'Fit for the Future' Cities

How technology can accelerate sustainable change

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vodafone

CONTENTS

FOREWORD

SMART CITIES HAVE A SIGNIFICANT ROLE TO PLAY IN CREATING A MORE ECOLOGICALLY AND ECONOMICALLY SUSTAINABLE EUROPE.

At their core, they're designed to improve well-being and encourage financial growth using digital services and innovative technology, including the Internet of Things (IoT). These benefits have never been more important as the world's increasing urbanisation has prompted complex challenges at a social, economic and environmental level.

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[1]. Within the European Union (EU) this proportion is even greater, with 75% of EU citizens currently living in cities[2]. 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[3]. 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[4]. 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

[1]According to the World Bank. See here: https://www.worldbank.org/en/topic/urbandevelopment/overview
[2]World Bank: Urban population (% of total population) – European Union, (accessed on 2022).
[3]United Nations: Generating power – Climate Action (accessed on 2022).
[4]See here: 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.
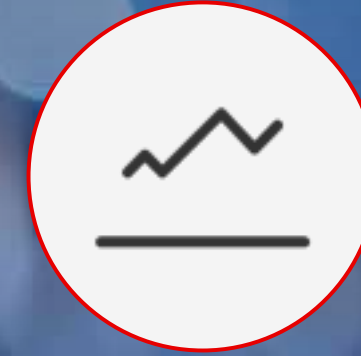
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HOW CAN SMART SOLUTIONS ADDRESS THE CHALLENGES FACING CITIES?

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
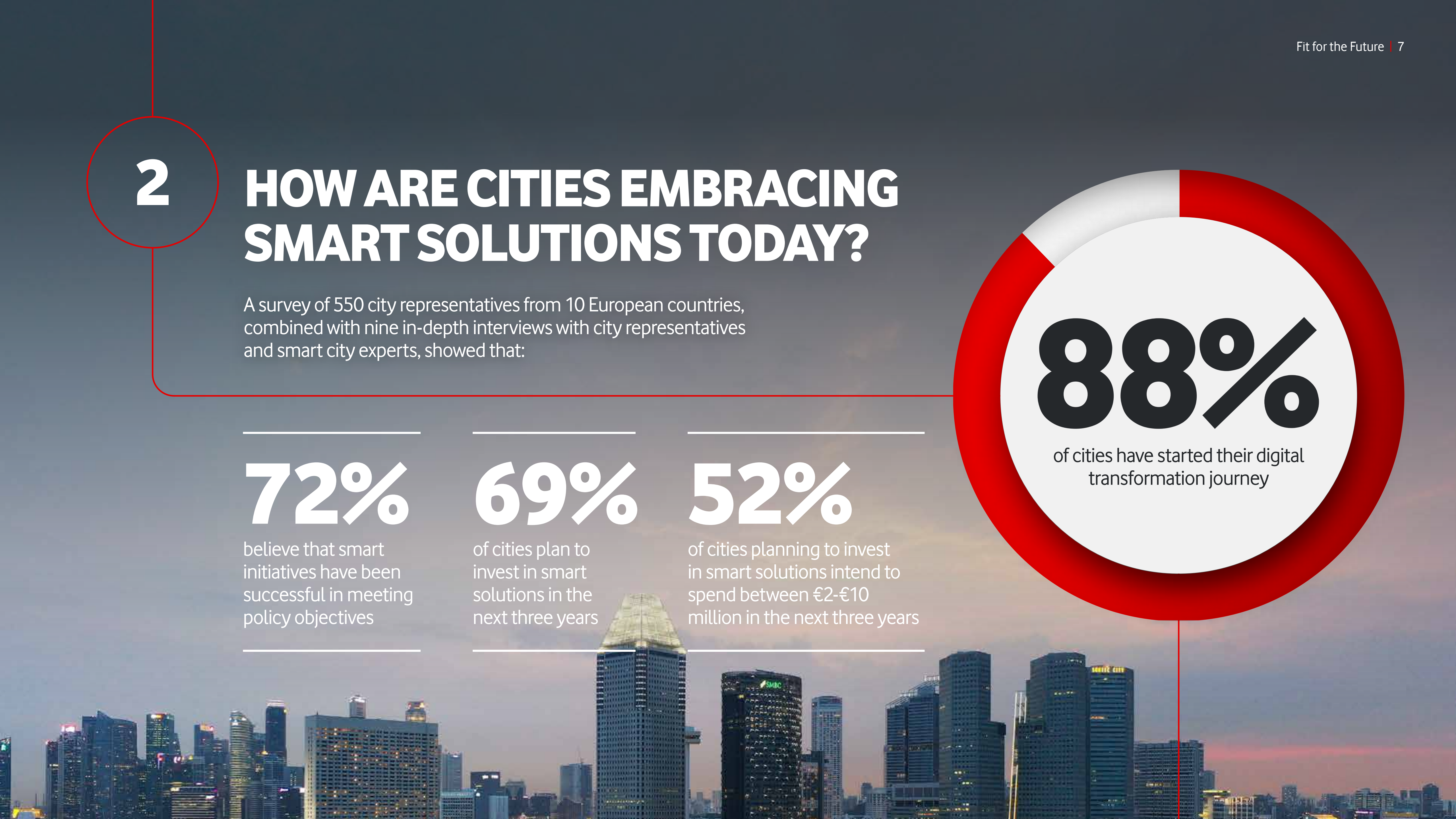
69%
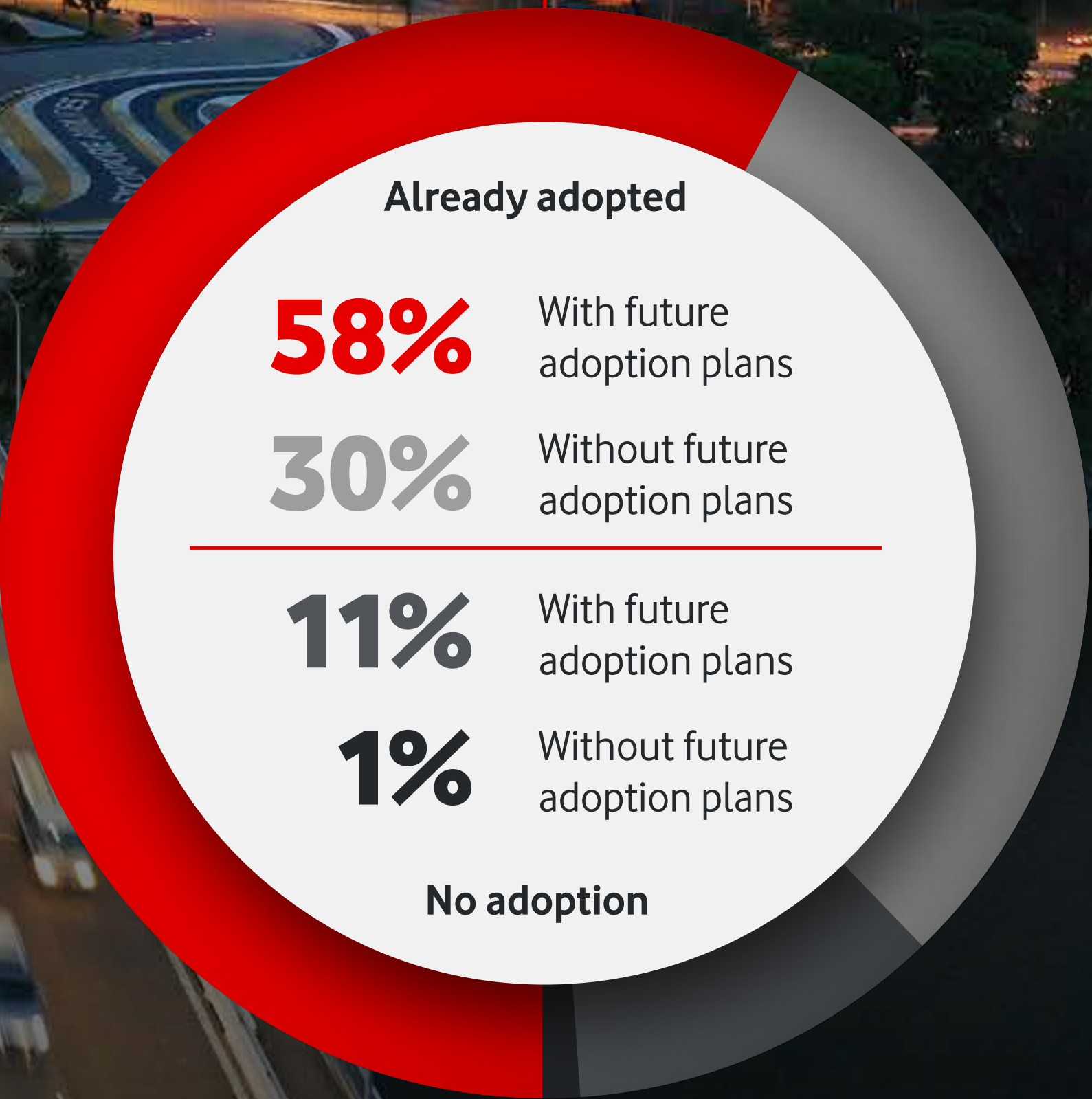of cities plan to invest in smart solutions in the next three years

52%
of cities planning to invest in smart solutions intend to spend between €2-€10 million in the next three years

88%
of cities have started their digital transformation journey

DISTRIBUTION OF SMART CITY SOLUTIONS ADOPTION

Already adopted

58% With future adoption plans

30% Without future adoption plans

11% With future adoption plans

1% Without future adoption plans

No 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.
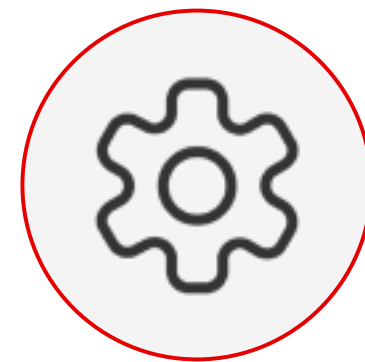
New Explorer

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.

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

(4)

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.
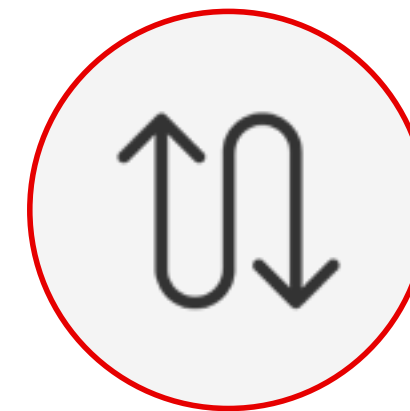
Promote
improved governance

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.

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HOW CAN SMART SOLUTIONS ADDRESS CHALLENGES FACING CITIES?

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) [2] and the European Commission [3]:

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%[4] of the world's population lived in urban areas, and the UN expects this to reach 68% by 2050 [5]. Across the EU, the proportion is 75%[6]. Globally, cities are responsible for more than 60%[7] 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[1]

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.

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[8]:

SOCIAL

ECONOMIC

ENVIRONMENTAL

Note: Based on Deloitte's report: Urban Future with a Purpose

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

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

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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) [9]

"Europe's level of urbanization is expected to increase to 83.7% in 2050" (2018) [10]

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) [11]

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) [12]

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 [13]. 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 [14] and over 17% of Europeans live in overcrowded homes (2022) [15]

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) [16]

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." [17] "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) [18]

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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) [19]

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."[20]
"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) [21]

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) [22]
"Outdoor air pollution could cause 6 to 9 million premature deaths a year by 2060 and cost 1% of global GDP" (2021) [23]

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Note: Based on Deloitte's report: Urban Future with a Purpose

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[24], showing the massive impact that smart solutions can have on the environment.

Mobility

Energy & environment

Horizontal services

Economy

Living & health

Safety & security

Government & education

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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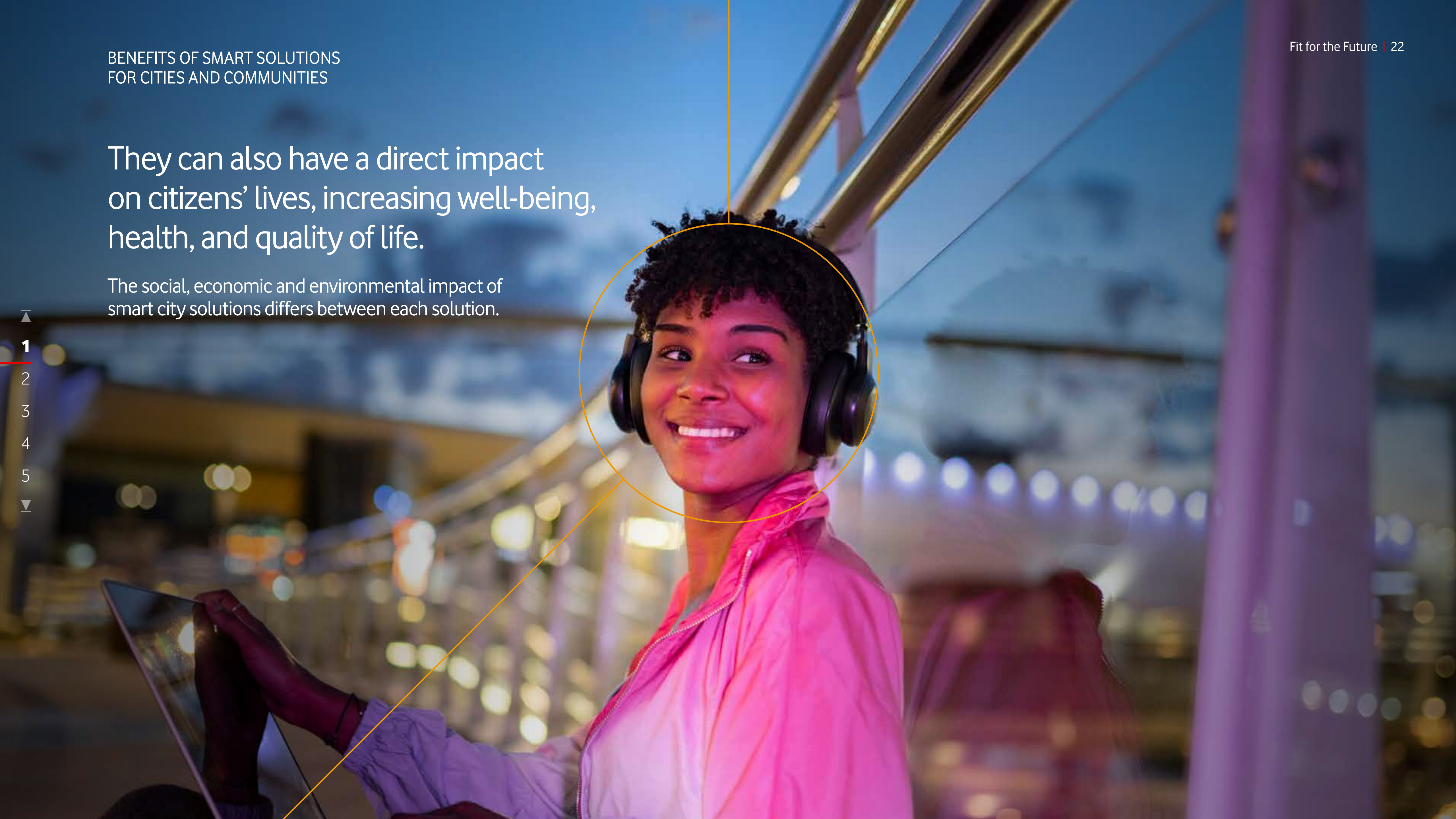
BENEFITS OF SMART SOLUTIONS
FOR CITIES AND COMMUNITIES

