted funding opportunities. 377 cities across Europe applied for the programme, with the European Commission committing to supporting cities that weren't selected as one of the 100 through the Mission Platform and additional funding opportunities.<sup>[54]</sup>

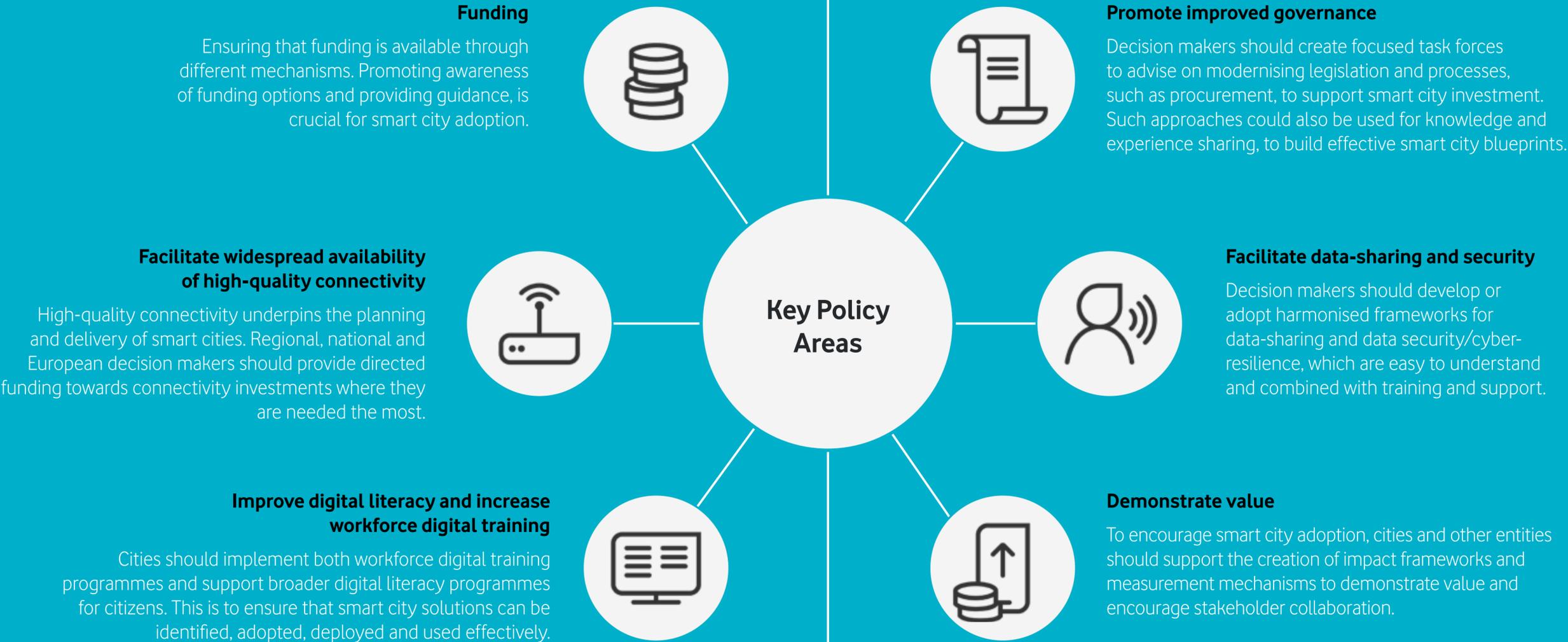


##### Cities Strategy | National Smart City Strategies

To promote cooperation among cities and ensure full coordination at a national level, some countries have been promoting national smart city strategies. Portugal<sup>[55]</sup>, Turkey<sup>[56]</sup>, UK<sup>[56A]</sup> and The Netherlands<sup>[57]</sup> are some of the examples that have already followed this approach.

**INFRASTRUCTURE,  
DIGITAL LITERACY AND  
DATA GOVERNANCE  
ARE KEY AREAS  
IN WHICH POLICY  
MAKERS CAN SUPPORT  
SUCCESSFUL SMART  
CITY DEVELOPMENT**

Barriers to progress can, with the right support and activation by Government and other decision makers, be turned into effective enablers. These will drive an acceleration towards approaches of smart city solutions that help meet policy objectives. The key areas where policy support should be provided can be mapped to the identified barriers and enablers as follows:



KEY POLICY AREAS

# Adequate funding and investment in smart cities is critical to achieve economic, social, and environmental ambitions

The EU has estimated that an average city of 100,000 people would need €1 billion to achieve climate neutrality by 2030<sup>[58]</sup> Therefore, additional funding programmes and investment plans will be needed to ensure cities have access to the funding they need to reach this goal.

Key policy areas:



Funding



Governance

## FUNDING: AVAILABILITY AND AWARENESS

- Investment in smart cities should be seen as a long-term commitment to ensure the financial stability of projects. Specific funding can be useful to kick-start and test solutions. However, a holistic portfolio approach should be adopted to enable a widespread roll-out of smart city solutions.
- Alternative sources of funding and procurement practices must be explored, e.g., public/private partnerships.
  - The EU has created several initiatives and funding opportunities to accelerate the digital transformation of cities. It has also been promoting innovative procurement practices to facilitate the adoption of solutions.

For further information on these programmes see the Appendix on page 115

- Governments and regional organisations have a responsibility to provide guidance and blueprints for cities to develop their investment plans, in order to:
  - Help cities explore alternative sources of finance, including private investment
  - Increase awareness of the funding available
  - Provide support for funding applications and widening eligibility criteria for subsidies



of countries in our survey identified funding as the most common barrier to transition.



of respondents mentioned funding as a barrier to future smart city investment.



of respondents cited the complexity of the procurement process as one of the main barriers to adopting smart city solutions.



The EU vision of a digital and green transition is supported by several programmes, granting funding opportunities and supporting mechanisms. For instance, the Digital Europe Programme has allocated a budget of €7.6 billion for 2021-2027 to fund investments in digital technology and infrastructure. The EU also devotes a large share of its funds to finance research and innovation under the Horizon Europe programme. Additionally, there are more specific initiatives, such as the European Urban Initiative targeted at sustainable urban development.

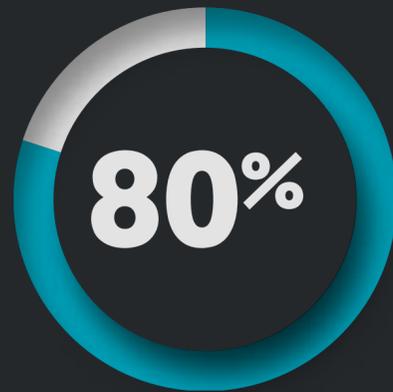
Note: Further information on these programmes and funding opportunities can be found on the Appendix (page 115).

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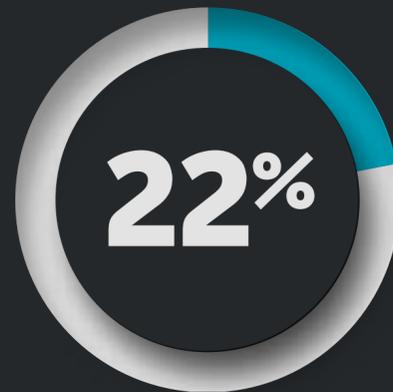
KEY POLICY AREAS

# It's essential to prepare business cases and develop a blueprint for a smart city, to ensure that decision makers make the best investment choices with their limited resources

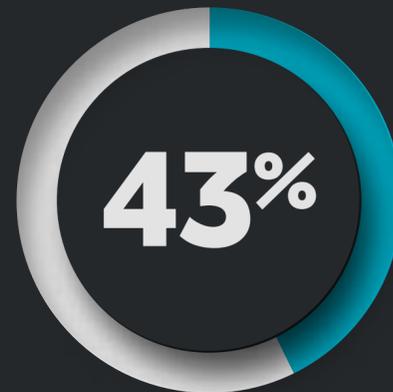
Participants in our survey struggled to find a business case for investment. The complexity of procurement processes also made it difficult to implement smart city solutions. Regulations on data sharing were also a concern.



of the profiles (all but the Front-Runners) reported either procurement or lack of strategy as one of their top three barriers.



of respondents reported privacy and safety concerns as barriers to future smart city investment. This included the GDPR, cybersecurity, and ethics with regards to Artificial Intelligence.



of respondents said that more investment was needed in data sharing systems to enable successful and smooth implementation of smart city solutions.

Key policy areas:



Governance



Data-sharing & Security



Demonstrate Value

## DEVELOPMENT OF SMART CITY BLUEPRINTS

- Decision makers should create task forces and smart city networks, with a remit to:
  - advise on appropriate modernisation of legislation and regulations that would support smart city investments.
  - test smart city solutions on a smaller scale 'within regulatory sandboxes', to assess their effectiveness before broader deployment.
  - support measures to identify effective procurement processes and provide advice on the most efficient and innovative procurement methods.
- Cities should also work towards identifying measurement and impact frameworks, to test the impact of deployed solutions, build blueprints and to efficiently share knowledge and experience on smart city deployment.



An example of task forces in practice is the UK Smart City Network<sup>[59]</sup>, an informal knowledge sharing forum that meets quarterly to discuss opportunities for collaboration and best practice across a range of issues, including IoT, data and connectivity. At EU level, the Climate Neutral and Smart Cities mission is a recent initiative, in which 100 cities will be experimentation hubs and a showcase to inspire other cities to follow the transformation process towards climate neutrality (net zero).

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KEY POLICY AREAS

# An improvement in digital literacy, among the workforce but also the population generally (as users of digital systems) is key to successful smart city adoption

21% of respondents to our survey told us that the inability of citizens to engage with digital services could hamper the roll-out of smart and green solutions. Support is needed to help overcome this problem.

Key policy areas:



Digital Literacy & Workforce Digital Training



Demonstrate Value

## ENCOURAGING SMART CITY ADOPTION THROUGH DIGITAL UPSKILLING

- Cities should establish workforce training programmes, to develop skills in the operation of smart digital solutions.
  - This helps decision makers recognize the benefit digital solutions can bring to their cities and helps them identify and adopt the best solutions, for the 52% of cities which haven't adopted workforce training and digital empowerment activities.
- Decision makers should establish digital literacy programmes, training teachers, buying digital equipment for schools and upskilling the city workforce for digital jobs.
  - Improving their skills will increase the trust of people in digital solutions and make it easier for them to use the available digital services.

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48% of cities have been investing in training programmes and digital empowerment activities, citizen engagement and platform apps.



45% of the EU's target of 20 million ICT specialists employed by 2030 has been reached (around 9 million employed by end of 2021),<sup>[60]</sup> with 55% of the target remaining.



54% of adults in the EU have basic digital skills: this is short of the 80% target set by the EU for 2030.<sup>[61]</sup>



50% of countries in our survey indicated that developing digital skills was one of the top two areas requiring future investment. 80% of countries indicated that it was one of the top three areas needing investment.



There are several initiatives across Europe focused on improving citizens' digital literacy and skills. For instance, in Portugal, the programme "Eu sou Digital" (which translates to "I am Digital") aims to enlist 30,000 volunteers and create 1,500 digital skill training centres for the purpose of training adults in basic digital knowledge<sup>[62]</sup>.

In France, the National Plan for Digital Inclusion included an initiative to recruit and train 4,000 France Services digital advisors, who have now conducted digital initiation workshops for more than 100,000 citizens.<sup>[63]</sup>

KEY POLICY AREAS

**High-quality connectivity underpins the planning and delivery of smart city deployment, with effective networks being the catalyst to the implementation of many smart city solutions**

Key policy areas:



Funding



High-quality Connectivity

**QUALITY CONNECTIVITY AS THE CATALYST FOR SMART CITY ADOPTION**

- The creation of a high-quality connectivity network depends on having an extensive coverage of:
  - Mobile networks, through an extended coverage of 5G across all populated areas<sup>[67]</sup>
  - Fixed networks, guaranteeing high-quality and fast connectivity, with a more intense deployment of fibre connections. (These covered only 50% of EU households in 2021).<sup>[68]</sup>
- Regional, national and European decisions makers should provide targeted funding for investments in connectivity where they are needed the most.
  - The Recovery and Resilience Facility, which allocates around €127 billion to digital investment presents a tremendous opportunity to accelerate the digital transformation and build high-quality connectivity networks.<sup>[66]</sup>
  - Specific support for public institutions such as schools and hospitals through, for example, development of connectivity voucher schemes, should also be considered to support take-up of high-quality connectivity.
- There should also be a review of other barriers to network rollout, such as planning regulations.