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

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38%

50%

36%

45%

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]

BENEFITS OF SMART SOLUTIONS
FOR CITIES AND COMMUNITIES

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

ECONOMIC

44%

of leader cities monetise
value from data"[29]

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 [30]

28%+

"Digital administrative citizen
services can reduce the
time spent interacting with
government from 28% - 61%" [31]

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BENEFITS OF SMART SOLUTIONS
FOR CITIES AND COMMUNITIES

ENVIRONMENTAL

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

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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

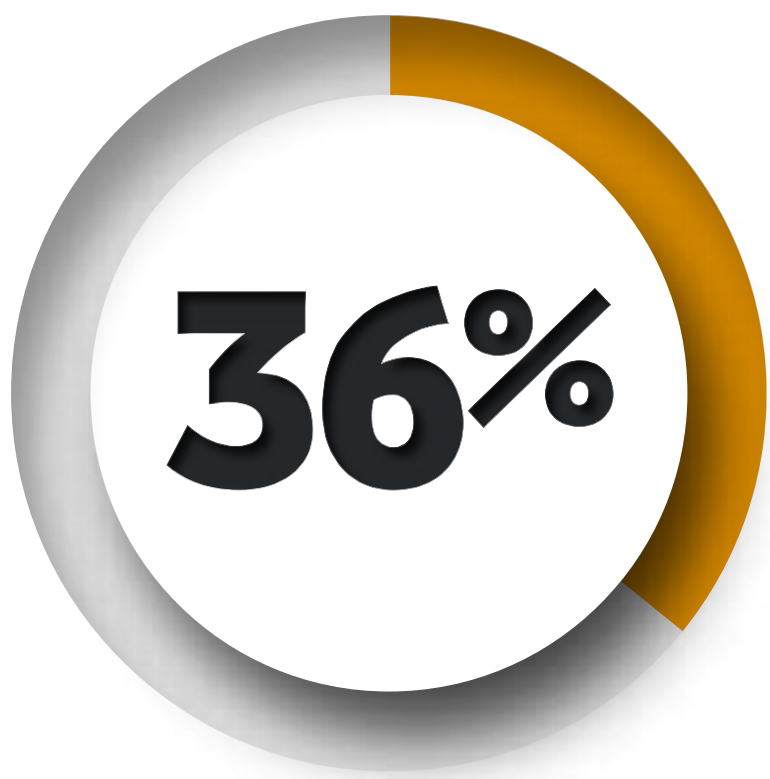Digital transition interconnected with the green transition

ENVIRONMENTAL

Energy and electricity
initiatives can prompt:[32]

"Smart city solutions such as air quality monitoring, and electricity,
water, and waste tracking can produce results such as: [33]

43%
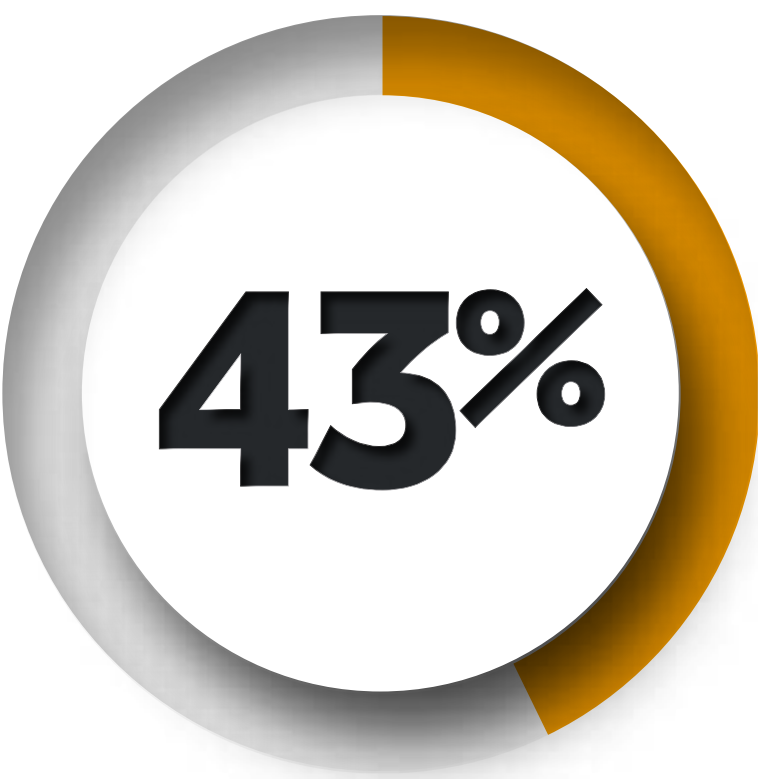
reduced energy
consumption

36%

increased renewable
energy usage

10-15% fewer GHG emissions

30-130KG less solid waste
per person per year

25-80L litres of water saved
per person per day

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.

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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.

EU DIGITAL STRATEGY

The EU Digital Strategy guides the digital transition, with initiatives to boost the adoption of tech solutions "that work for people" [36]; increase the efficiency, fairness and digitalisation of economies, and stimulate the creation of an "open, democratic and sustainable society" [37]. 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.

EXAMPLES OF INITIATIVES TARGETING CITIES

European Green Deal

EU Strategy on Adaptation to Climate Change

Smart and Sustainable Mobility Strategy
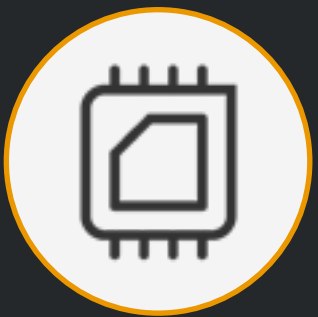
Renovation Wave

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

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 '100 Climate-Neutral and Smart Cities [38] 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". [39]

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

100 selected cities to be Climate-Neutral and Smart

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

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 Hauge
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

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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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88%

of cities have already started their digital transformation journey

GBR	DEU	ESP	ITA	PRT	ROU	GRC	FIN	CZE	TUR
94%	88%	87%	92%	66%	75%	85%	80%	65%	95%

72%

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

GBR	DEU	ESP	ITA	PRT	ROU	GRC	FIN	CZE	TUR
73%	72%	71%	77%	74%	51%	58%	65%	57%	84%

90%

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

GBR	DEU	ESP	ITA	PRT	ROU	GRC	FIN	CZE	TUR
100%	100%	92%	100%	35%	60%	100%	75%	100%	100%

78%
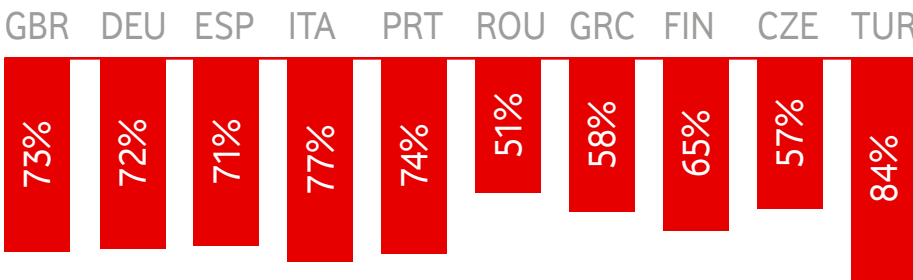
consider that smart city solutions are something valued in their local authorities
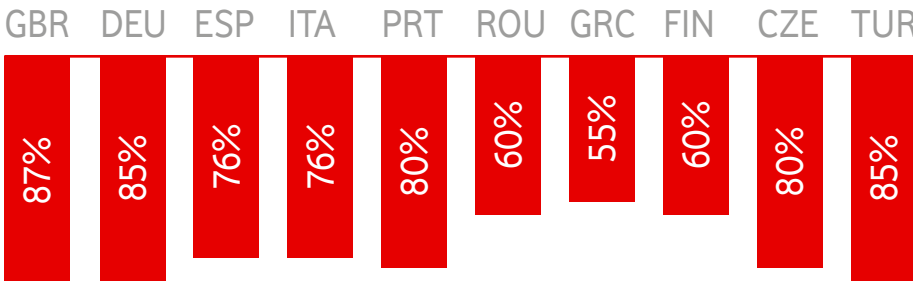
GBR	DEU	ESP	ITA	PRT	ROU	GRC	FIN	CZE	TUR
87%	85%	76%	76%	80%	60%	55%	60%	80%	85%

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:

Survey   Interviews

Please see appendix for more information
on the research process.

The following pages represent the results
from our research.

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

PERCEPTION OF SMART
AND SUSTAIBLE 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

Cluster	%	Most common smart city solutions adopted
Energy & environment	49%	Smart lighting	Energy monitoring
Safety & security	48%	Smart video surveillance & analytics	Emergency response optimisation
Mobilty	47%	Smart Traffic Lights	Mobility Operating System
Government & education	44%	Digital land-use and building permits	Local civic engagement applications
Living & health	43%	Smart health monitoring devices	Real-time air quality information
Economy	37%	Smart mapping	Smart licensing
Horizontal services	32%	Communication Infrastructure	IoT Platform

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.

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PERCEPTION OF SMART
AND SUSTAIBLE 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

Single Policy Driver
27 pp

5pp

12pp

10pp
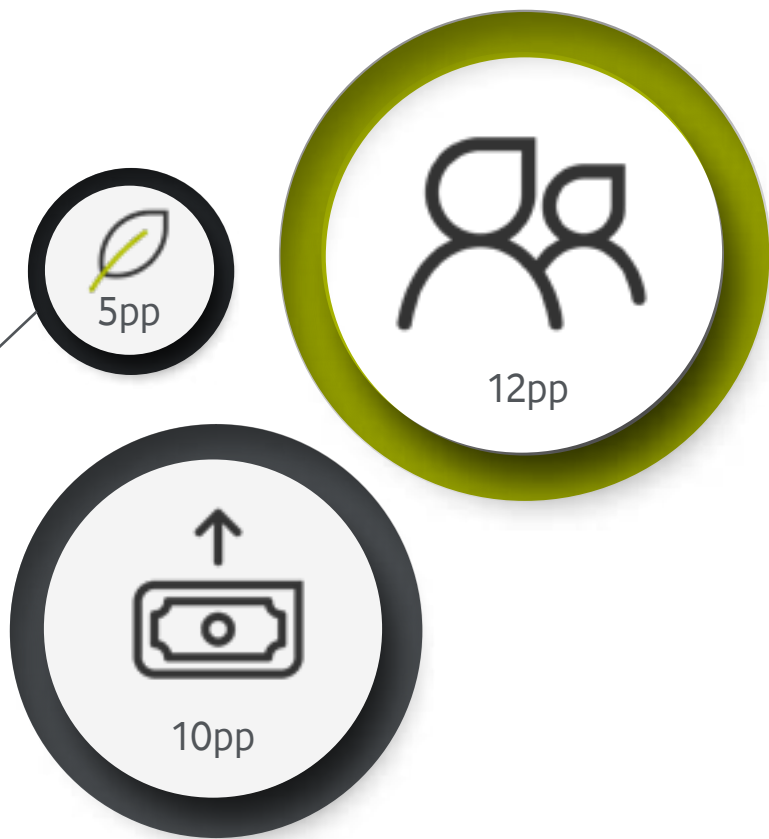
Two-fold Policy Driver
29 pp

6pp

13pp

10pp
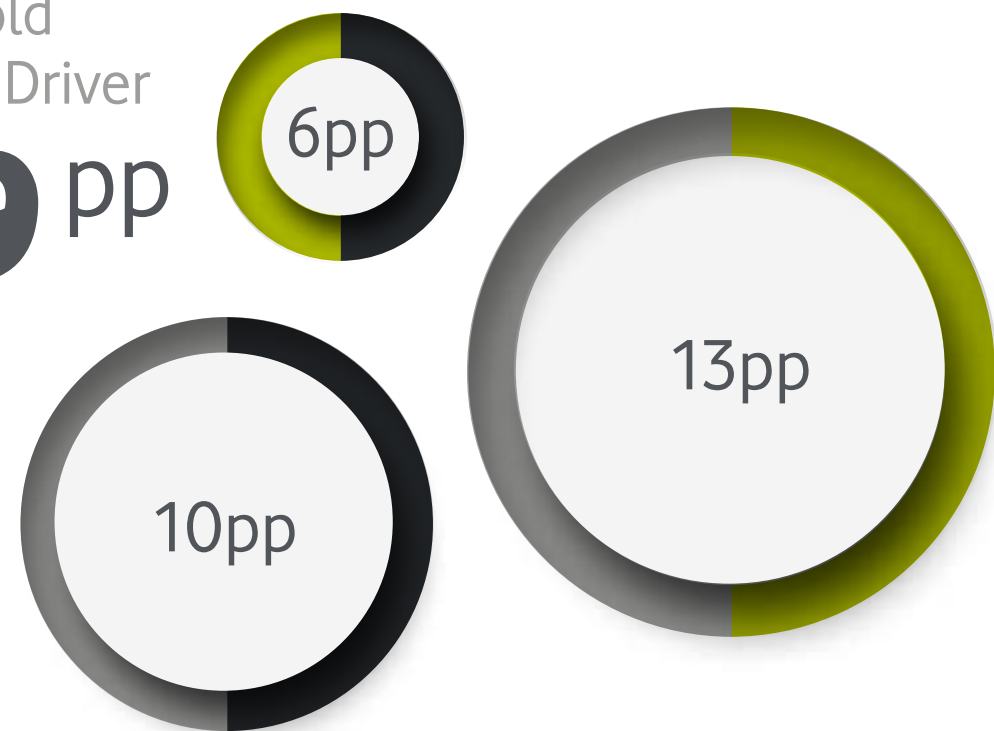
Cities driven by a single policy are less likely to prioritise environmental drivers
(only 19% of these cities prioritise environmental drivers)

○ Social   ○ Economic   ○ Environmental

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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BARRIERS
TO ADOPTION

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

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"[40] — 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.
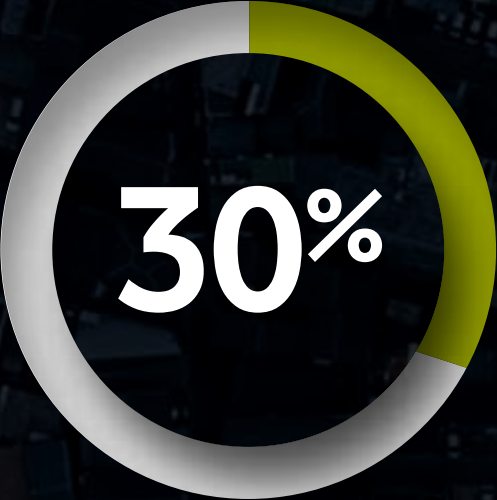
30% Lack of funding
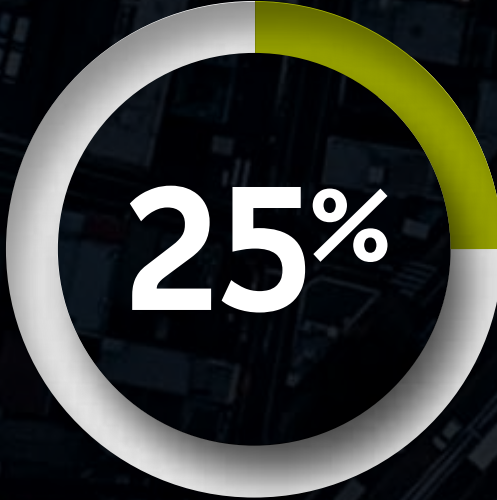
25% Legislative barriers
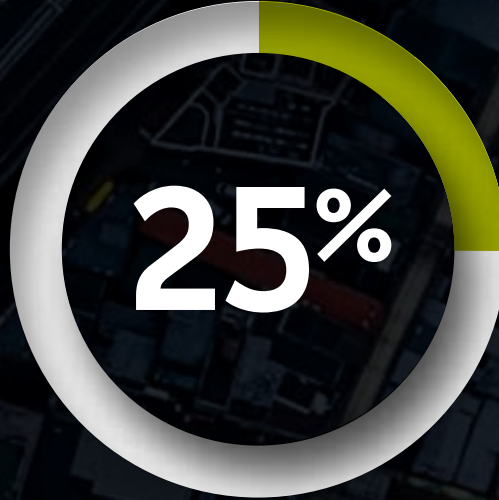
25% Lack of adequate infrastructure
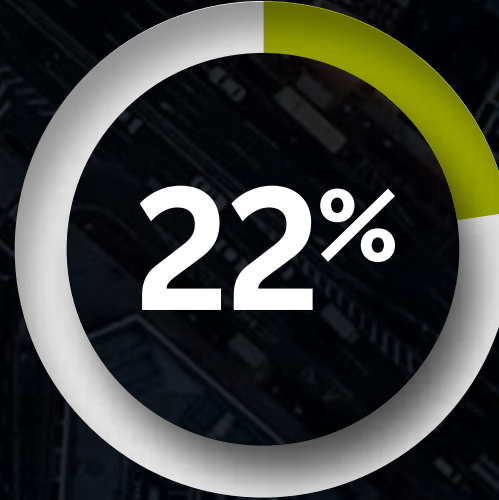
22% Privacy & safety concerns
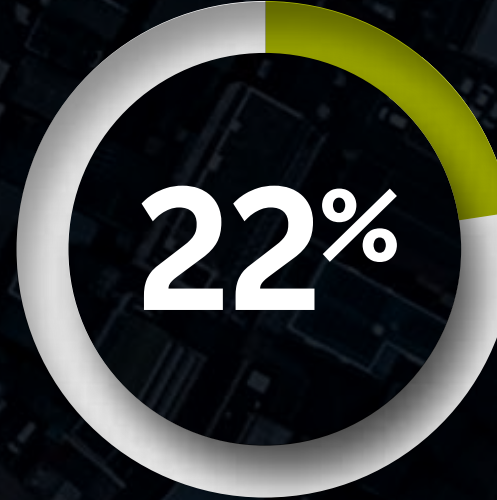
22% High complexity of procurement procedures
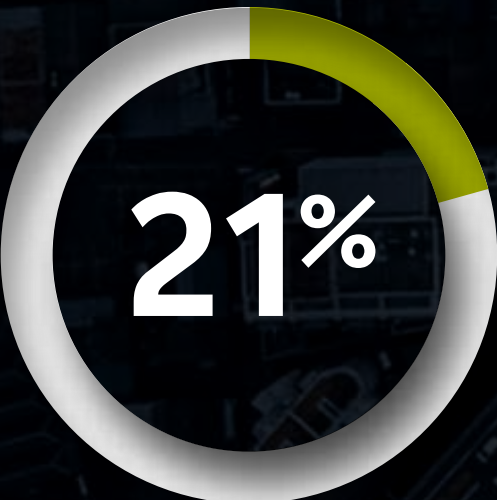
21% Lack of strategy
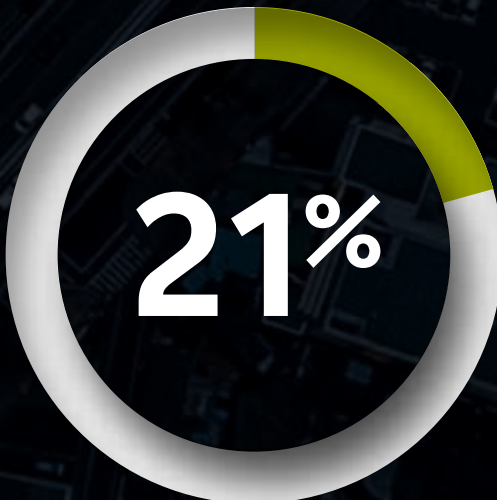
21% Lack of digital skills of people
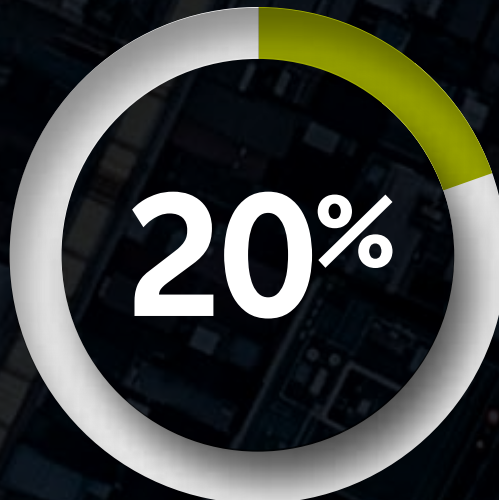
20% Challenges in integration with existing systems
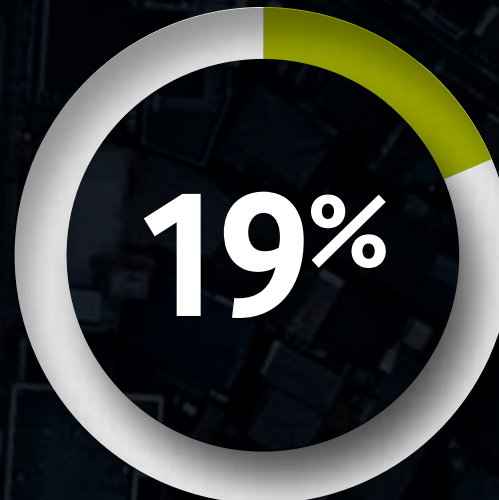
19% Lack of suitable offers in the market
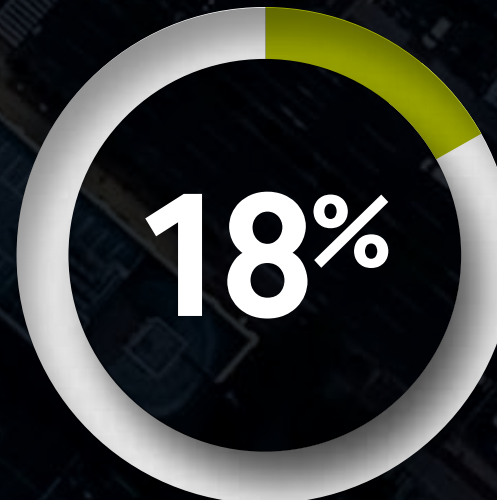
18% Lack of internal capability and skills

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.

39%

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.

Funding

Legislative, regulatory or policy barriers
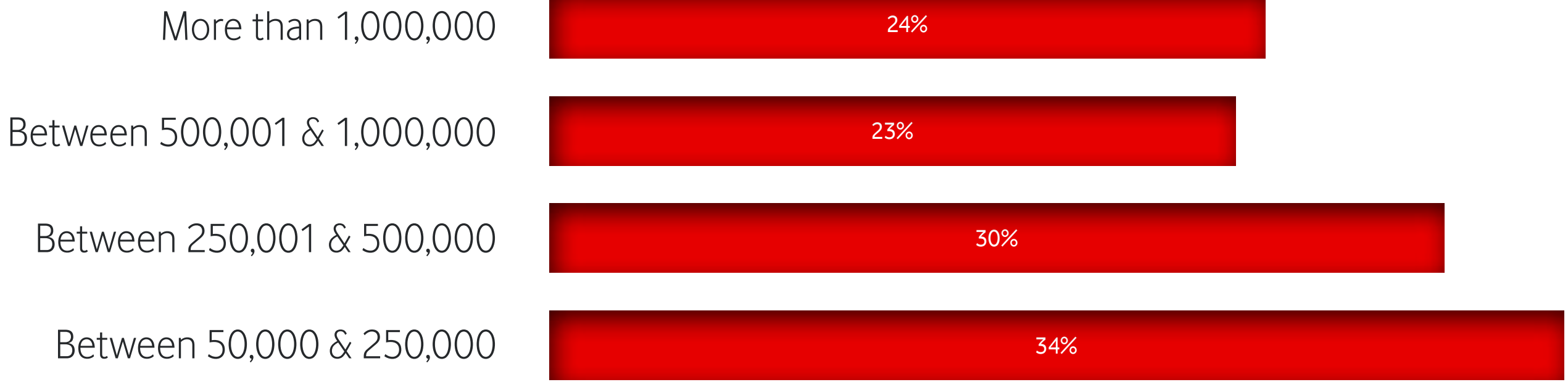
Lack of adequate infrastructure

Lack of funding as a key barrier, by city size

More than 1,000,000	24%
Between 500,001 & 1,000,000	23%
Between 250,001 & 500,000	30%
Between 50,000 & 250,000	34%

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.

27%
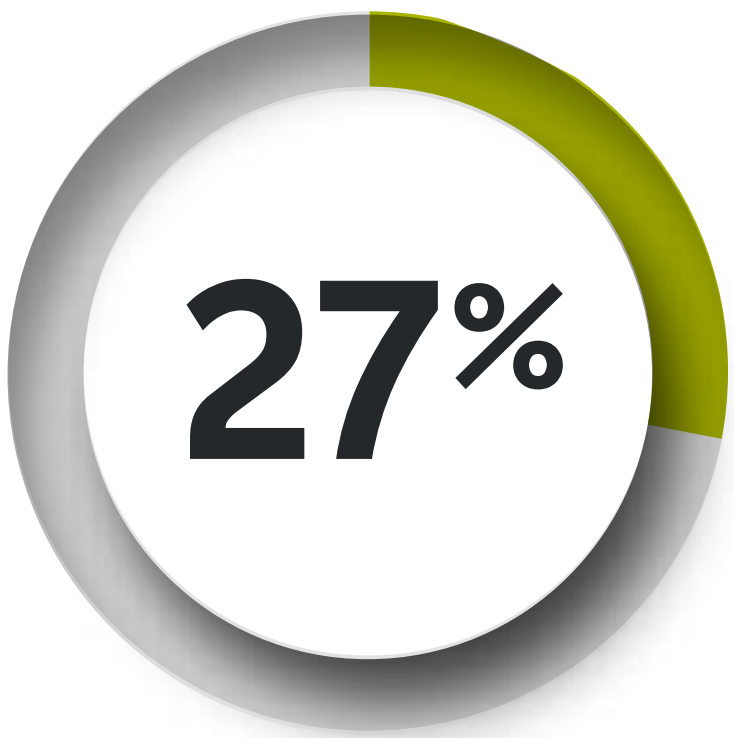
of cities that have adopted smart tech solutions and plan to continue cite legislative barriers as a key topic. This compares with 22% of cities that haven't yet started to add smart solutions.

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

More than 1,000,000	33%
Between 500,001 & 1,000,000	22%
Between 250,001 & 500,000	23%
Between 50,000 & 250,000	25%
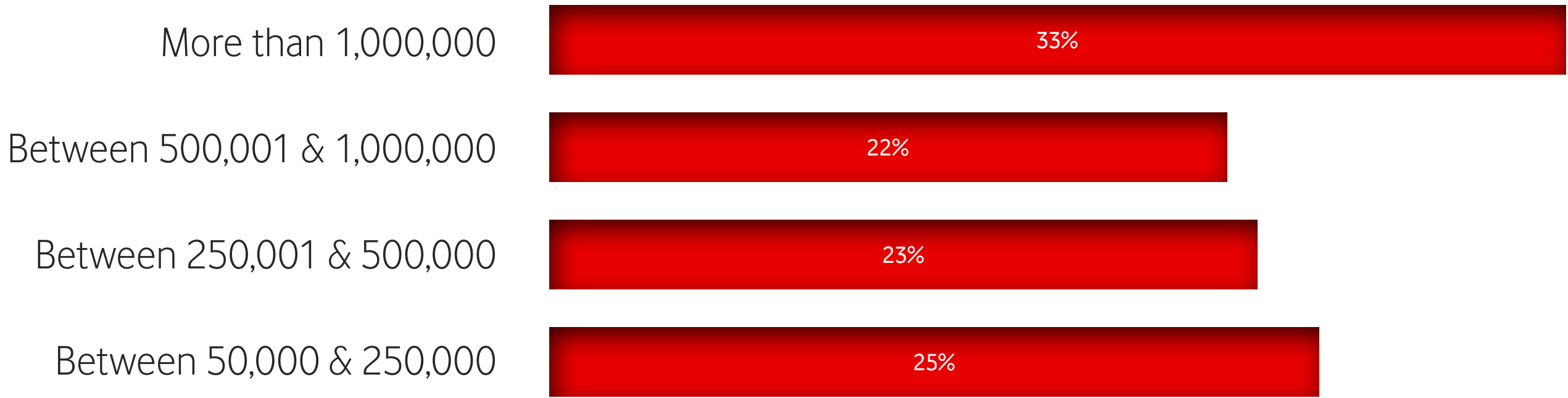
Many of the larger cities are in countries where legislative barriers are considered a significant constraint, such as Italy, Turkey and Spain.