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of survey respondents said that further investments in connectivity were required to ensure successful implementation of smart solutions.



of countries in the surveyed identified the need for more investment in other digital infrastructure to enable the smooth and successful implementation of smart city solutions.



of households in the European Union were covered by Fibre to the Premises (FTTP) in 2021.<sup>[64]</sup>



of populated areas in the EU had 5G coverage in 2021: this was considerably short of the DESI target.<sup>[65]</sup>



The 5G Action Plan is a key EU initiative to boost the deployment of 5G infrastructure and services<sup>[69]</sup>. This programme supports the adoption of critical new technology, such as connected cars and remote health monitoring systems, important for economies and society at large. In Germany the government has taken steps towards to ensure 5G coverage for its entire population by 2030 and aims to speed up 5G and fibre access in underserved areas<sup>[70]</sup>. In addition, its programme seeks to establish 4G and 5G network coverage across 7,800km of railway lines<sup>[71]</sup>.

# 05

## STARTING YOUR JOURNEY TO BECOME A SMART AND SUSTAINABLE CITY

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## SMART CITIES NEED SMART AMBITIONS

To take advantage of the benefits that a smart city can offer, decision makers should think big, be creative and have an ambition to push the boundaries and innovate for the benefit of their people and their environment. They need to remove silos and think about each use case as a mechanism for interconnecting city functions.

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**Digital transformation of cities started 10-15 years ago with the deployment of smart solutions as a response to solve specific problems. Unfortunately, a lot of these 'digital responses' failed due to a lack of planning, but nobody ever really asked why.**

Using technology doesn't make a city 'smart', it's how you implement it and the quality of the data generated that makes a city smart. To create a successful and sustainable smart city that optimises the way it performs and enhances the lives of its people, you need to look at the bigger picture. What do you want to achieve, why do you need to do it and what other benefits can be gained by your 'digital response'?

That's why having a clear vision and strategy is critical. Before you start developing your strategy, you need to know where you're starting from. You need to understand where you are on your journey and what to plan for next. We categorise cities into 5 different archetypes based on their maturity level:



New Explorer



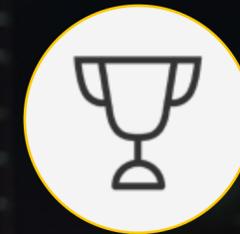
Pathfinder



Foundational Architect



Integration Seeker



Front-Runner

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# Once you know your archetype, what's next?

Now you know where you are on your journey, or where you're starting from, it's time to create your vision and strategy to develop the future of your city.

You'll need to consider how digitalisation will transform your city, not just in the short term but how it will enable the city of the future.

You'll need a strategy that has growth and technology at its heart. Aim to leverage solutions that will integrate seamlessly with your smart city platform and help you innovate for the future with the digitalisation of your city's infrastructure.

Fundamental to the success of any smart city project is the implementation of a governance framework that drives innovation, promotes collaboration and puts citizens at the centre of the planning process.

Citizens should be put first in the development of your vision and strategy. After all, they live in your city and understand what works and what doesn't.

Use them as an organic think tank with millions of collaborators that all have specialist knowledge. For example, nobody knows your transport system like your commuters. Having collaborative interaction with those citizens has the capacity to revolutionise the way your transport system works.

Adopting an innovative governance approach will directly improve the quality of life of your local community, whilst promoting sustainable social, economic and environmental solutions. To assist with developing the correct governance approach for your city, assuming you don't already have a robust system, we've created a framework to help you.

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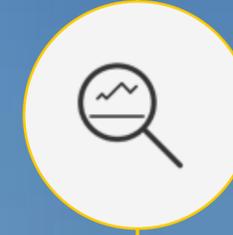
**Strategy**  
How do we get there and when?



**Smart City Self Assessment**  
Current state. What is your archetype?



**Future City Vision**  
Digital and Sustainable city



**Gap Analytics**  
What is needed to go from current to future state

# A simple framework

Creating a sustainable, secure and resilient city will require you to develop a clear set of guidelines. Our 'Open Smart City Architecture' framework can help break down your needs into a clear set of deliverables. The wheel splits smart city functions into four segments:



Environment & Sustainability



Citizenship & Society



City Management



Enablers



All the segments within the wheel can generate data and facilitate insight which supports efficiency and innovation, having an impact on each area of city life, but don't be fooled. Not all data is useful.

City systems should enable important outcomes for society, the economy, and the environment. However, they can only do this if the data generated is of sufficient quality to inform actions and drive desired outcomes. Generating data for the sake of having data isn't beneficial and simply costs money and bandwidth, clogging up city infrastructure.

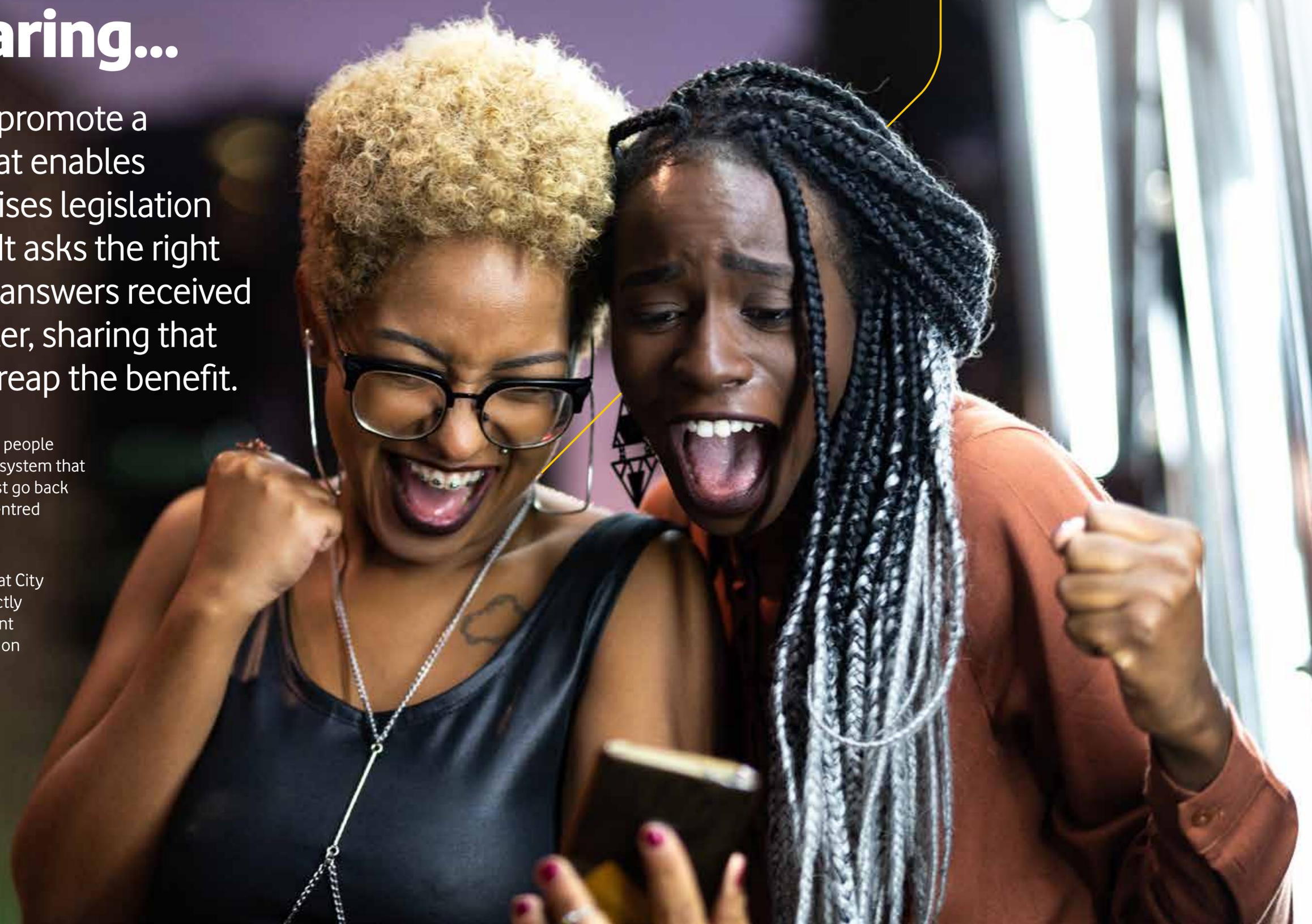
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# Sharing is caring...

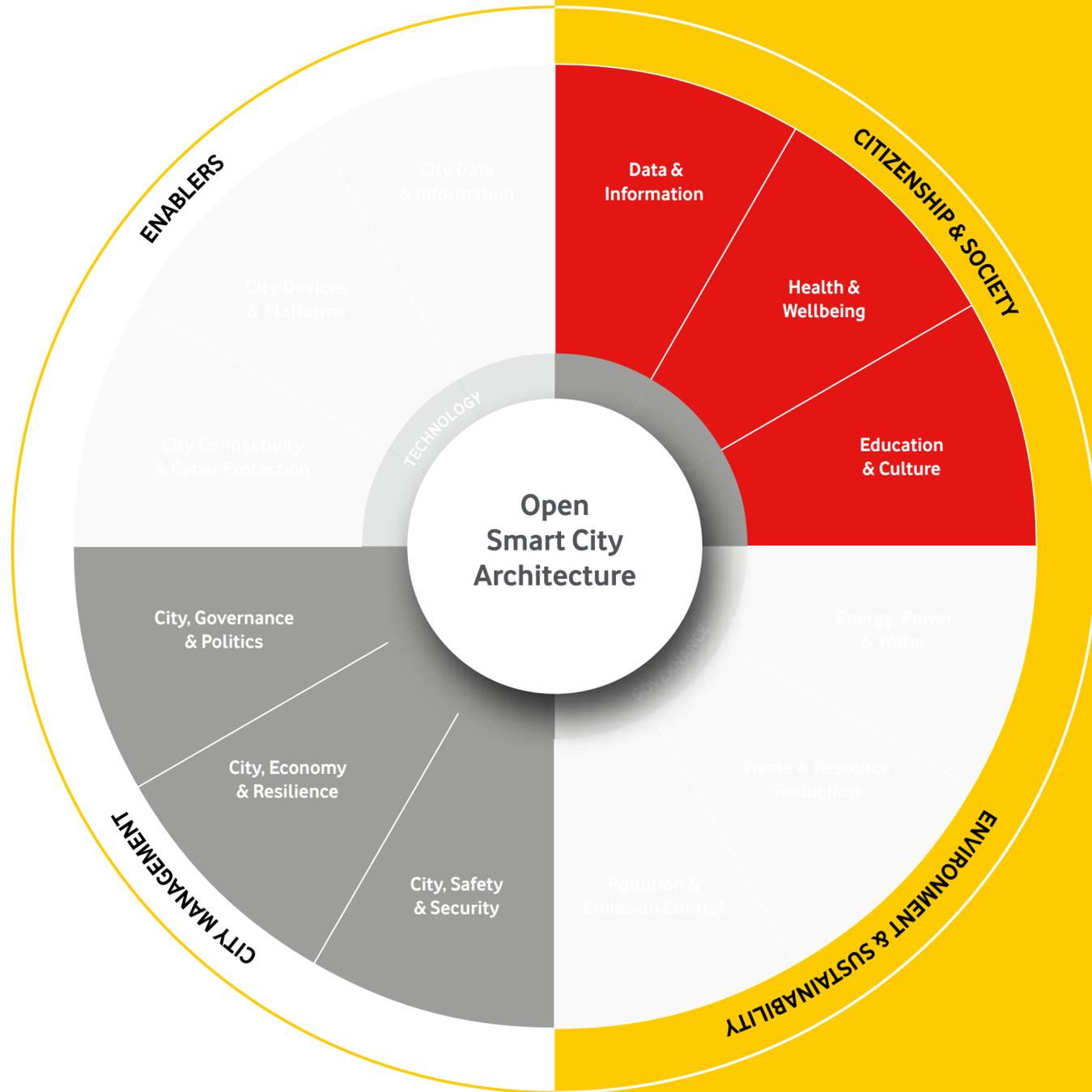
Successful smart cities promote a governance strategy that enables innovation and modernises legislation that drives investment. It asks the right questions and uses the answers received to make their cities better, sharing that data to help its citizens reap the benefit.