Country Spotlight

Only

5%

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

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"[41]. As such, the collaboration of regional and national governmental bodies is needed, and funding required.

25%

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.
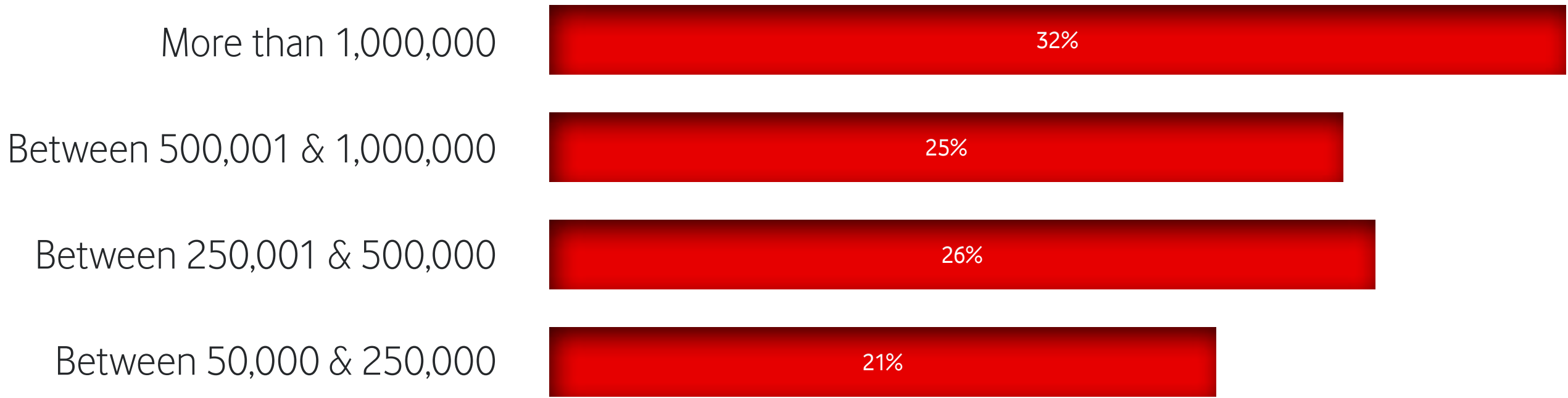
Funding

Legislative, regulatory or policy barriers

Lack of adequate infrastructure

Lack of funding as a key barrier, by city size

More than 1,000,000	32%
Between 500,001 & 1,000,000	25%
Between 250,001 & 500,000	26%
Between 50,000 & 250,000	21%

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.[42]

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.

27%
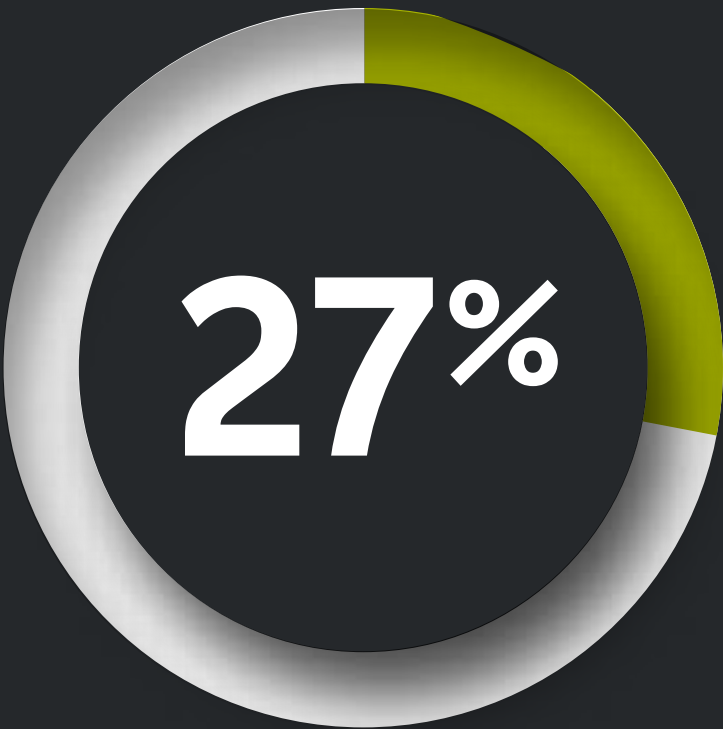
of cities that haven't started their digital transformation journey report lack of strategy as a key barrier. This is more than double the cities that have started implementation (12%).

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

More than 1,000,000
- 14%
- 12%

Between 500,001 & 1,000,000
- 24%
- 17%

Between 250,001 & 500,000
- 18%
- 22%

Between 50,000 & 250,000
- 25%
- 25%

○ Lack of digital skills and tech literacy of people   ● Lack of strategy

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.

22%

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%**
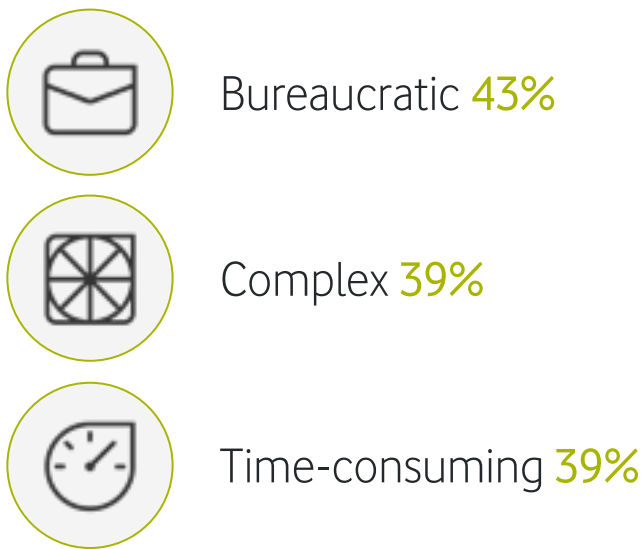
EU Spotlight

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.
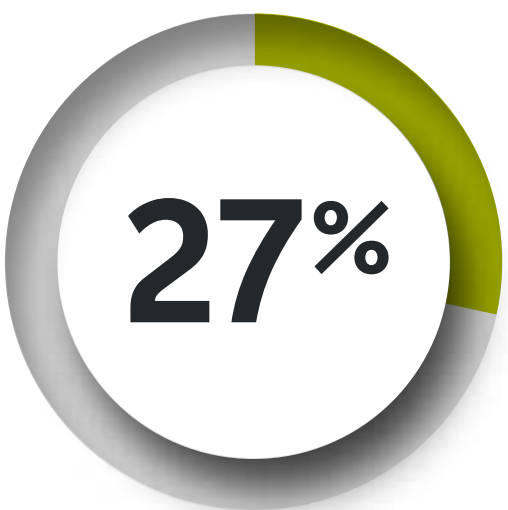
28%
Public-private partnership

27%
Public procurement for innovative solutions

25%
Operating contracts

24%
Licensing

23%
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.

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.

40%

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

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%).

Funding mechanism	Percentage
Regional or national funds	48%
Public private partnerships	42%
Local, autonomous funds, including loans	39%
Consumption-based finance and/or user fees	36%
Recovery and Resillience fund	34%
Other European sources (e.g. ERFD, Invest EU, Horizon 2020, Horizon, EIB, etc)	29%
Other (e.g. crowdfunding and other aids/subsidies)	5%
Not sure/Prefer not to say	2%

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

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.

48%
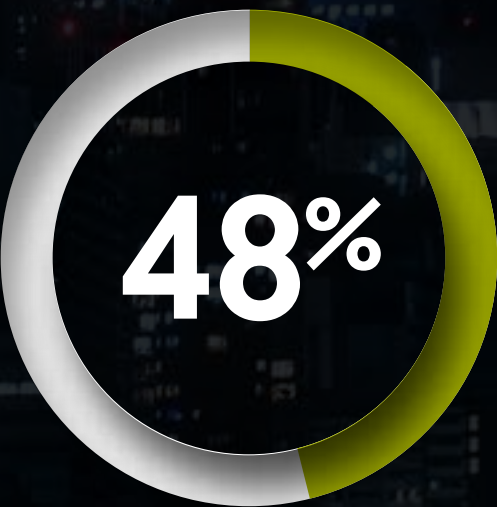
Training Programmes and Digital Empowerment Activities

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.

48%
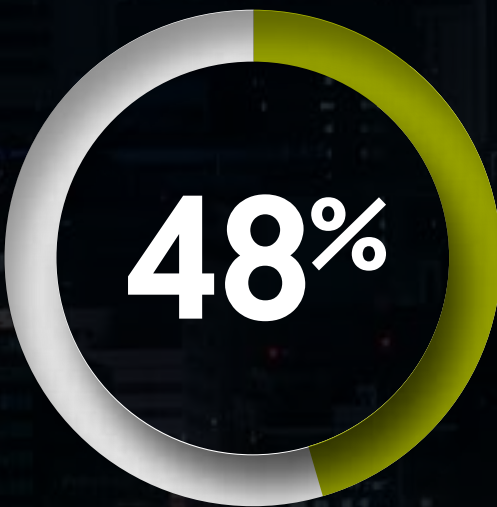
Citizen Engagement Platforms and Apps

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.

44%
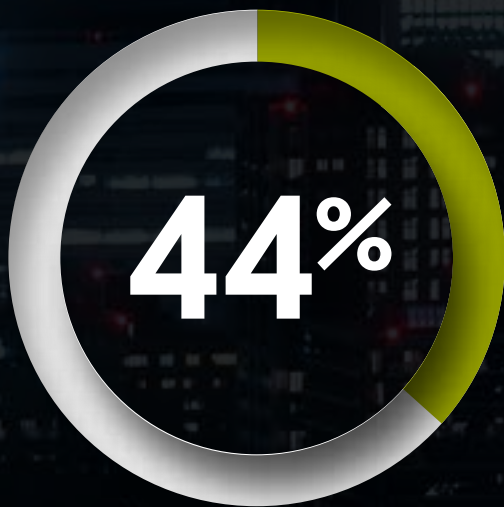
Data Management Policies and Practices

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]

43%
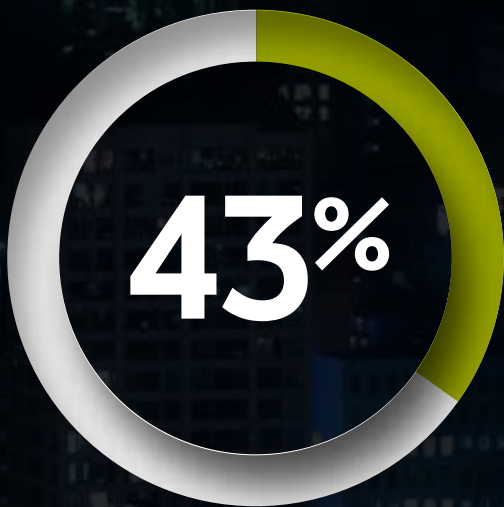
Formally Approved Digital Strategy

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: **35%** Urban Data Platforms   **31%** Interoperability practices
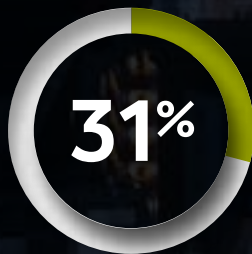
PLANS FOR
FUTURE INVESTMENTS

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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PLANS FOR
FUTURE INVESTMENTS

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.

69% of cities report that they have plans to adopt smart initiatives	31% don't have plans to adopt smart initiatives

84% have started the journey.
Cities plan to invest in these clusters:

Economy
38%
23%

Living & Health
36%
50%

Government & Education
36%
33%

Safety & Security
41%
32%

Horizontal Services
37%
30%

Energy & Environment
46%
37%

Mobility
39%
30%

⬤ Started journey and wants to continue

⬤ Didn't start journey but wants to
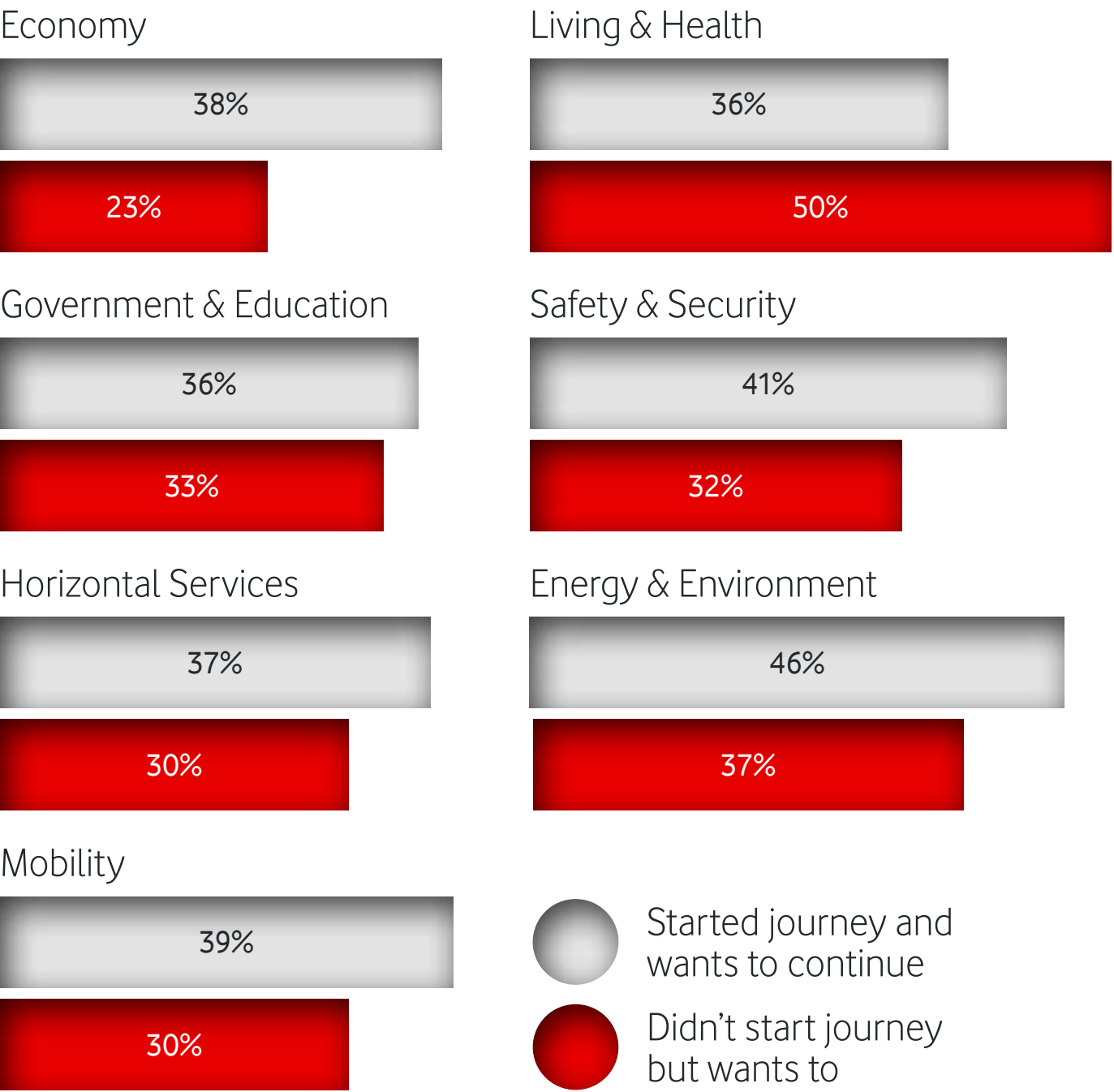
Cities that have started the journey plan mostly to invest in solutions in the clusters of Energy & Environment (46% of cities), Safety & Security (41%), and Mobility (39%). Preferences across different clusters seem to be relatively homogeneous, which reveals diagonal strategies to transform cities 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

41%
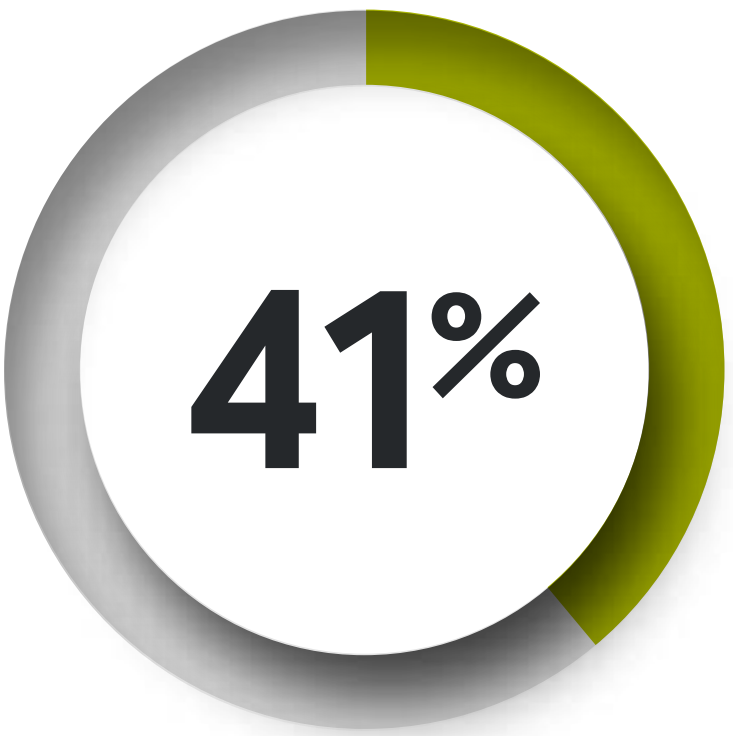
of cities with more than 1 million people plan to adopt smart solutions in the Horizonal Services cluster, a higher importance than among other cities (35%).

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

Have started the journey

Have not started the journey

0%   10%   20%   30%   40%   50%   60%   70%   80%   90%   100%

● Not sure/Prefer not to say
● Less than €0.5 million
● €0.5 million - €2 million
● More than €2 million up to €5 million
● More than €5 million up to €10 million
● More than €10 million up to €50 million
● More than €50 million
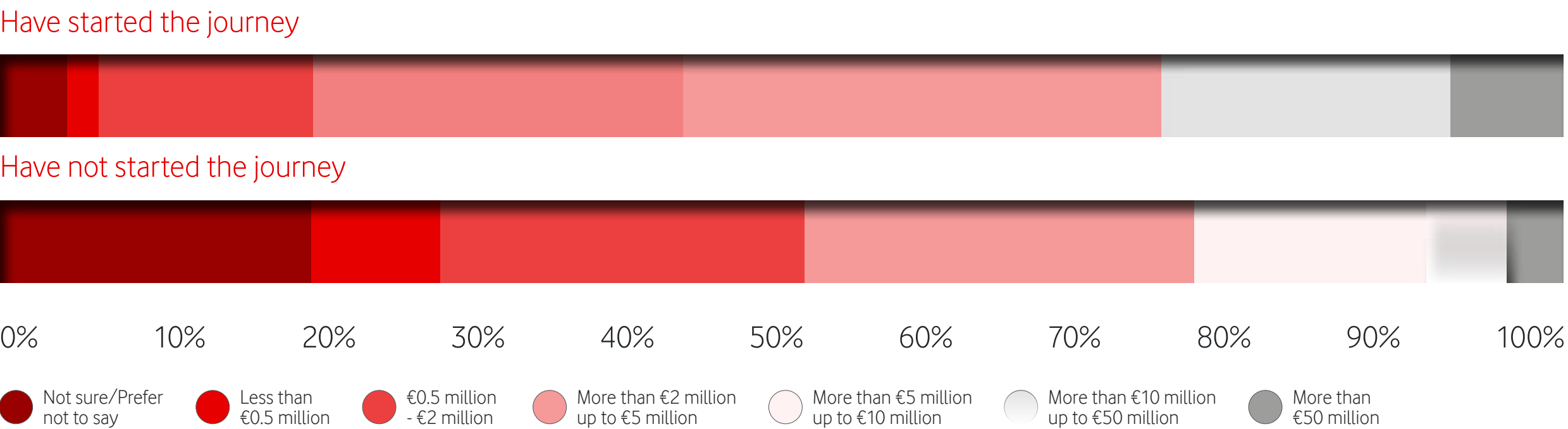
Most cities (52%) plan to spend between €2 and €10 million in the next 3 years.

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 to correlate with their size.

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

48%
Regional or national funds

46%
Public-private partnerships

40%
Local, autonomous funds

35%
Recovery ad Resilience Fund*

25%
Other European Sources*

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

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.

03

HOW DOES YOUR CITY'S PROFILE AFFECT YOUR JOURNEY?

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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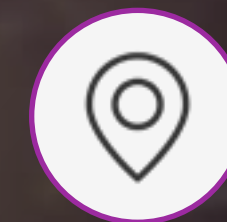
NEW EXPLORER

"I am eager to start my digital transformation journey."
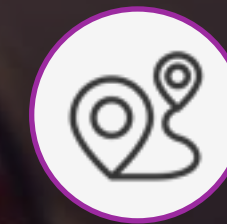
PATHFINDER

"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."
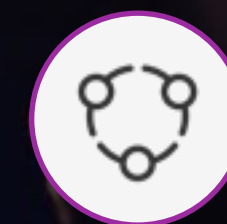
INTEGRATION SEEKER

"Integrating solutions would help me create synergies and further maximise the benefits of the solutions in place."
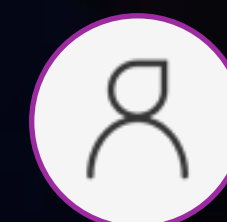
FRONT-RUNNER

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

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.

Strategy & Governance

Considers whether the city has a strategy and vision for its development, and which governance practices they have in place.

Data, Tech & Infrastructure

Checks the digital infrastructure of a city, including internet access, connectivity and 5G networks, as well as the tech solutions already deployed, and the data practices and governance models followed.

Talent & Skills

Examines the level of skills and internal capacity of both public servants and citizens, including tech literacy and the numbers of ICT specialists, for assessing the ability to implement, invest and use smart city solutions.

Innovation Promptness

Checks capacity and openness to innovation, including ecosystem management and open data/policies approach, as well as appetite for risk-taking.

Funding

Considers cities' access and use of funding and financing opportunities to invest in smart city solutions.

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

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.

Strategy & Governance
Talent & Skills
Funding
Innovation Promptness
Data, Tech & Infrastructure

18% of responders

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.[47]

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.

Strategy & Governance
Talent & Skills
Funding
Innovation Promptness
Data, Tech & Infrastructure

45% of responders

Illustrative example

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

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.

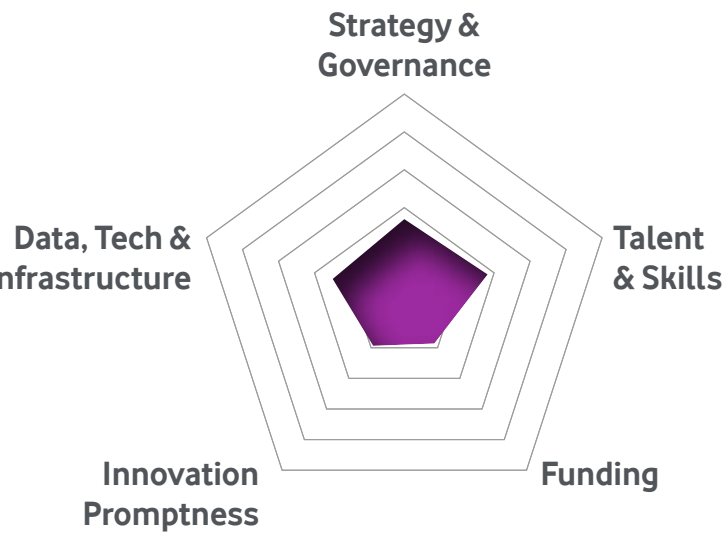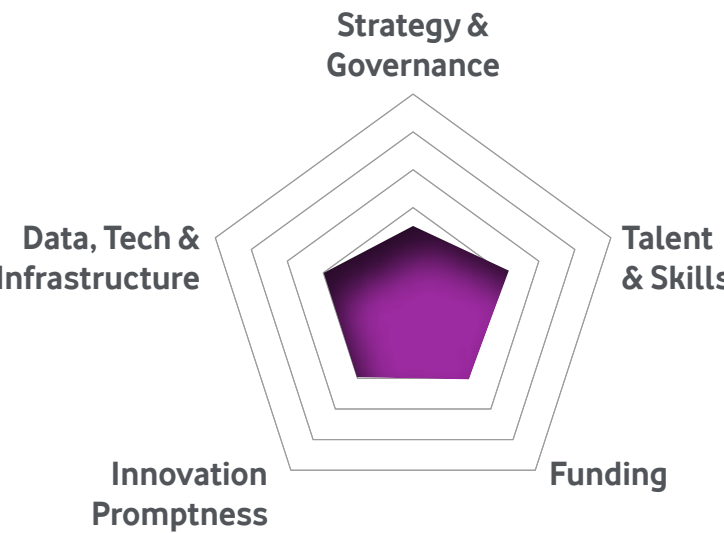Strategy & Governance
Talent & Skills
Funding
Innovation Promptness
Data, Tech & Infrastructure

11% of responders
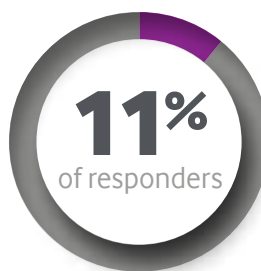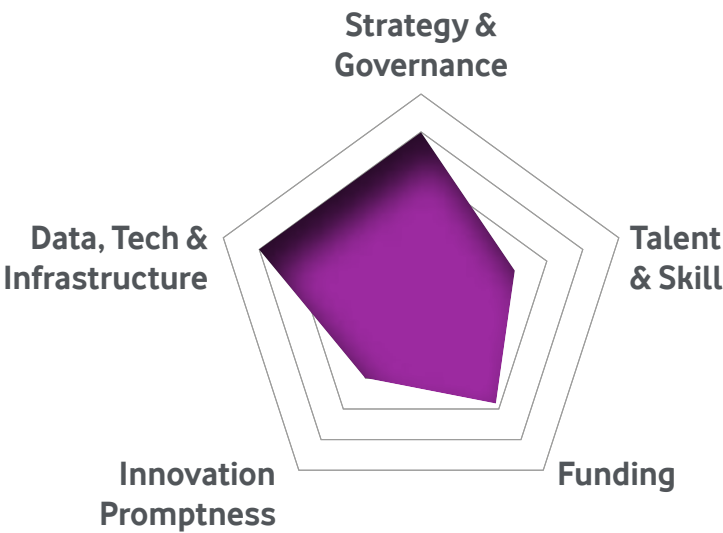
Illustrative example

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

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.

Strategy & Governance
Talent & Skills
Funding
Innovation Promptness
Data, Tech & Infrastructure

15% of responders
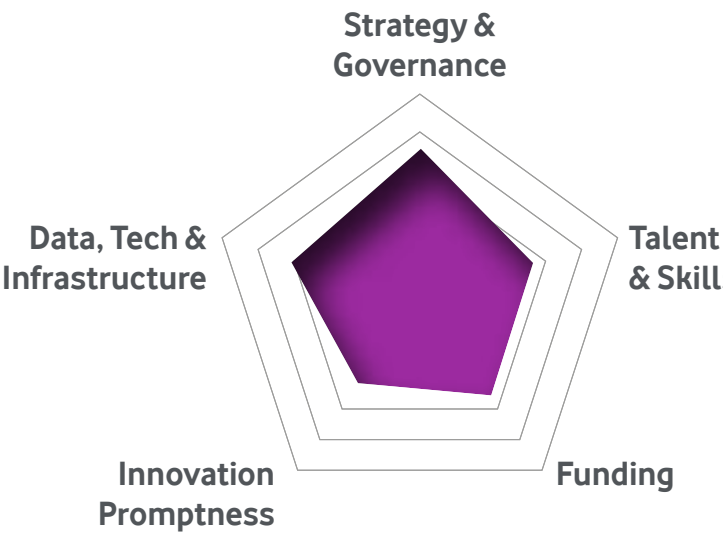
Illustrative example

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.[50]

Front-Runner

Techhnologically 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.