If data is the lock that provides access to insight, people are the key. To develop a sustainable urban eco-system that uses technology to provide quality data, we must go back to your governance model and take a human-centred approach to planning.

When we look at the framework, you'll notice that City Management and Citizenship & Society are directly opposite each other. Why? Well, City Management and your governance model has a direct impact on your citizens' day-to-day lives, and it helps us to map needs to outcomes.



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## City Management within the framework is your mechanism to promote:



### Citizenship

Creating a learning environment that nurtures cultural diversity, promotes health and wellbeing and enables direct civic engagement. This is where questions get developed in-line with a need. After all, there's no point counting fish if you want to know how many trees there are.



### Economy

Having a focus on how you can utilise smart city solutions to enhance city and town centre living whilst boosting economies and revitalising urban areas. Adding value is a must. Cities should be able to demonstrate that solutions identified and deployed have a positive impact. Utilising impact frameworks and models help cities generate support for solutions.



### Health & Wellbeing

Implementing safe travel and transport systems with low environmental impact, such as zero carbon public transport can reduce accidents and pollution, having considerable impact on the health and wellbeing of your citizens.

Initiatives such as city bicycle schemes, a robust charging network, autonomous vehicles to transport people and low emission zones can all have considerable impact.

But creating a healthy environment for your citizens isn't just about getting around town. Cities should be safe, secure places that make it easy for citizens to exercise, learn and create a culture that promotes collaboration and inclusion.

By aligning your City Management with Citizenship & Society you'll create a mechanism for your citizens to get involved in the development process, whilst promoting civic engagement, creativity and innovation. Think how these segments can overlap to provide not just a vertical benefit but the horizontal as well. For instance, educating city residents with digital literacy and workforce training not only enhances collaboration and creates a safe online culture but also instils confidence in the information being generated by cities.

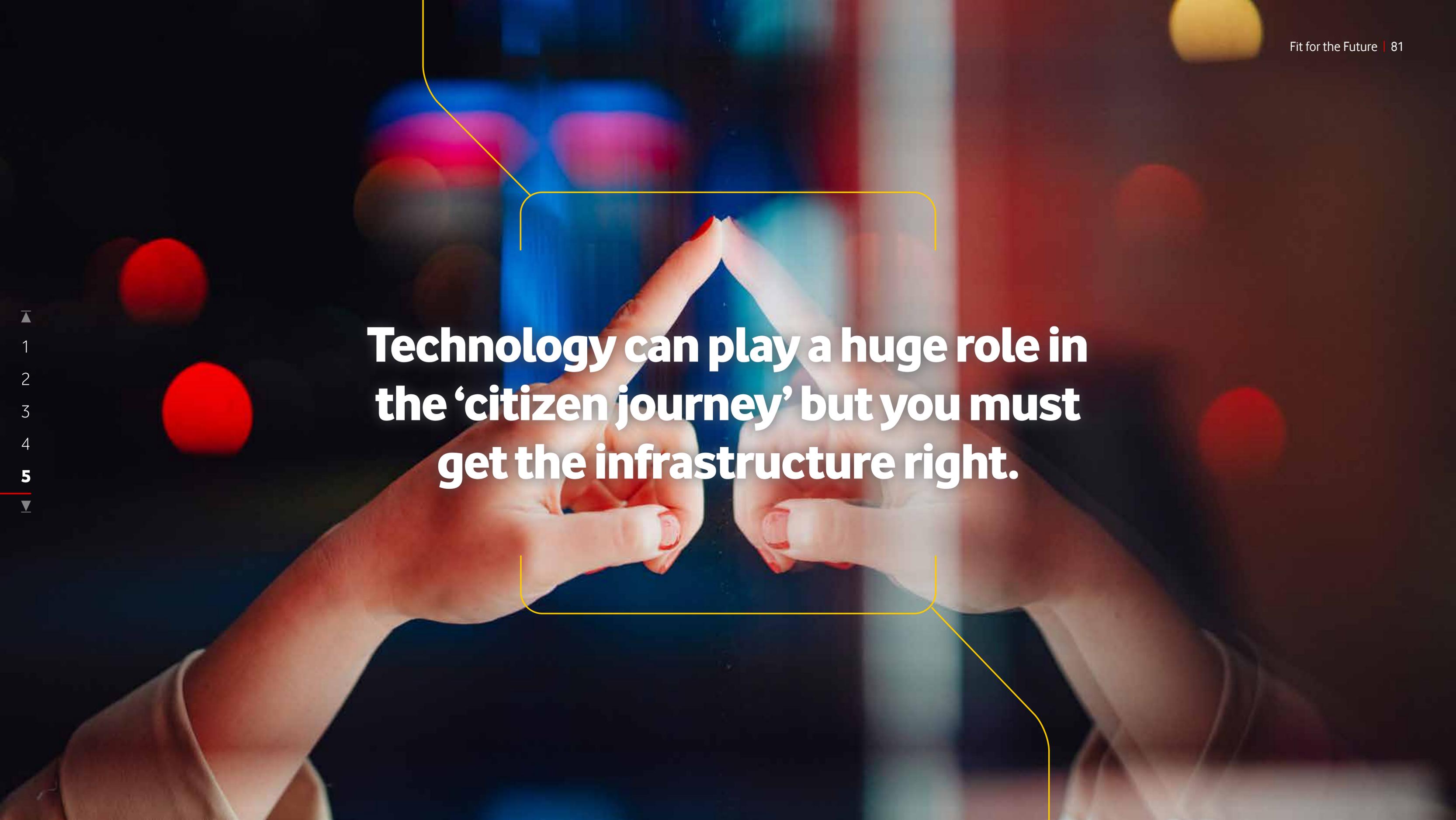
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## Technology & Environmental Sustainability

This report highlights that prioritising changes to urban infrastructure in-line with green transition is critical. People and Data are the primary focus and technology is the enabler to facilitate. But what does that mean?

Technology has a massive role to play in building a smart city environment that will lead to energy reduction, lower pollution and a better way of life for your citizens. Smart infrastructure isn't just about the wires, cables, and sensors. A smart infrastructure is an eco-system of different solutions that combine to provide quality data and analytical feedback on the performance of the cities functions. Think about your citizens as customers, you want them to have the best experience possible, so they're happy with the smart services they receive and then want more.

A photograph of two hands, one from the left and one from the right, with fingers pointing towards each other to form a heart shape. The background is dark with colorful bokeh lights in shades of red, blue, and yellow. A yellow line graphic starts from the top left, goes down, then right, then down again, framing the top and right sides of the heart. Another yellow line graphic starts from the bottom right, goes left, then up, then left again, framing the bottom and left sides of the heart.

**Technology can play a huge role in the 'citizen journey' but you must get the infrastructure right.**

## City infrastructure must be reliable, resilient and provide efficient secure access to digital resources, such as:

- City platforms & devices
- Data & information

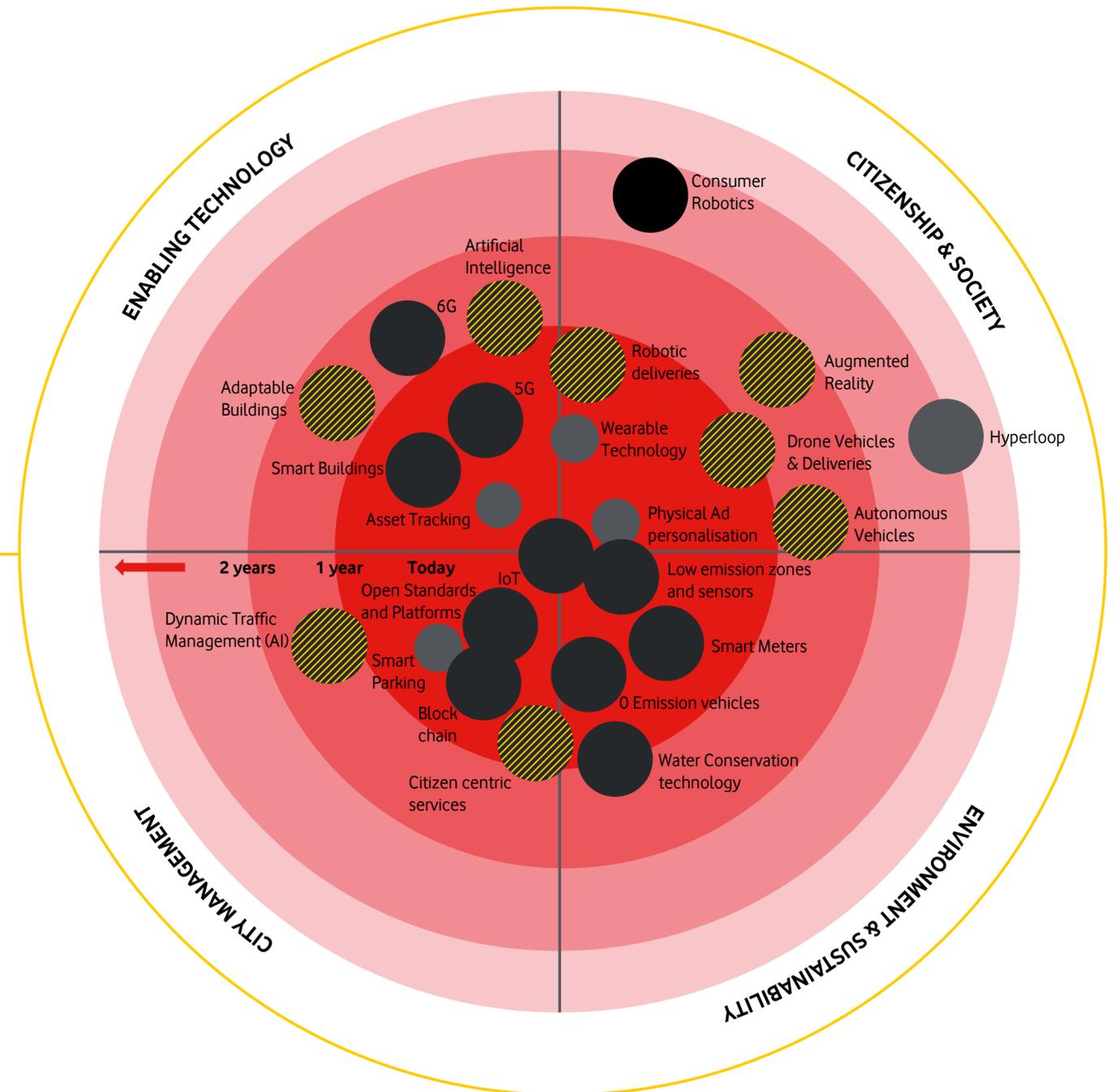
The solutions listed above can provide digital intelligence that makes city services run more efficiently, reduce costs and drive sustainability targets.

Probably one of the most important factors when considering technologies within a city environment is scalability and integration. Open standards can help cities to scale and integrate technologies, which can reduce overhead and leverage better intelligence from city systems. When planning your data strategy, consider how it will scale, plan for growth, and look to leverage technologies that minimise impact on your city's infrastructure.

## Think about the future

Understanding which technologies can benefit which challenges and then their roadmap for development is critical to planning for the future. As you develop your strategy, you'll need to consider what the world will look like at certain milestones in your city's development.

The diagram below highlights some of the technologies that will be fundamental to your smart city.



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LEARN FROM OTHER CITIES

**Like most things, cities are impacted by trends, so understanding what other cities are experiencing and the direction they're taking to respond can help you with your digitalisation process and have an impact on your journey. Some areas where you can benefit include:**

- Understanding solutions that have worked for other cities
- Creating realistic budgets to deliver solutions that provide 'real' benefits
- Developing a roadmap that is achievable and deliverable with long term 'north star' goals
- Removing barriers and avoiding creating data silos
- Integrating solutions that can easily scale beyond the city to support urban and regional development

However, cities are complex environments and one size certainly doesn't fit all when learning from other cities — always have your own needs at the front of your mind. Think how situations impact your environment and think about the future.

Provided your strategy is thought about early and you put an emphasis on creating a robust governance model, your city can reap the benefit from leveraging digital technologies.



**Environmental Sustainability**

Reducing pollution, energy consumption and waste, whilst building a healthy environment



**Social Sustainability**

Creating an inclusive city that promotes, education and culture, and supports a healthy environment to live and work that provides open, clean, safe places for your citizens and society to flourish.



**Economic Sustainability**

Creating an engine of economic growth through innovation, digitalisation and investment (This can only be done with effective leaders and empowered citizens.)

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This report has been created to give you all the information you need to develop a digital strategy and shows how you can use technology to build a better, smarter and more sustainable city for the future.

## **Ready to transform your city?**

Start your journey today at  
[www.vodafone.com/business/industry/public-services-smart-cities](http://www.vodafone.com/business/industry/public-services-smart-cities)

# APPENDIX

**A1. Approach and survey methodology**

**A2. Model for mapping city profiles**

**A3. Profile factsheets**

**A4. Smart city solutions by cluster**

**A5. EU Programmes and funding opportunities**

▲  
1  
2  
3  
4  
5  
▼

# APPENDIX

**A1. Approach and survey methodology**

A2. Model for mapping city profiles

A3. Profile factsheets

A4. Smart city solutions by cluster

A5. EU Programmes and funding opportunities

▲  
1  
2  
3  
4  
5  
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**THE SURVEY WAS  
CONDUCTED BY  
OPINION MATTERS,  
AN INDEPENDENT  
MARKET RESEARCH  
CONSULTANCY,  
BETWEEN 15.03.2022  
AND 19.04.2022**

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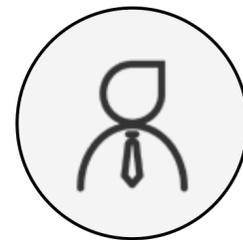
### Target sample

- 550 city representatives from 10 European countries participated in our survey regarding smart city development in their city. Geographical distribution of cities: Spain (100), UK (100), Italy (100), Germany (100), Romania (20), Portugal (50), Czech Republic (20), Turkey (20), Greece (20) and Finland (20).
- Screening questions were used to validate that the following conditions were met for inclusion in the survey:
  - Population of the local authority above 50,000
  - Respondent is an employee of a local authority or government department, in a municipality, metropolitan area, district or state
  - Respondent is at high level of authority in the local authority's decision making over technology and innovation.

### Distribution of respondents by function and decision-make role:



C-level representatives (38%)



Mayors (3%)



Mayor's Advisors (4%)



Senior Management (41%)



Elected officials (14%)



Person who makes the final decision on investments in this area

Person collectively responsible with other people

Part of the assessment and analysis process

Consulted before any decision or action is taken

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APPROACH AND SURVEY METHODOLOGY

Distribution of respondents by type of local authority and population:

40%

Between 50,000 and 250,000

31%

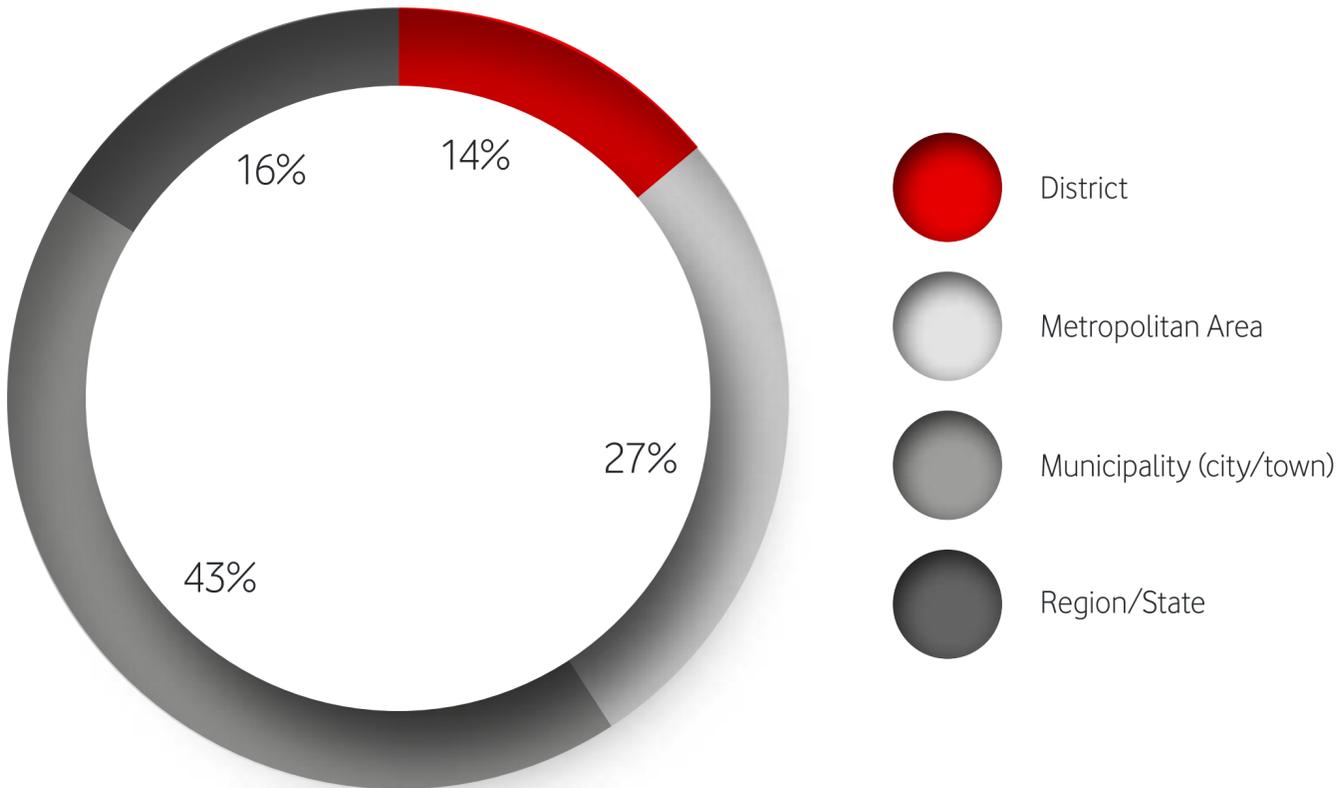
Between 250,000 and 500,000

17%

Between 500,000 and 1,000,000

12%

More than 100,000,000



Ensuring data quality and validation

The survey took the form of a self-assessment exercise, which requires some caution in the interpretation of results. The survey team ensured the quality of the data collected through automated checks, cyclical checks, control procedures and additional manual data quality checks. This ensured that responses were given by humans and not by automated respondents; that respondents who entered the survey could not re-enter again later; and that contradictory or incoherent answers were excluded. Controls were applied if respondents didn't answer the questionnaire at a reasonable pre-defined speed or if they answered the same type of option for all questions.

# APPENDIX

A1. Approach and survey methodology

**A2. Model for mapping city profiles**

A3. Profile factsheets

A4. Smart city solutions by cluster

A5. EU Programmes and funding opportunities



## The city profile model has been used to distinguish between the different stages (maturity) and approaches of cities to digital transformation

The team considered five interdependent dimensions to assess the digital maturity of a city. Each dimension was measured through responses to a set of pre-selected questions in the survey.

### Strategy & Governance

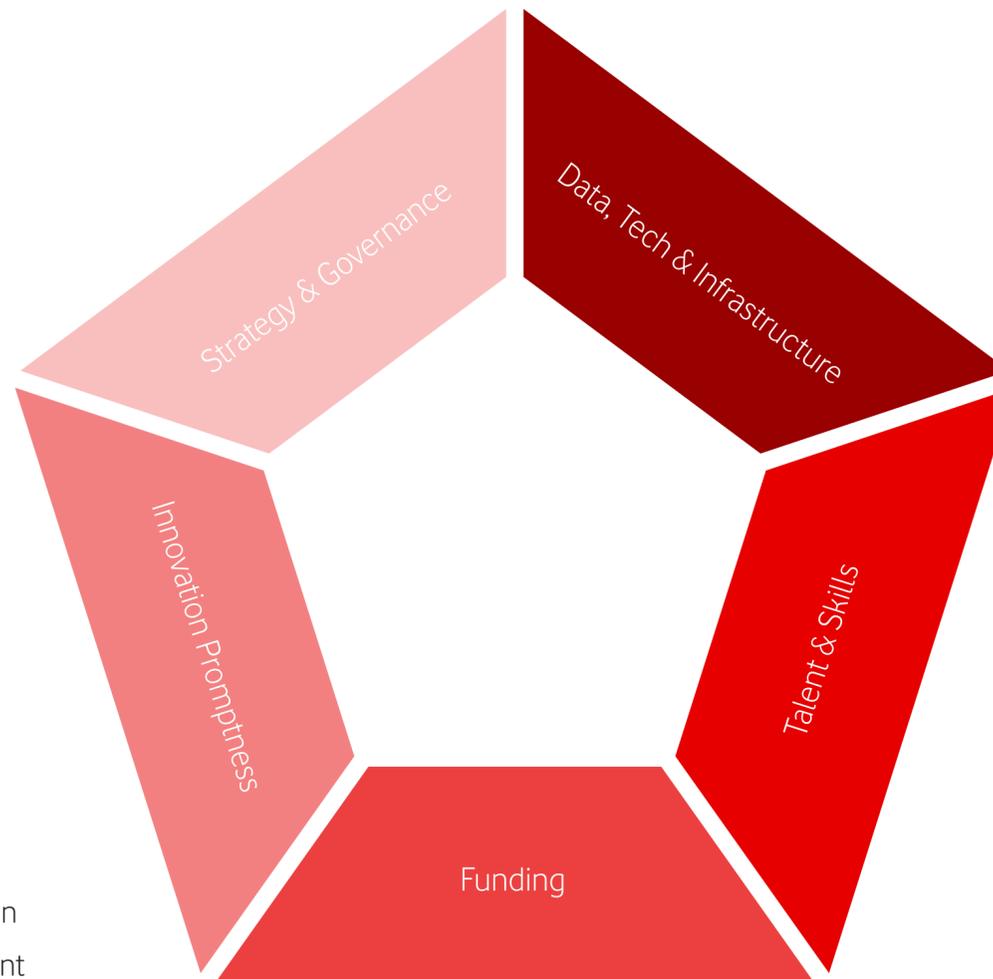
Survey questions to understand to what extent:

- The organisational structure and governance is agile, non-siloed and with data driven decisions
- There is a formally approved smart city/ digital strategy
- Lack of strategy is perceived as a barrier to development

### Innovation Promptness

Survey questions to understand to what extent:

- Innovation is placed at core of local authority' initiatives and if the city is willing to take the risks of the process—even when results are unpredictable
- It has adopted innovative solutions such as blockchain, AI or a digital twin
- Lack of compelling business case and/or high complexity of procurement procedures were perceived as a barrier for development



### Data, Tech & Infrastructure

Survey questions to understand to what extent:

- The digital infrastructure can cope with current and future digital plans or alternatively if it is perceived as a barrier
- There are already smart solutions adopted. If so, how many and what are the plans
- Data management policies, strategies and open data practices exist, as well as urban data platform and interoperability of solutions or practices
- There is a lack of adequate digital infrastructure or technology

### Talent & Skills

Survey questions to understand to what extent:

- The team has the right digital capabilities and skills needed for smart city development
- A workforce training and digital empowerment programme is in place
- Lack of internal capabilities and skills

### Funding

Survey questions to understand to what extent:

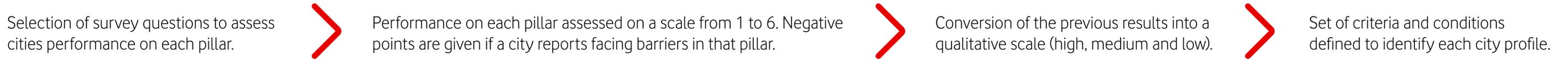
- The local authority has a consistent and significant budget for sustainability and digitalization, and easily accesses and explores alternative funding sources/mechanisms
- Lack of funding is perceived as main barrier in the adoption of smart solutions
- The level of funding per capita on smart solutions over the last three years is higher or lower than average of similar cities

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MODEL FOR MAPPING CITY PROFILES

# The city profile model is used to identify the different stages and approaches of cities to digital transformation

## Approach



## Criteria



### New Explorer

- New Explorers are at the start of their transformation journey. Cities that have not yet adopted any solutions are automatically classified as a New Explorer. Therefore, in case of no solutions are automatically classified as a New Explorer.
- Cities were also classified as New Explorers if they have implemented less than three clusters or less than six solutions, have only a limited tech infrastructure.