Strategy & Governance
Talent & Skills
Funding
Innovation Promptness
Data, Tech & Infrastructure

11% of responders
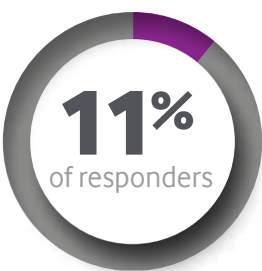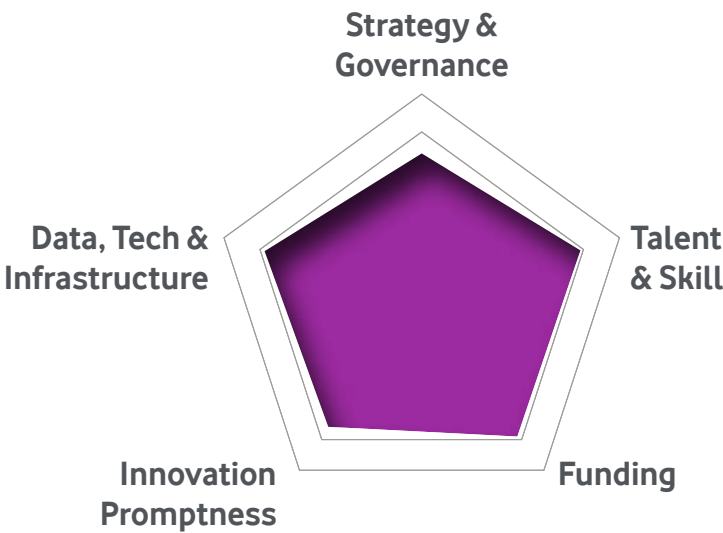
Illustrative example

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

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..

Country	New Explorer	Pathfinder	Foundational Architect	Integration Seeker	Front-Runner
Czech R	45%	50%	5%		
Finland	30%	40%	5%	20%	5%
Germany	20%	56%	10%	9%	5%
Greece	25%	25%	30%	10%	10%
Italy	12%	51%	14%	8%	15%
Portugal	20%	46%	8%	20%	6%
Romania	35%	35%	15%	15%	
Spain	16%	30%	8%	30%	16%
Turkey	15%	45%	5%	15%	20%
United Kingdom	11%	49%	14%	12%	14%
Total	18%	45%	11%	15%	11%

■ New Explorer ■ Pathfinder ■ Foundational Architect ■ Integration Seeker ■ Front-Runner
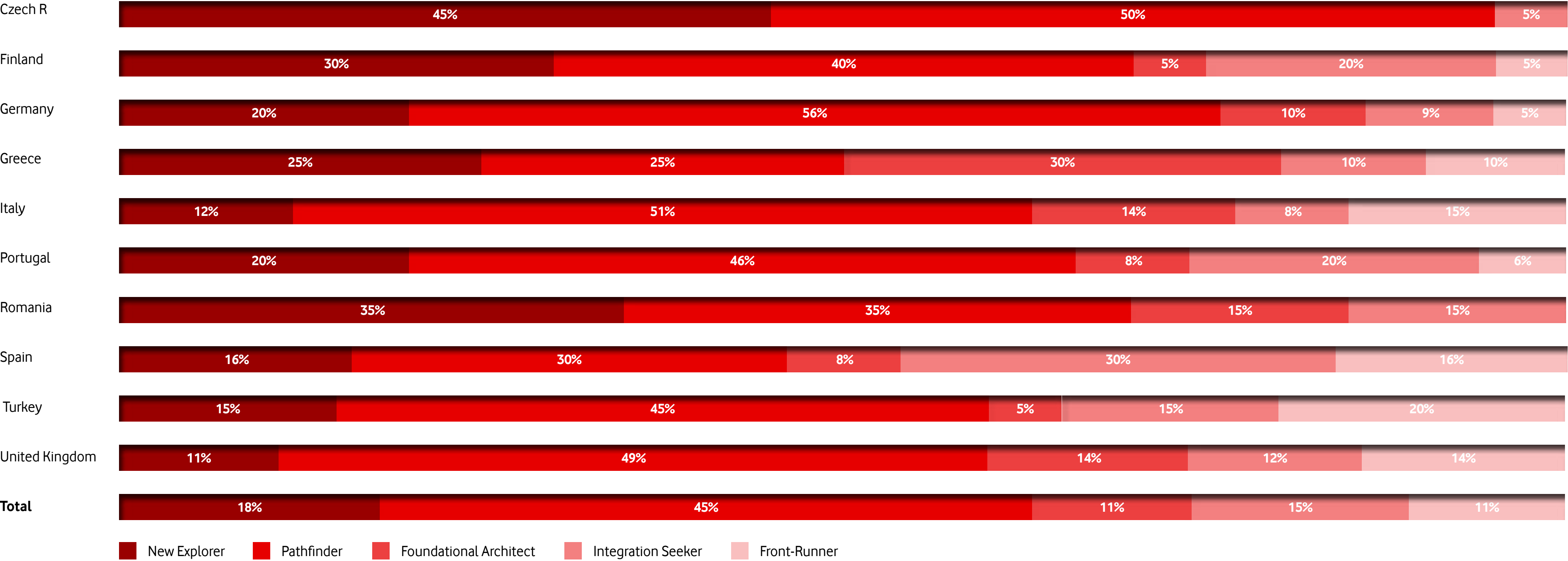
Among the Romanian cities surveyed, none was considered as a Front-Runner. According to DESI scores, Romania ranks last on the indicators related with digital public services and digital skills. These are both important components to support the adoption and promotion of smart city solutions. The same 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

35%
Lack of funding
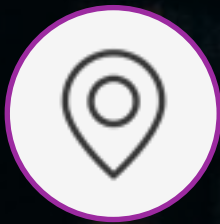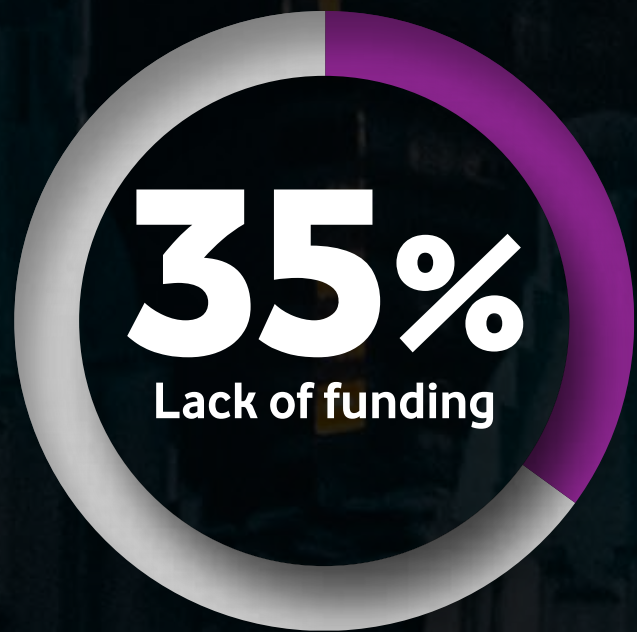
28%
Lack of strategy

25%
Legislative, policy regulatory barriers

Pathfinder

29%
Lack of funding
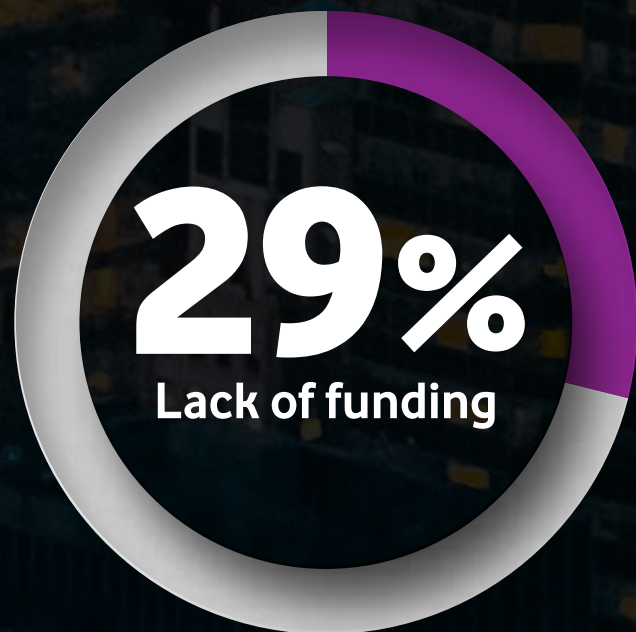
27%
Lack of strategy

26%
Existing digital infrastructure or technology

Foundational Architect

38%
Complexity of procurement
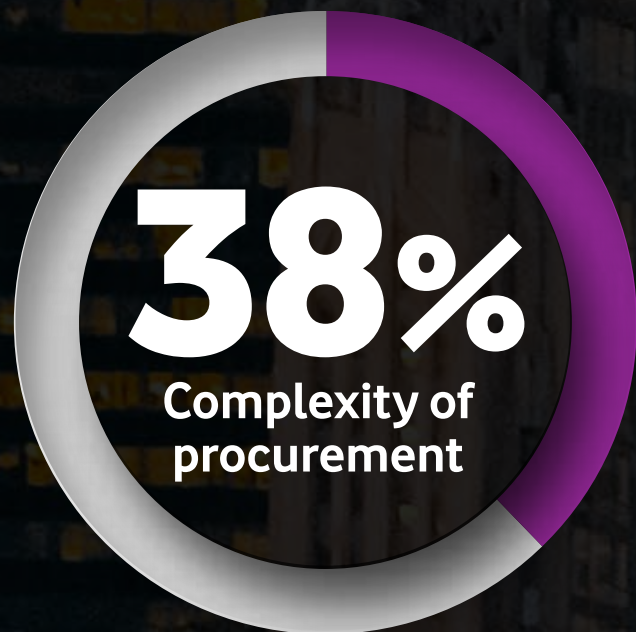
33%
Existing digital infrastructure or technology

28%
Legislative, policy regulatory barriers

Integration Seeker

39%
Lack of funding

29%
Legislative, policy regulatory barriers

29%
Complexity of procurement

Front-Runner

33%
Legislative, policy regulatory barriers
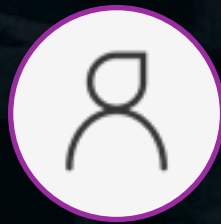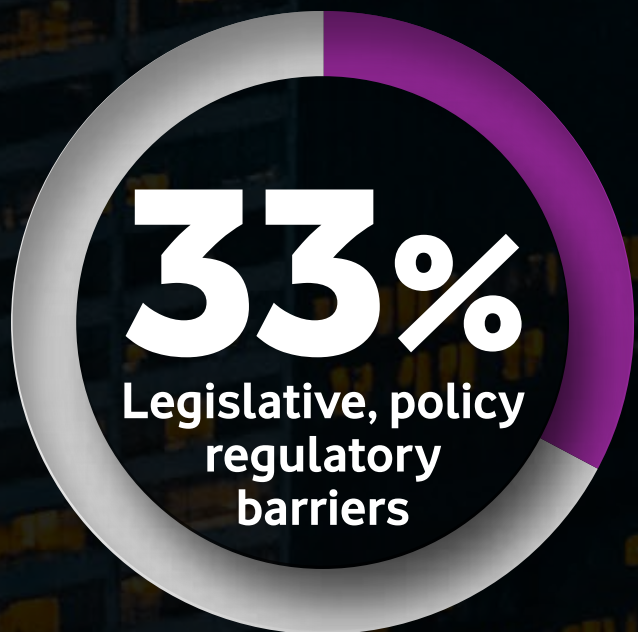
32%
Privacy, safety and security concerns

28%
Integration challenges

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)

Legend:
- Not sure/Prefer not to say
- Less than €0.5 million
- 0.5 million to €2 million
- More than €2 million up to €5 million
- More than €5 million up to 10 million
- More than €10 million up to €50 million
- More than €50 million
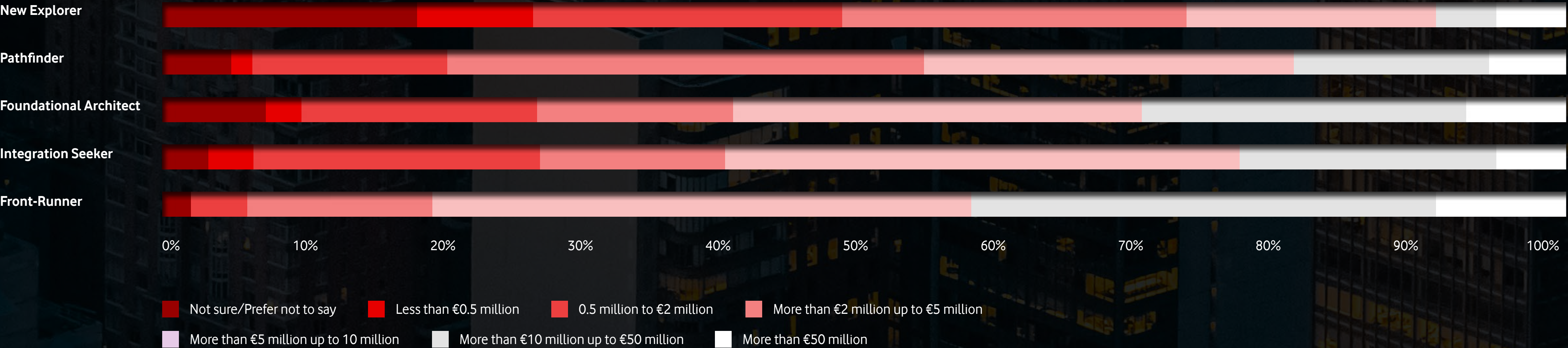
43% of Front-Runner cities plan to invest more than €10 million, compared to 26% for Foundational Architects and Integration Seekers and 17% for New Explorers and Pathfinders. 13% of New Explorers that want to adopt solutions do not know or will not disclose how much they plan to spend.

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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

48%
Regional /national funds
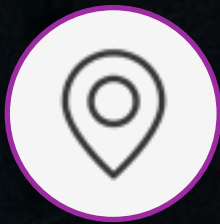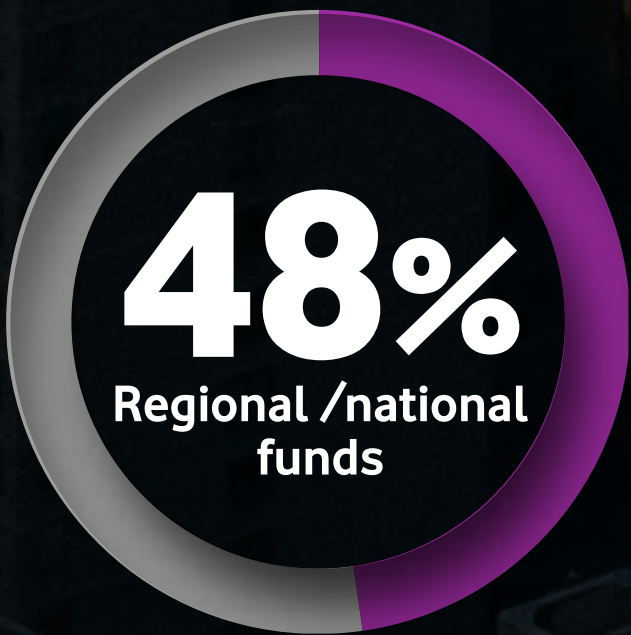
38%
Local, autonomous funds

38%
Public-private partnerships

Pathfinder

53%
Public-private partnerships

44%
Regional /national funds

38%
Consumption-based finance and/or user fees

Foundational Architect

55%
Regional /national funds
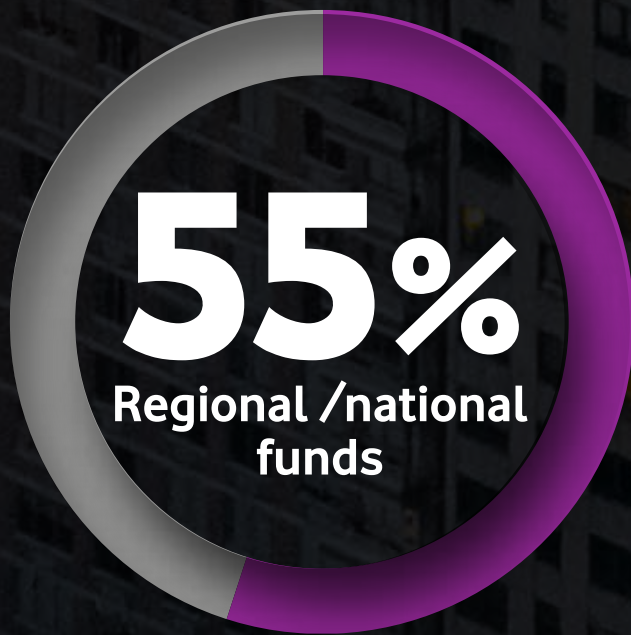
45%
Recovery and Resilience Funds

43%
Local, autonomous funds

Integration Seeker

55%
Local, autonomous funds
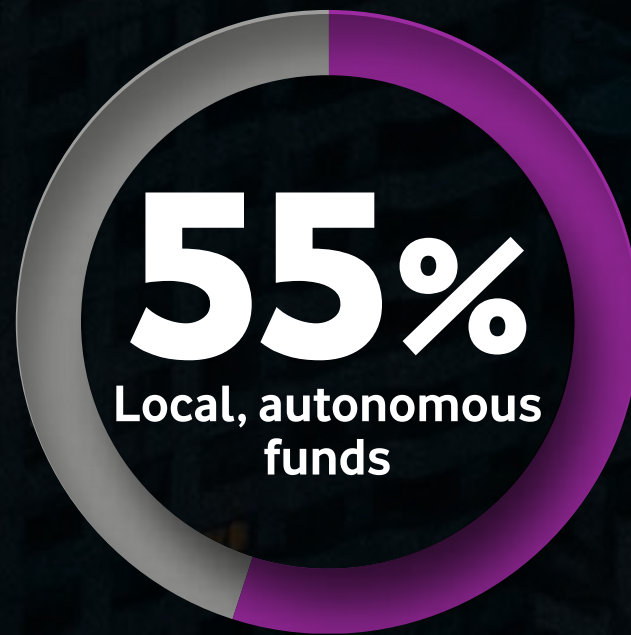
50%
Regional /national funds

43%
Public-private partnerships

Front-Runner

52%
Regional / national funds
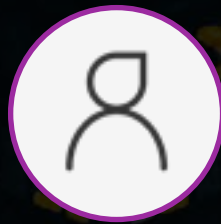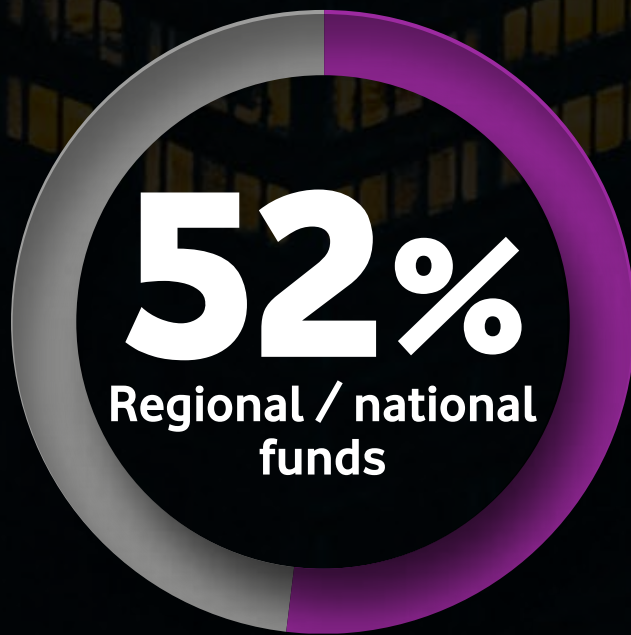
52%
Recovery and Resilience Funds

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	Pathfinder	Foundational Architect	Integration Seeker	Front-Runner
74%	**61%**	**69%**	**73%**	**87%**
44% Living & Health	**43%** Energy & Environment	**55%** Horizontal Services	**57%** Energy & Environment	**5%** Energy & Environment
34% Energy & Environment	**36%** Saftey & Security	**45%** Saftey & Security	**55%** Saftey & Security	**4%** Mobility
33% Government & Education	**35%** Government & Education	**40%** Mobility	**52%** Economy	**4%** Saftey & 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

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recommendations

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.

04

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

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.

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

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.[52]

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.[53]

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.[54]

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[55], Turkey[56], UK[56A] and The Netherlands[57] are some of the examples that have already followed this approach.

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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:

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Funding

Ensuring that funding is available through different mechanisms. Promoting awareness of funding options and providing guidance, is crucial for smart city adoption.

Promote improved governance

Decision makers should create focused task forces to advise on modernising legislation and processes, such as procurement, to support smart city investment. Such approaches could also be used for knowledge and experience sharing, to build effective smart city blueprints.

Facilitate widespread availability of high-quality connectivity

High-quality connectivity underpins the planning and delivery of smart cities. Regional, national and European decision makers should provide directed funding towards connectivity investments where they are needed the most.

Key Policy Areas

Facilitate data-sharing and security

Decision makers should develop or adopt harmonised frameworks for data-sharing and data security/cyber-resilience, which are easy to understand and combined with training and support.

Improve digital literacy and increase workforce digital training

Cities should implement both workforce digital training programmes and support broader digital literacy programmes for citizens. This is to ensure that smart city solutions can be identified, adopted, deployed and used effectively.

Demonstrate value

To encourage smart city adoption, cities and other entities should support the creation of impact frameworks and measurement mechanisms to demonstrate value and encourage stakeholder collaboration.

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[58] Therefore, additional funding programmes and investment plans will be needed to ensure cities have access to the funding they need to reach this goal.
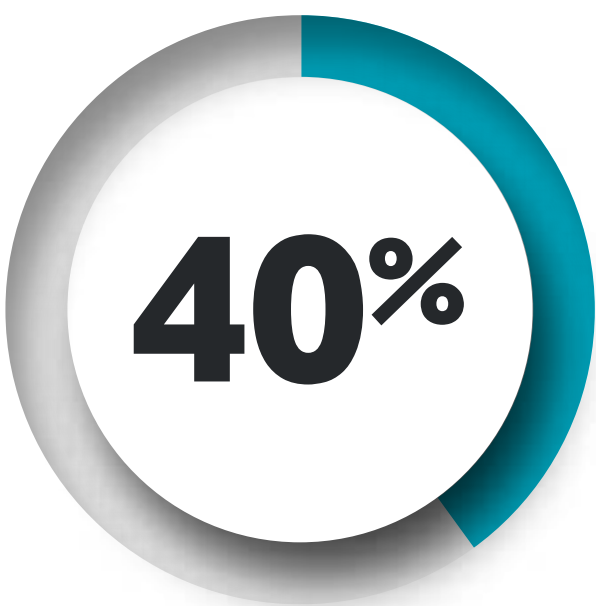
Key policy areas:

Funding

Governance

40%

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

30%

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

22%

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

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

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).

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.

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.

80%

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

22%
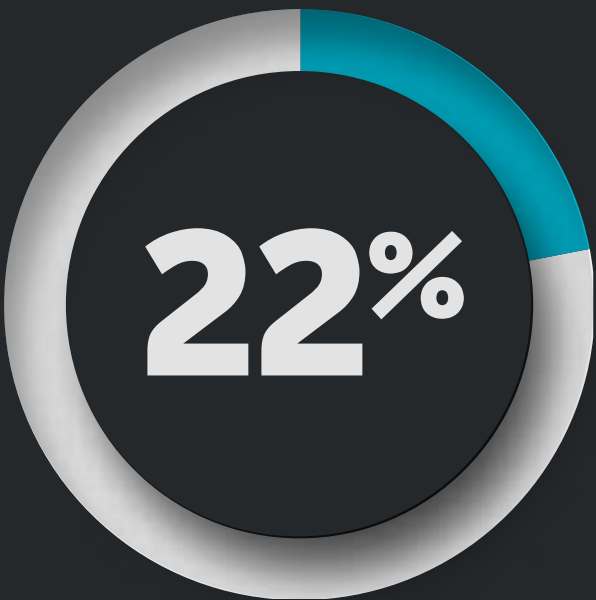
of respondents reported privacy and safety concerns as barriers to future smart city investment. This included the GDPR, cybersecurity, and ethics with regards to Artificial Intelligence.

43%
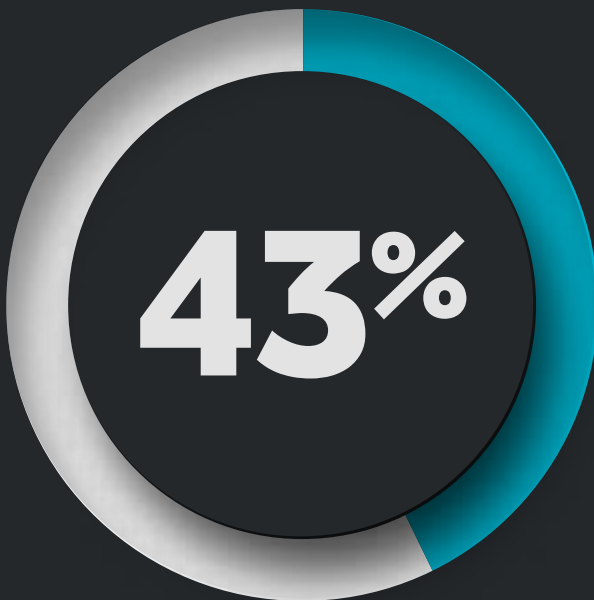
of respondents said that more investment was needed in data sharing systems to enable successful and smooth implementation of smart city solutions.

An example of task forces in practice is the UK Smart City Network[59], 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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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.

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),[60] 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. [61]

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[62].

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.[63]

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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:
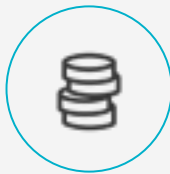
Funding

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[67]

  - Fixed networks, guaranteeing high-quality and fast connectivity, with a more intense deployment of fibre connections. (These overed only 50% of EU households in 2021). [68]

- 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. [66]

  - 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.
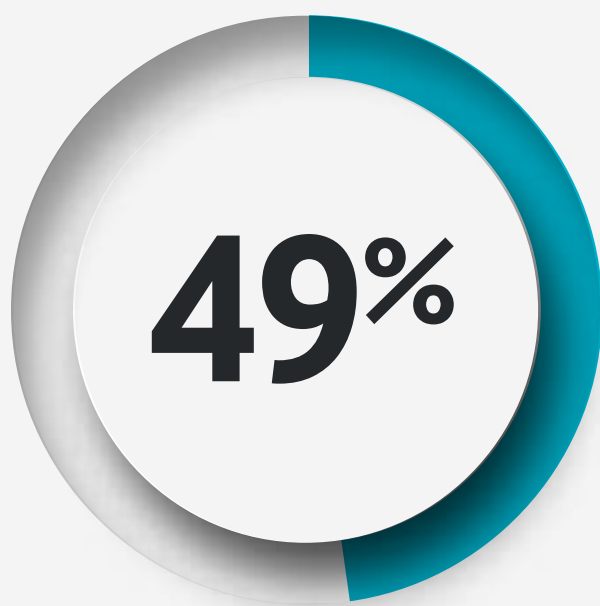
49%
of survey respondents said that further investments in connectivity were required to ensure successful implementation of smart solutions.

35%
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.

50%
of households in the European Union were covered by Fibre to the Premises (FTTP) in 2021.[64]
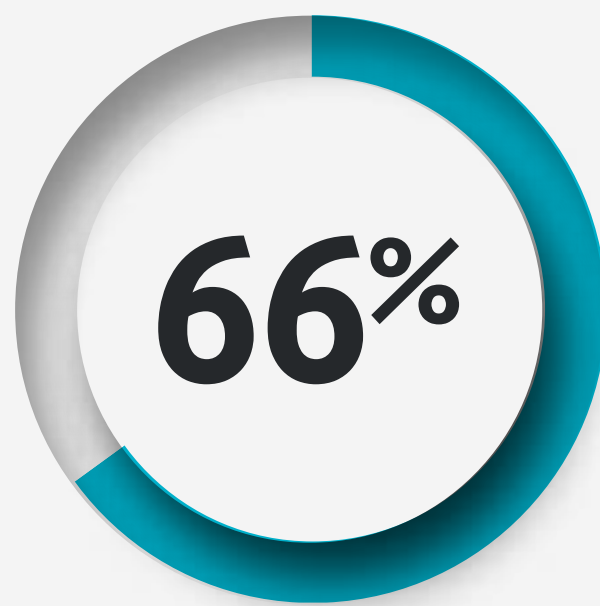
66%
of populated areas in the EU had 5G coverage in 2021: this was considerably short of the DESI target. [65]

The 5G Action Plan is a key EU initiative to boost the deployment of 5G infrastructure and services[69]. 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[70]. In addition, its programme seeks to establish 4G and 5G network coverage across 7,800km of railway lines[71].