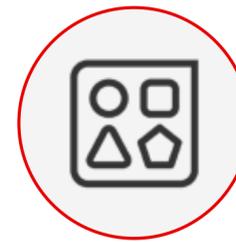
### Pathfinder

- The main bottleneck of a pathfinder is the lack of vision and guidance. Thus, the Strategy & Governance dimension must be scored low or medium.
- Moreover, most clusters were considered medium developed – thus higher than the New Explorer.



### Foundational Architect

- A Foundational Architect has a high score for the Strategy & Governance dimension.
- These cities usually have either a command-and-control platform or an urban data platform in place.
- However, a Foundational Architect has implemented only a small number of solutions.
- Consequently, its primary focus is on infrastructure development and strategy.
- Cities that have adopted more than 10 solutions are not included in this profile.



### Integration Seeker

- The Integration Seeker has already implemented a significant number of solutions (at least 10).
- However, it lacks an integrated platform to leverage the potential synergies of the solutions combined. It does not have a command-and-control platform in place or an urban data platform.
- Developments for the Strategy & Governance and Data, Tech and Infrastructure pillars are assessed as at least medium.



### Front-Runner

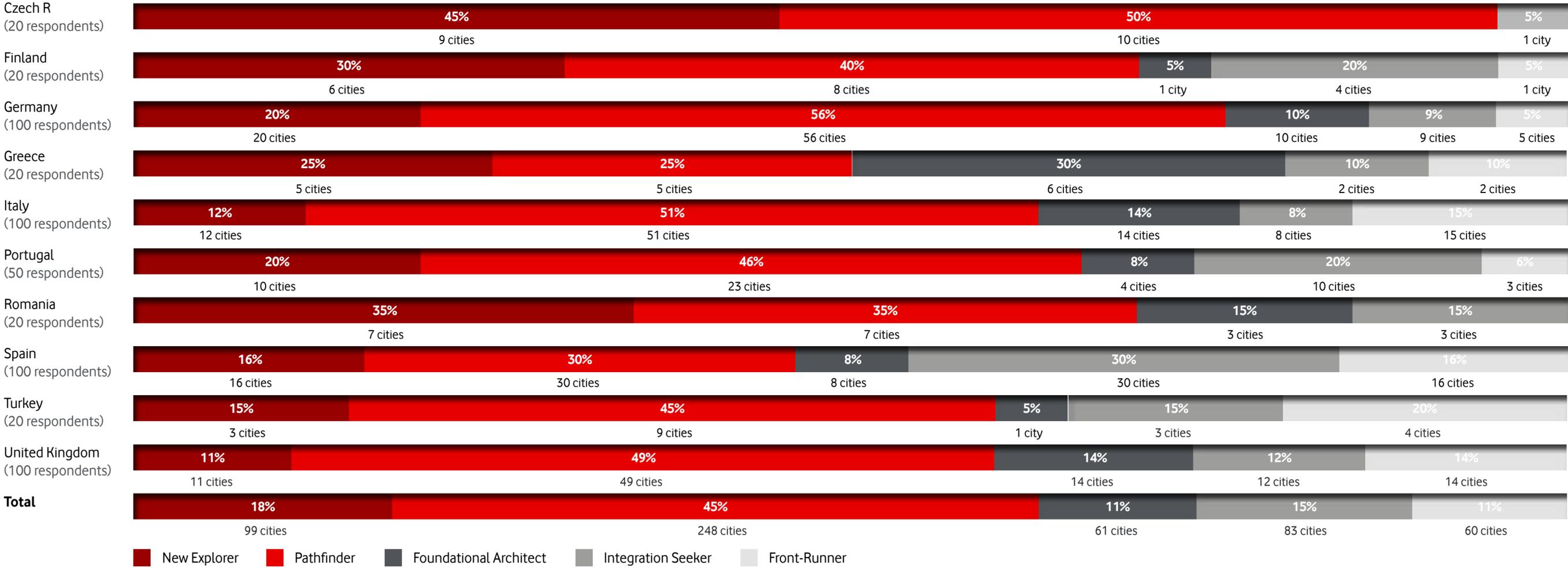
- A Front-Runner belongs to the group of more digitally advanced cities, with a consistent higher performance in all pillars.
- To be considered as a Front-Runner, developments in at least three out of the five pillars need to be considered as high and none classified can be low.
- Front-Runners have a command-and-control platform, urban data platform or digital twin, and AI and blockchain have been implemented.

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MODEL FOR MAPPING CITY PROFILES

We've analysed the results by country, to understand how profiles split per geography

There are significant variations in city profiles between countries. However, given sample sizes, findings for the smaller markets can't be deemed statistically significant.





# APPENDIX

A1. Approach and survey methodology

A2. Model for mapping city profiles

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A5. EU Programmes and funding opportunities

▲  
1  
2  
3  
4  
5  
▼

PROFILE FACTSHEETS



New Explorer  
99 respondents

# New Explorer cities are the ones taking the first steps and have none or very few solutions in place

New Explorers are at the beginning of the digital transformation journey – only 32% have implemented smart solutions, with the most solutions adopted being Government & Education, Mobility and Economy. Eager to start the journey, around 40% of cities have in place workforce training & digital empowerment or people engagement platforms/apps, important enablers of digital transformation.



**Country Spotlight**

Czech Republic has the highest percentage (45%) of cities in the survey classified as New Explorer.

# 45%

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# 68% of New Explorer cities have not adopted any smart solution yet

## Which areas would benefit from additional investment?

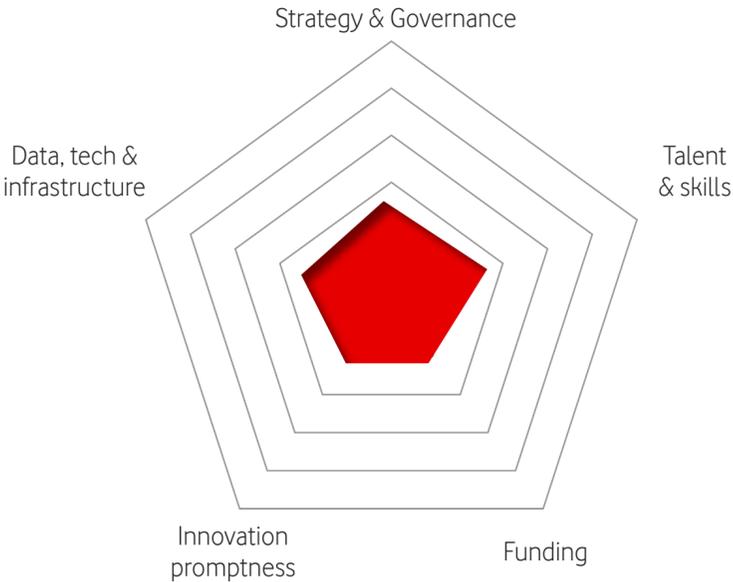


Data, Tech & Infrastructure (41%)



Talent & Skills (41%)

## Distribution of New Explorer's score by dimension



## What are the most common smart city solutions implemented? (For those that have adopted solutions)



Smart Mapping (19%)



Data Analytics (13%)



Digital land-use and building permits (16%)



Smart Parking (13%)



Mobility Operating System (13%)

Note: According to framework in page 23 and solutions list in the appendix

## What are the most prevalent enablers of digital transformation?



Workforce training & digital empowerment



Citizen engagement platforms / apps

## How do New Explorer cities procure smart city projects?

The most-used procurement methods are long-term lease and direct delivery - reported by 28% of New Explorer cities.

PROFILE FACTSHEETS



New Explorer

### More than half of the New Explorers in the survey mentioned lack of funding or lack of a strategy (or both) as key obstacles

These cities have an opportunity, and should focus on developing a well thought out strategy, aligned with their needs and priorities, and explore available funding opportunities.

#### Barriers

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2  
3  
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# 35%

of New Explorer cities report lack of funding as a key barrier, above the average of 30% for all cities. More smaller cities, with less than 500,000 inhabitants (41%) report lack of funding as a key barrier (41%), compared to larger cities.



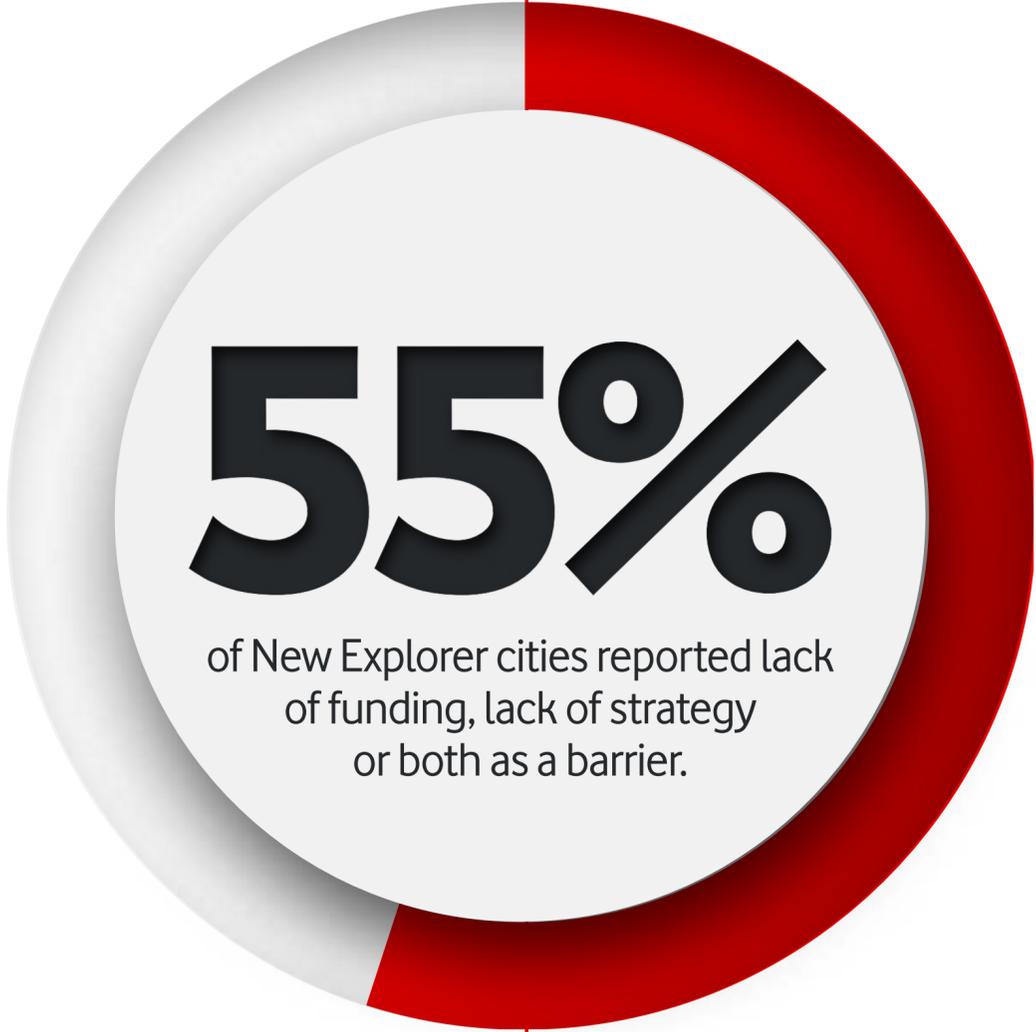
# 28%

of New Explorer cities report lack of strategy as a key barrier, above the average of 21% for all cities. None of the 16 New Explorer cities with more than 1 million inhabitants cited lack of strategy as a barrier.



# 25%

of New Explorer cities cited legislative, policy and regulatory barriers as a key barrier. 38% of cities with more than 1 million inhabitants cited legislative, policy and regulatory barriers.





New Explorer

### Opportunities

Since they don't have solutions in place or are at the start of their digital transformation journey, New Explorer cities can benefit from the design of a structured and thought-out strategy, which identifies the shortcomings to address and the opportunities to explore.

Lack of funding can be seen as an opportunity to explore innovative funding mechanisms, including crowdsourcing and public-private partnerships.

New Explorers should seek to integrate themselves into regional and national networks, or benefit from city pairing initiatives and mentoring: this will increase their awareness of and access to opportunities.

### Possible Solutions



Video surveillance



Real-time air quality information



Smart parking



Smart street lighting



People counting / Flow management



Smart operations



Energy monitoring



Communication infrastructure

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**Pathfinder**  
248 respondents

## Having adopted smart solutions, Pathfinders lack a strategy ensuring a balanced expansion across clusters

15% of Pathfinder cities have adopted solutions in only one cluster, with Energy & Environment, Mobility and Safety & Security being the most common. Workforce training & digital empowerment and Data management policies, strategies and open data practices are the most common enablers in place.



### Country Spotlight

More than half (56%) of German cities were categorised at Pathfinder cities, the highest percentage among the 10 countries in the survey.

**56%**

**15%** of Pathfinder cities have adopted solutions in only one cluster.

### Which areas would benefit from additional investment?

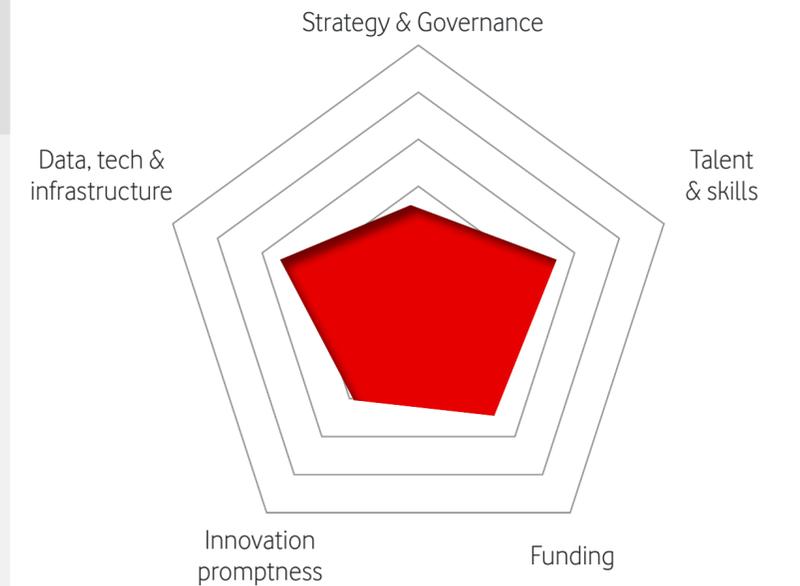


Connectivity (48%)



Governance (45%)

### Distribution of Pathfinder's score by dimension



### What are the most common smart city solutions implemented?



Smart traffic lights (23%)



Emergency Response Optimisation (22%)



Smart lightning (23%)



Real-time air quality information (22%)

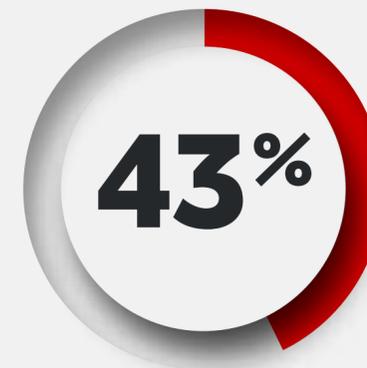


Smart Water Management (21%)

### What are the most prevalent enablers of digital transformation?



Workforce training & digital empowerment



Data management policies, strategies and open-data practices

### How do Pathfinder cities procure smart city projects?

Public Procurement for Innovative Solutions (31%) and Public-Private Partnerships (29%) are the two most common procurement procedures. Collaboration with private entities is once again a relevant aspect.

Note: According to framework in page 23 and solutions' list in the appendix



Pathfinder

## Pathfinders have started to adopt solutions but require funding and a strategy to pursue their ambition

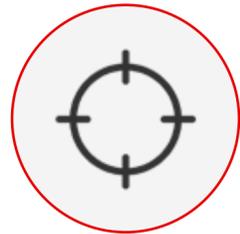
Pathfinders continue to cite barriers aligned with the ones reported by New Explorer, namely lack of funding and strategy, followed by the lack of adequate existing digital infrastructure. Smaller cities are more affected by lack of funding and strategy. They should use regional and national networks to improve their knowledge and capabilities and to help define their roadmap to transformation.

### Barriers



# 29%

of Pathfinder cities report lack of funding as a key barrier. Slightly more smaller cities (up to 250,000 inhabitants) report lack of funding as a key barrier – 32%



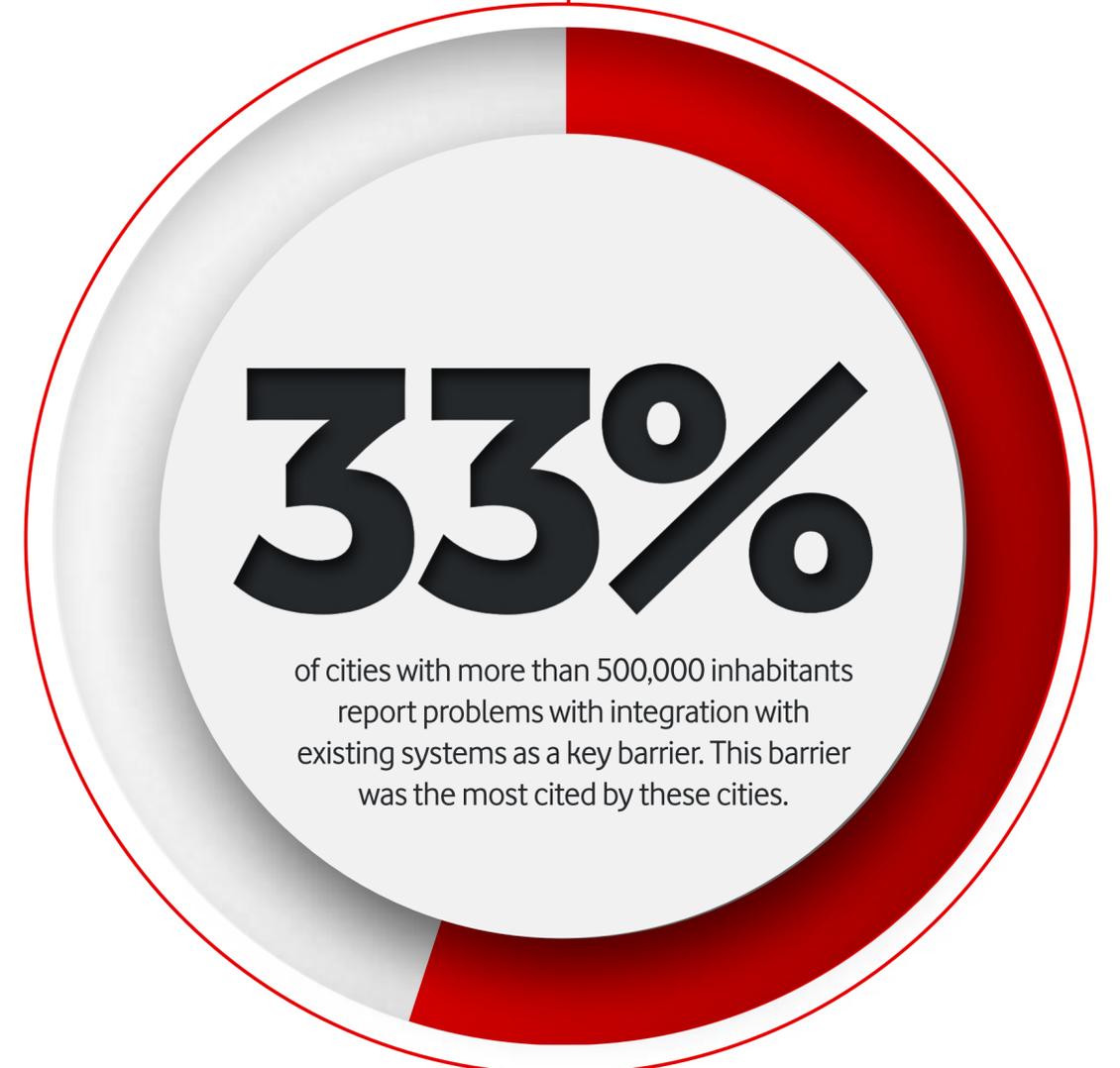
# 27%

of Pathfinders report lack of strategy as a key barrier, above the 21% average for all cities. Slightly more smaller cities (up to 500,000 inhabitants) report lack of strategy as a key barrier – 30%



# 26%

of Pathfinder cities report lack of an adequate digital infrastructure as a key barrier.



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Pathfinder

**Opportunities**

Being at the early stages of smart city development and not having many solutions in place, Pathfinder cities can benefit from the design of a structured and well thought out strategy, and implementation of an adequate digital infrastructure for the strategy.

Integration into regional/national networks and relationships, to develop internal knowledge and improve access to funding and strategic opportunities.

Opportunity to work on integration of systems: larger cities report this more as a keybarrier.

**Possible Solutions**



Emergency Response Optimisation



Smart Operations



Green spaces management



Communication infrastructure



Smart Communities



Integrated mobility & third-party business information



Smart waste collection & management

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**Foundational Architect**  
82 respondents

## While guided by a clear strategy, most Foundational Architects still lag behind in the adoption of solutions

More than three-quarters of Foundational Architect cities have citizen engagement platforms / apps and/or have a formally approved smart city strategy. With a strong focus on infrastructure, these cities invest a lot in Horizontal Services. With all foundations for digital transformation in place, they lack a more intense adoption of solutions: with only 5% of Foundational Architect cities have adopted solutions in all clusters.



### Country Spotlight

Among all countries in the survey, Greece has the highest percentage of cities categorized as Foundational Architects (30%).

**30%**

**54%** of Foundational Architect cities have adopted solutions in the Horizontal Service cluster.

### Which areas would benefit from additional investment?

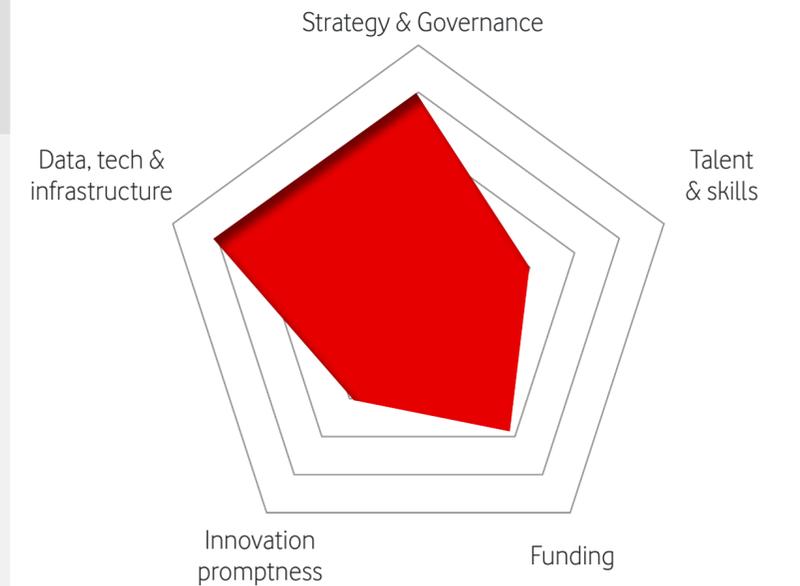


Connectivity (50%)



Data-sharing systems (57%)

### Distribution of Foundational Architect's score by dimension



### What are the most common smart city solutions implemented? (For those that have adopted solutions)



Smart lightning (41%)



Communication Infrastructure (36%)



Energy Monitoring (38%)



Data Analytics (31%)



Command and control Platform (31%)

### What are the most prevalent enablers of digital transformation?



Citizen engagement platforms / apps



Formally approved smart city strategy

### How do Foundational Architect cities procure smart city projects?

Privatisation (34%) and Public-Private Partnerships (31%) are the two most common procurement procedures.

Note: According to framework in page 23 and solutions' list in the appendix

PROFILE FACTSHEETS



Foundational Architect

# The complexity of procurement is the key barrier most reported by Foundational Architects

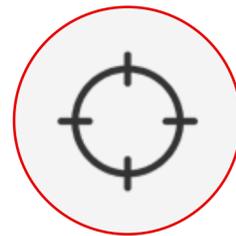
The barrier most identified by Foundational Architect cities is the high complexity of procurement procedures, make it difficult for them to implement smart solutions more extensively. An ecosystem of partners for procurement can improve the uptake of solutions.

## Barriers



# 38%

of Foundation Architect cities reported the high complexity of procurement procedures as a key barrier, above the average of 21% for all cities. 44% of smaller Foundation Architect cities (up to 500,000 inhabitants) cited the complexity of procurement as a barrier.



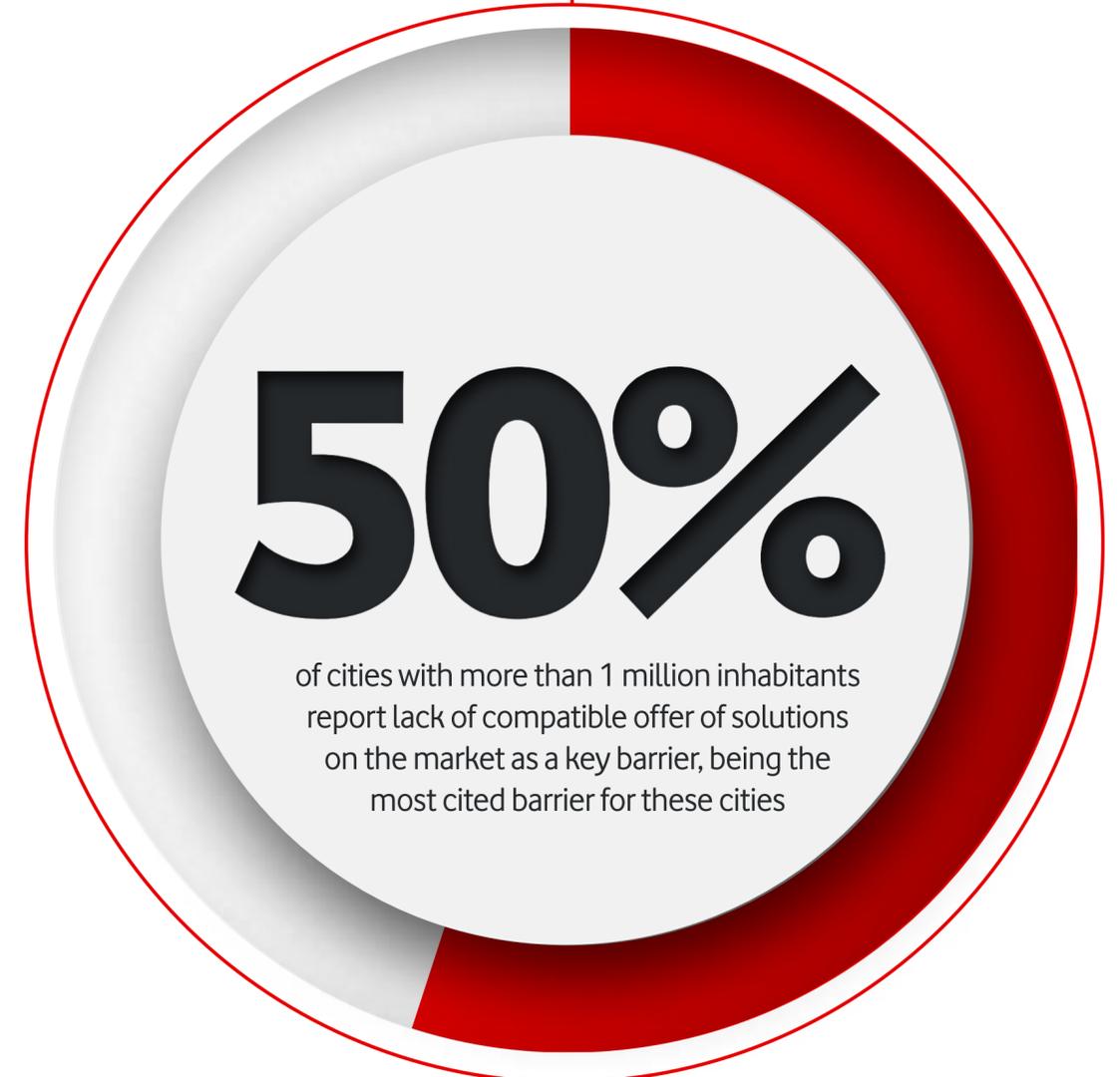
# 33%

of Foundation Architect cities report lack of adequate existing digital infrastructure as a key barrier, above the 25% for all cities. No Foundation Architect city with more than 1 million inhabitants reported lack of adequate infrastructure as key barrier.



# 28%

of Foundation Architect cities identified legislative, policy and regulatory barriers as a key barrier, similar to the average for all cities.



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Foundational Architect

### Opportunities

Since Foundational Architect cities already have the basis of a well thought out infrastructure and strategy, accelerating the adoption of smart city solutions can take these cities rapidly up to the next level of maturity.

Benefit from an ecosystem of partners to accelerate the adoption of smart solutions, either quick wins or long-term projects.

Having a clear strategy and adequate infrastructure, solutions can be tailored to the city's priorities and integrated with legacy systems.

### Possible Solutions



Emergency Response Optimisation



Predictive maintenance of infrastructure



Traffic flow/light management



Climate and air quality control



Smart Communities / Telemedicine



Smart campus / Classroom of the future



Mobility as-a-service



Urban Data Platform / Digital Twin

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**Integration Seeker**  
61 respondents

## Integration Seekers lack common platforms and other Horizontal Services solutions to enable them to achieve benefits of synergy

At least half of the Integration Seeker cities have adopted solutions in each of the clusters – except for Horizontal Services, which only has 20%. Integration Seekers lack solutions and common platforms to capitalise fully on the smart solutions they've implemented. They recognise this weakness and the importance of investing in connectivity.



### Country Spotlight

3 in 10 Spanish cities were categorised as Integration Seeker cities, the highest percentage among all countries in the survey.

**30%**

**80%** haven't adopted solutions in Horizontal Services cluster.

### Which areas would benefit from additional investment?

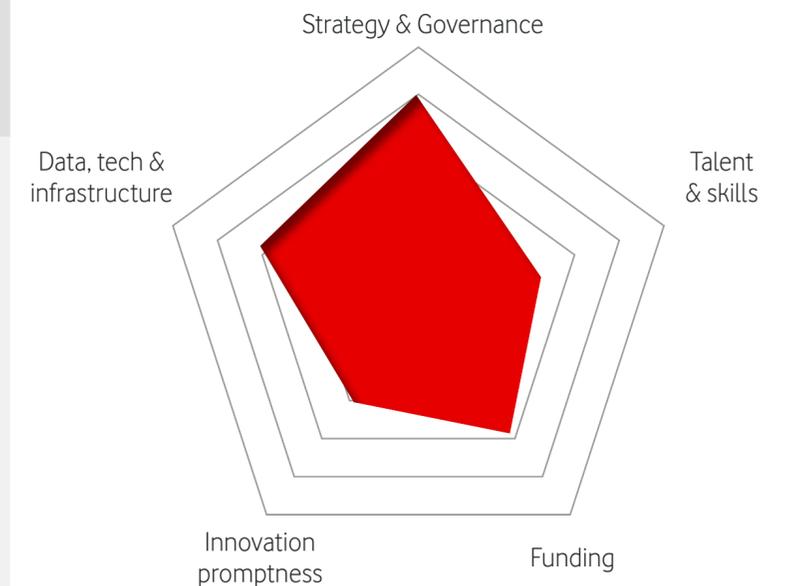


Connectivity (60%)



Talent & Skills (55%)

### Distribution of Integration Seeker's score by dimension



### What are the most common smart city solutions implemented? (For those that have adopted solutions)



Smart video surveillance and analytics (54%)



Emergency response optimisation (52%)



Energy monitoring (52%)



Smart lightning (52%)



Smart waste collection and management (50%)

### What are the most prevalent enablers of digital transformation?



Workforce training & digital empowerment



Citizen engagement platforms / apps

### How do Integration Seeker cities procure smart city projects?

Public Procurement for Innovative Solutions (44% of Integration Seeker respondents) and Operating Contracts (41%) are the most common procurement procedures.

Note: According to framework in page 23 and solutions' list in the appendix



Integration Seeker

## 40% of Integration Seekers say lack of funding is their biggest barrier, particularly those from smaller cities

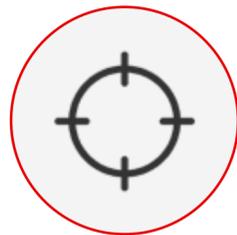
The high complexity of procurement procedures and legislative, policy and regulatory barriers are also seen as major hurdle.

### Barriers



# 39%

of Integration Seeker cities reported lack of funding as a key barrier, above the 30% average for all cities. 46% of smaller Integration Seekers (up to 250,000 inhabitants) cited the lack of funding as a key barrier.



# 29%

of Integration Seeker cities identified the high complexity of procurement procedures as a key barrier, above the 21% average for all cities.



# 29%

of Integration Seeker cities identified legislative, policy and regulatory barriers as a key barrier, above the 25% average for all cities. 41% of larger Integration Seekers (more than 500,000 inhabitants) cited legislative barriers as a key barrier.



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Integration  
Seeker

**Opportunities**

If Integration Seeker cities can get the right opportunities, in terms of integration solutions, leveraging on technology and partnerships to create synergies between all the solutions they have implemented, they can overcome the barrier of lack of integration and reach Front-Runner level.

Opportunity to explore innovative funding solutions, given their level of technological maturity and smart city development.

Integration of solutions in a common platform / IoT Platform / Urban data platform can translate into efficiency and economic gains.

**Possible Solutions**



Emergency Response  
Optimisation



Smart communities / First-  
aid alerts



Integrated mobility & third-  
party business information



Green spaces  
management



Smart citizen cyber risk  
management



Smart operations



Dynamic public transit  
deployment & routing



Urban data platform /  
Data analytics

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**Front-Runner**  
60 respondents

## Front-Runners are leading the way on digital transformation, with innovation at the core of their approach

About 85% of Front-Runners consider that their smart initiatives have been successful in meeting their policy goals. Internal capacity and capabilities are given particular attention, with 80% of Front-Runner cities providing workforce training and digital empowerment for their staff. Another characteristic is active, regular and consistent engagement with people and local stakeholder ecosystems to innovate and develop smart city initiatives



### Country Spotlight

Among the Romanian cities surveyed, none was considered as Front-Runner. (The same happened for the Czech Republic.)

**87%** of cities plan to adopt more smart solutions in next 3 years.

### Which areas would benefit from additional investment?

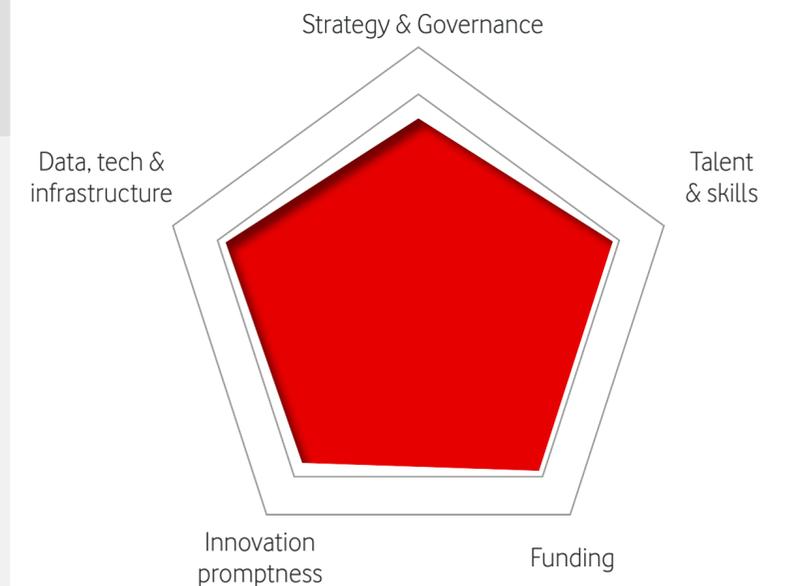


Data-sharing systems (62%)



Connectivity (56%)

### Distribution of Front-Runner's score by dimension



### What are the most common smart city solutions implemented? (For those that have adopted solutions)



Smart video surveillance and analytics (55%)



Real-time air quality information (50%)



Smart traffic lights (52%)



Smart logistics (47%)



Mobility operating systems (47%)

### What are the most prevalent enablers of digital transformation?



Workforce training & digital empowerment



Blockchain, AI or digital twin

### How do Front-Runner cities procure smart city projects?

Public-Private Partnerships, cited by 40% of respondents, and Public Procurement for Innovative solutions, quoted by 38%, are the most common procurement procedures.

Note: According to framework in page 23 and solutions' list in the appendix



Front-Runner

## Front-Runner cities tend to face bigger challenges such as legislative and data privacy barriers

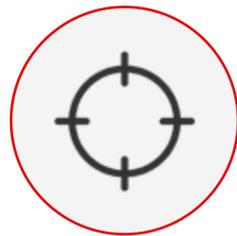
This profile reports more complex challenges, usually coming at later stages of development, namely legislative, policy and regulatory barriers – privacy, safety and security concerns – and integration issues with existing systems.

### Barriers



# 33%

of Front-Runners reported legislative, policy and regulatory issues as a key barrier, above the average of 25% for all cities. An even larger percentage of larger Front-Runner cities (more than 1 million inhabitants) cited legislative barriers as a key barrier – 44%



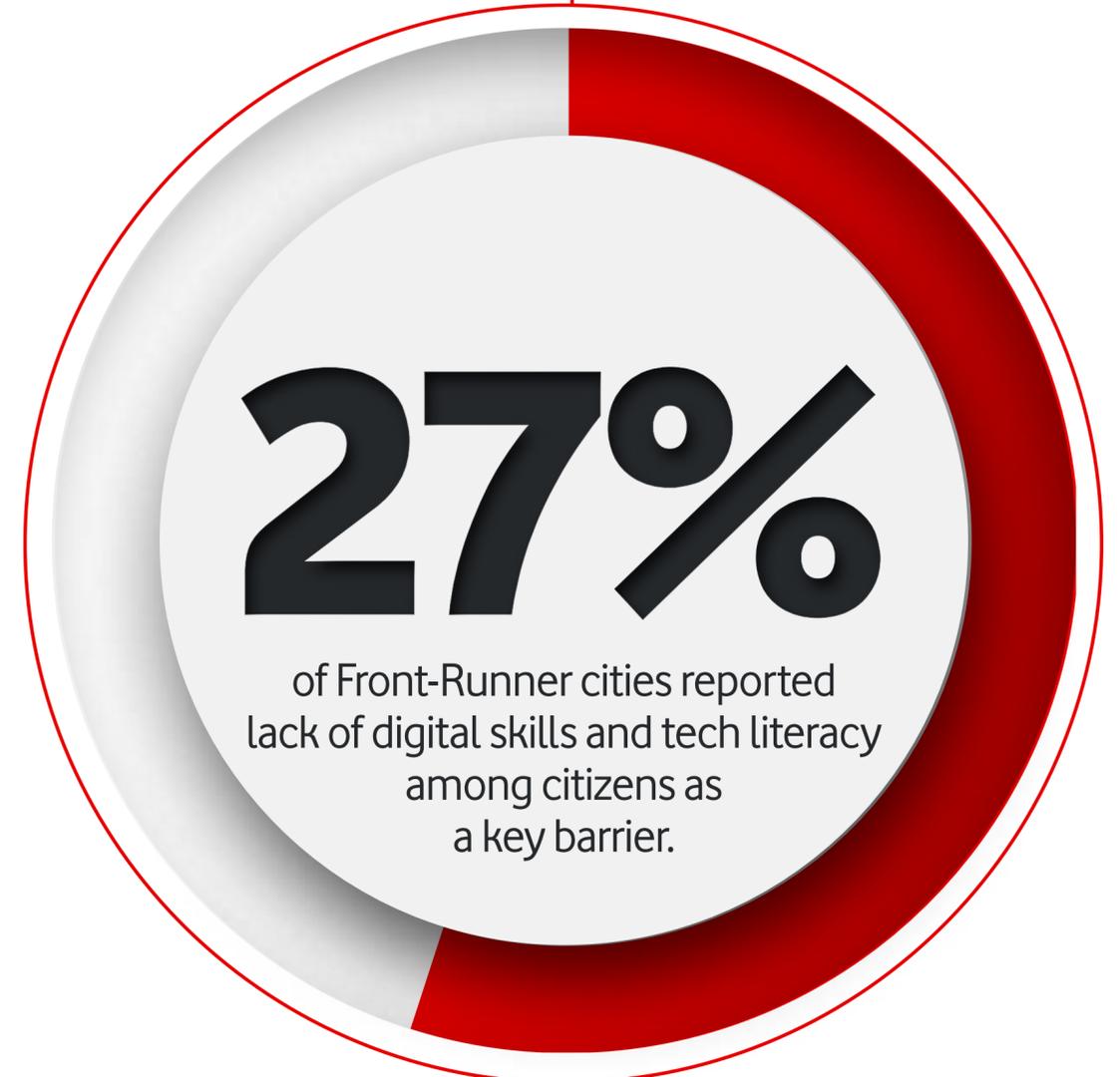
# 32%

of Front-Runners reported privacy, safety and security concerns as a key barrier, above the 22% average for all cities. A larger percentage of Front-Runner cities (more than 500,000 inhabitants) cited privacy and safety concerns as a key barrier – 44%



# 28%

of Front-Runner cities cited problems with integration with existing systems as a key barrier, above the 20% average for all cities



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Front-Runner

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### Opportunities

Front-Runners are vital hubs of smart innovation and knowledge, and so can more easily adopt pioneering solutions. They have easier access and greater flexibility and can adopt alternative business models and funding solutions. They can test pilot schemes in an agile way and scale up rapidly, benefiting from knowledge sharing with other Front-Runners.

Their high level of digital maturity enables Front-Runner cities to recognise their specific needs and adopt tailored solutions according to policy priorities.

Front-Runners have an opportunity to develop long-lasting partnerships with important private sector partners, collaborating with them to develop creative solutions .

### Possible Solutions



Predictive maintenance of infrastructure



Remote patient monitoring



Seamless intermodal mobility



Mobility as-a-service



Real-time crime mapping



Predictive analytics



Fire and flood control



Digital Twin

# A4

## APPENDIX

A1. Approach and survey methodology

A2. Model for mapping city profiles

A3. Profile factsheets

**A4. Smart city solutions by cluster**

A5. EU Programmes and funding opportunities



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1  
2  
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Smart city solutions assessed in our research cover a wide range of options in each cluster

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### Mobility

- Traffic flow/light management
- Smart traffic lights
- Smart parking
- Smart logistics
- Dynamic public transit deployment & routing
- Seamless intermodal mobility
- Integrated mobility & third-party businesses info
- Mobility-as-a-service & transport
- Autonomous vehicles



### Safety & security

- Smart video surveillance & analytics
- People counting/flow management
- Predictive policing
- Gunshot monitoring
- Public alarms & intercom
- Smart border
- Smart Citizen Cyber Risk Management
- Real-time crime mapping
- Emergency response optimisation



### Living & health

- Real-time air quality information
- Smart health monitoring devices
- Smart benches
- Smart retail/shopping
- Telemedicine
- Remote patient monitoring
- First aid alerts
- Online care search and scheduling
- Smart communities: buildings, parks, offices, hospitals, campuses, stadiums, ports



### Government & education

- Local civic engagement applications
- Smart voting & participatory budgeting
- Digital land-use and building permitting
- Predictive maintenance of infrastructure
- Smart regulation
- Classroom of the future with smart dashboards
- Smart student experience
- Personalised education
- Smart campus



### Economy

- Peer-to-peer accommodation platforms
- Smart licensing
- Smart mapping
- Crowd and traffic tracking for tourism
- Revenue management
- Contract monitoring
- Digital business tax
- Local e-career centres



### Energy & environment

- Energy monitoring
- Smart water management (consumption tracking and leakage detection)
- Green spaces management
- Smart street lighting & dynamic electricity pricing
- Smart waste collection & management
- Climate and air quality control
- Smart Grid
- Fire and flood control



### Horizontal services

- Communication Infrastructure
- Data Analytics
- IoT platform
- Command and control platform

# A5

## APPENDIX

A1. Approach and survey methodology

A2. Model for mapping city profiles

A3. Profile factsheets

A4. Smart city solutions by cluster

**A5. EU Programmes and funding opportunities**

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# The EU has a set of initiatives to increase the uptake of public procurement and access to funding and financing opportunities

## Procurement

To promote transparency and the harmonisation of public procurement standards across Europe, the EU has a set of common regulatory frameworks that are applicable to the purchases made by governmental agencies and specific public utility operators. These regulations apply to bids whose monetary value surpasses a specific threshold and have been incorporated into national legislation. For lower value bids, national regulations apply, but national laws must comply with the fundamental rules of EU law.

## Funding and financing

Aligned with its twin transition strategy, the EU has created several initiatives and funding and financing opportunities that are available for cities to speed up their digital transformation. Investment directed towards innovation and research has been increased for the period of 2021-2027, with the urban dimension playing an increasingly important role in EU's structural policies and funds, namely in the Cohesion policy.

EU initiatives aimed at improving public procurement accessibility and practices:

EU initiatives aimed at increasing access to funding and financing opportunities:



Innovation Procurement

Increase demand-side innovation



Green Procurement

Ensure products and services are environmentally-friendly



Social Procurement

Make socially-responsible purchases



eProcurement

Increase transparency, savings and efficiency



Recovery and Resilience Facility

National plans to foster green transition and digital transformation



Digital Europe Programme

Calls for the digitalisation of cities



European Urban Initiative

Pilots in the field of sustainable urban development



Horizon Europe

Research & Innovation activities and pilots

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## For funding and financing, to accelerate the green and digital transition, the EU has launched several programmes and initiatives (non-exhaustive)

The funding period of 2014-2020 set the tone for a strategy aimed at encouraging the green and digital transition. This has been strengthened for the period of 2021-2027, with increased funding for sustainable, resilient and digital cities and countries. The EU has devoted a substantial share of its resources to funding research and innovation initiatives, with the goal of boosting the creation and implementation of pioneering solutions and mechanisms.

Distribution of respondents by function and decision-make role:



### Recovery and Resilience Facility

The national Resilient and Recovery Facility (RRF) aim to make European countries and economies more sustainable and resilient, as well as prepared for challenges and opportunities posed by the green and digital transition. With an overall budget of €672.5b each RRF Plan should account for a minimum of 37% of expenditures for climate investments and reforms and a minimum of 20% of expenditure to foster the digital transition<sup>[72]</sup>



### Digital Europe Programme

Integrated in the EU's vision of a twin transition, the Digital Europe Programme provides strategic funding to support the digital transformation, through investments in digital technology and infrastructure. It focusses on 5 key capacity areas: supercomputing, artificial intelligence, cybersecurity, advanced digital skills, and ensuring a wide use of digital technologies across the economy and society<sup>[73]</sup> For 2021-2027, it is worth €7.6b.

The programme contemplates calls projects to support smart city development, such as the creation of data spaces and the implementation of testing and experimentation facilities for AI and robotics in smart cities. Advice and support is provided by the "100 climate-neutral and smart cities" mission and the Intelligent Cities challenge.



### European Urban Initiative

This aims to strengthen participatory and integrated approaches to sustainable urban development and provide a stronger link to the EU's Cohesion policy. The urban dimension of the Cohesion policy has been strengthened: a minimum of 8% of the European Regional Development Fund (which finances the EUI) in each Member State must be invested in projects selected by cities, based on their own sustainable urban development strategies. With a budget of €400 million for 2021-2027<sup>[74]</sup>, the EUI finances innovative actions and provides support for capacity and knowledge building, territorial impact assessments, policy development and communication.



### Horizon Europe

This is the EU's key funding programme for research and innovation, to support nations, regions and cities in tackling global challenges, such as climate change, pollution of oceans and land, the fight against cancer, and inclusive growth. The programme's budget has been gradually rising, with an overall budget for 2021-2027 of<sup>[75]</sup> €96,889b.

Among other things, the programme contemplates 5 missions, including the "100 climate-neutral and smart cities" mission, for which the EU plans to invest around €360 million between 2021 and 2023<sup>[76]</sup>. The funds will be spent on research and innovation in areas such as mobility, energy and urban planning, and providing cities with the technical, regulatory and financial assistance to achieve their goals.

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