05

STARTING YOUR JOURNEY TO BECOME A SMART AND SUSTAINABLE CITY

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.

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:
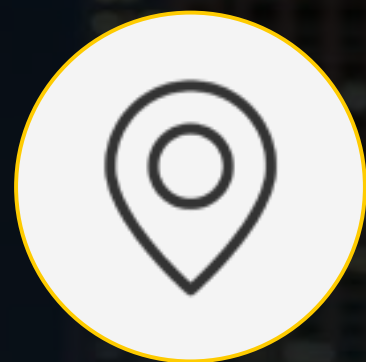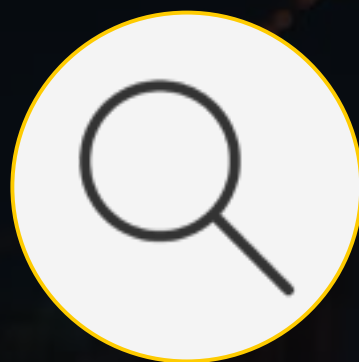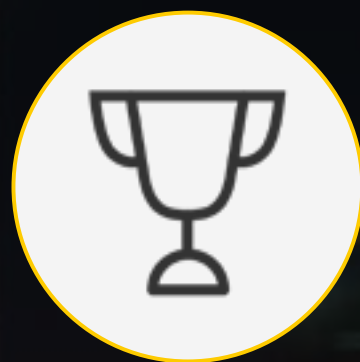
New Explorer

Pathfinder

Foundational Architect

Integration Seeker

Front-Runner

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 Assesment
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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ENABLERS
City Data & Information
City Devices & Platforms
City Connectivity & Cyber Protection

CITIZENSHIP & SOCIETY
Data & Information
Health & Wellbeing
Education & Culture

ENVIRONMENT & SUSTAINABILITY
Energy, Power & Water
Waste & Resource Reduction
Pollution & Emission Control

CITY MANAGEMENT
City, Governance & Politics
City, Economy & Resilience
City, Safety & Security

TECHNOLOGY
GOVERNANCE

Open Smart City Architecture

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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Open
Smart City
Architecture

ENABLERS

CITIZENSHIP & SOCIETY

TECHNOLOGY

ENVIRONMENT & SUSTAINABILITY

CITY MANAGEMENT

Data &
Information

Health &
Wellbeing

Education
& Culture

City Data
& Information

City Devices
& Platforms

City Connectivity
& Cyber Protection

City, Governance
& Politics

City, Economy
& Resilience

City, Safety
& Security

Energy, Power
& Water

Waste & Resource
Reduction

Pollution &
Emission Control

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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ENABLERS

City Data & Information

City Devices & Platforms

City Connectivity & Cyber Protection

CITIZENSHIP & SOCIETY

Data & Information

Health & Wellbeing

Education & Culture

TECHNOLOGY

Open Smart City Architecture

City, Governance & Politics

GOVERNANCE

Energy, Power & Water

City, Economy & Resilience

Waste & Resource Reduction

City, Safety & Security

Pollution & Emission Control

CITY MANAGEMENT

ENVIRONMENT & SUSTAINABILITY

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.

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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:
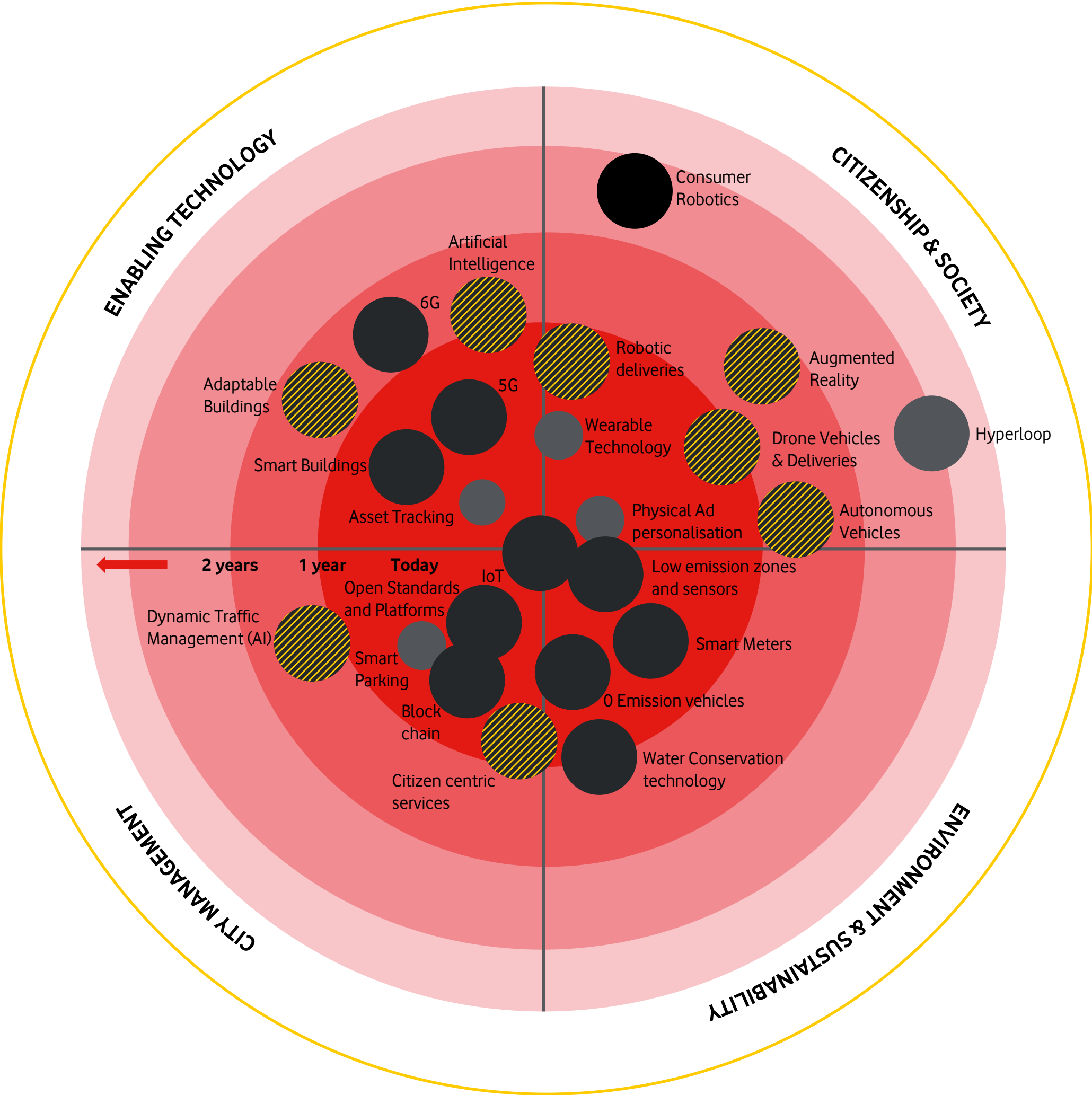
- City platforms & devices

- 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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- Medium impact technology
- High impact technology
- High impact reliable technology that needs to mature

ENABLING TECHNOLOGY

CITIZENSHIP & SOCIETY

CITY MANAGEMENT

ENVIRONMENT & SUSTAINABILITY

Consumer Robotics
Artificial Intelligence
6G
Adaptable Buildings
5G
Robotic deliveries
Augmented Reality
Hyperloop
Smart Buildings
Wearable Technology
Drone Vehicles & Deliveries
Asset Tracking
Autonomous Vehicles
Physical Ad personalisation
2 years   1 year   Today
IoT
Low emission zones and sensors
Dynamic Traffic Management (AI)
Open Standards and Platforms
Smart Parking
Smart Meters
0 Emission vehicles
Block chain
Citizen centric services
Water Conservation technology

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

vodafone

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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

APPENDIX

THE SURVEY WAS CONDUCTED BY OPINION MATTERS, AN INDEPENDENT MARKET RESEARCH CONSULTANCY, BETWEEN 15.03.2022 AND 19.04.2022

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%)

46%	39%	10%	5%

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
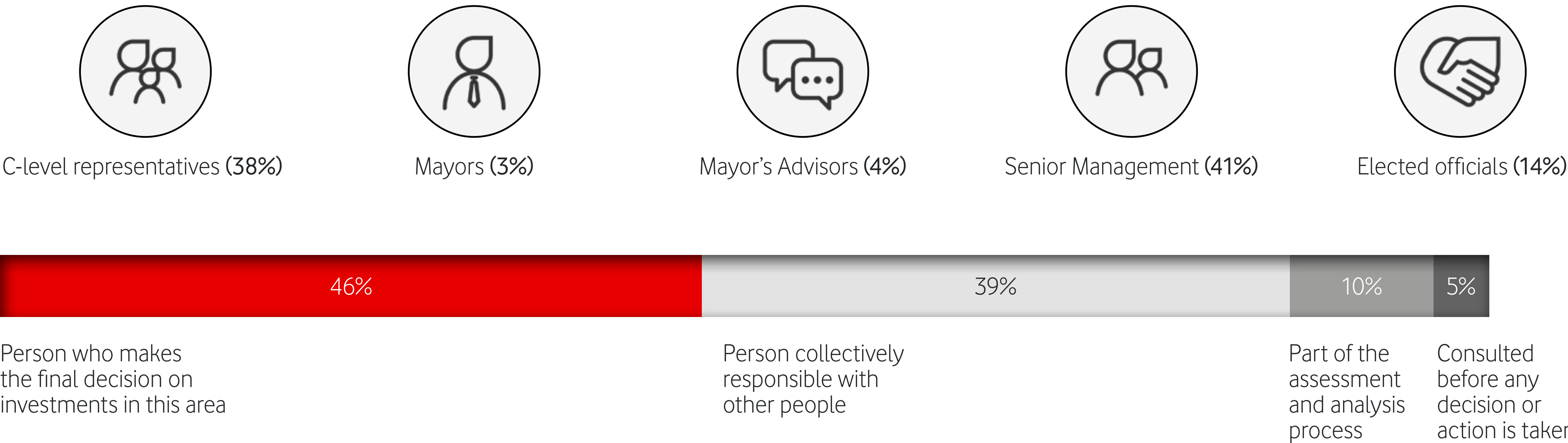
Distribution of respondents by type of local authority and population:

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

14%

16%

27%

43%

- District
- Metropolitan Area
- Municipality (city/town)
- Region/State
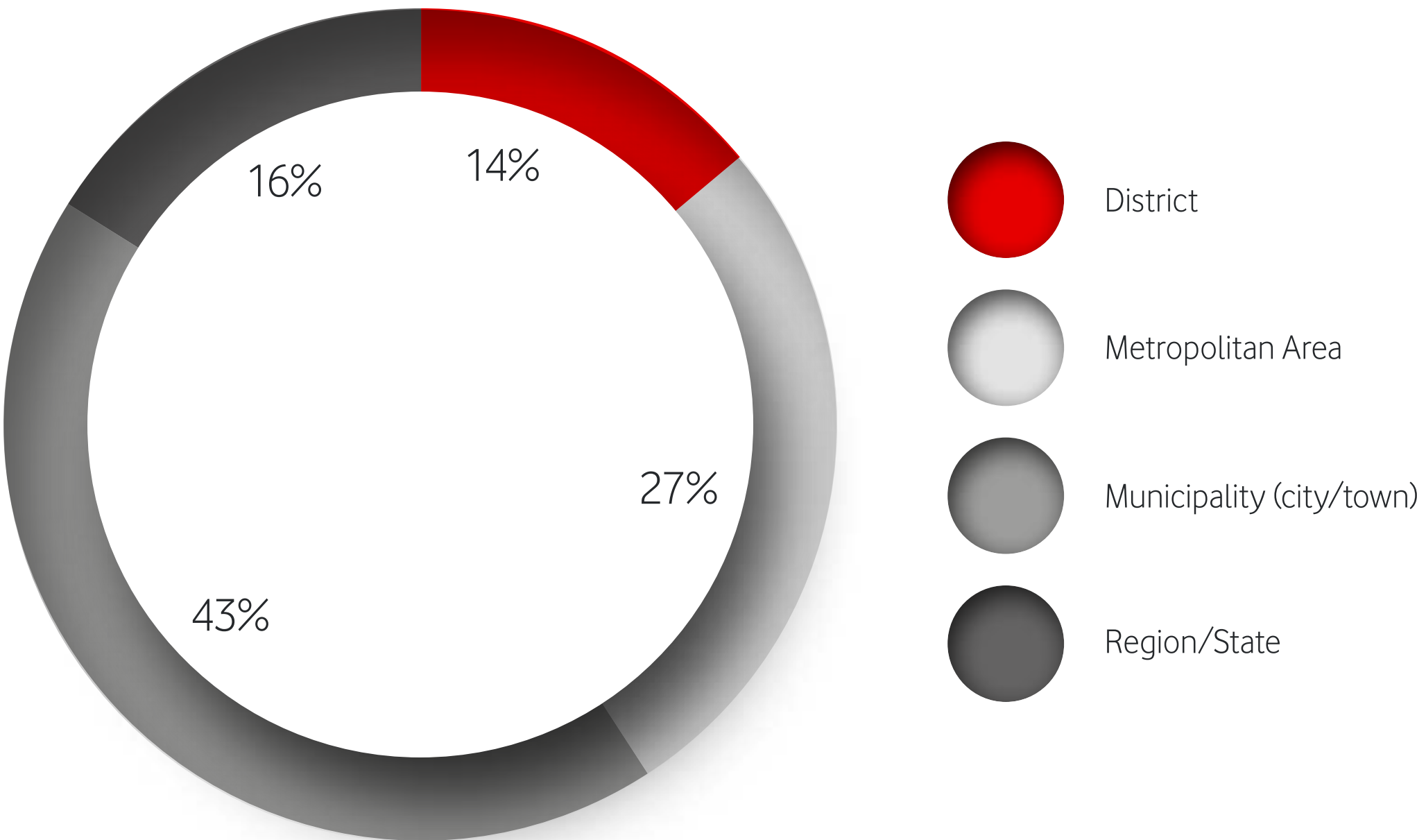
Ensuring data quality and validation

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

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
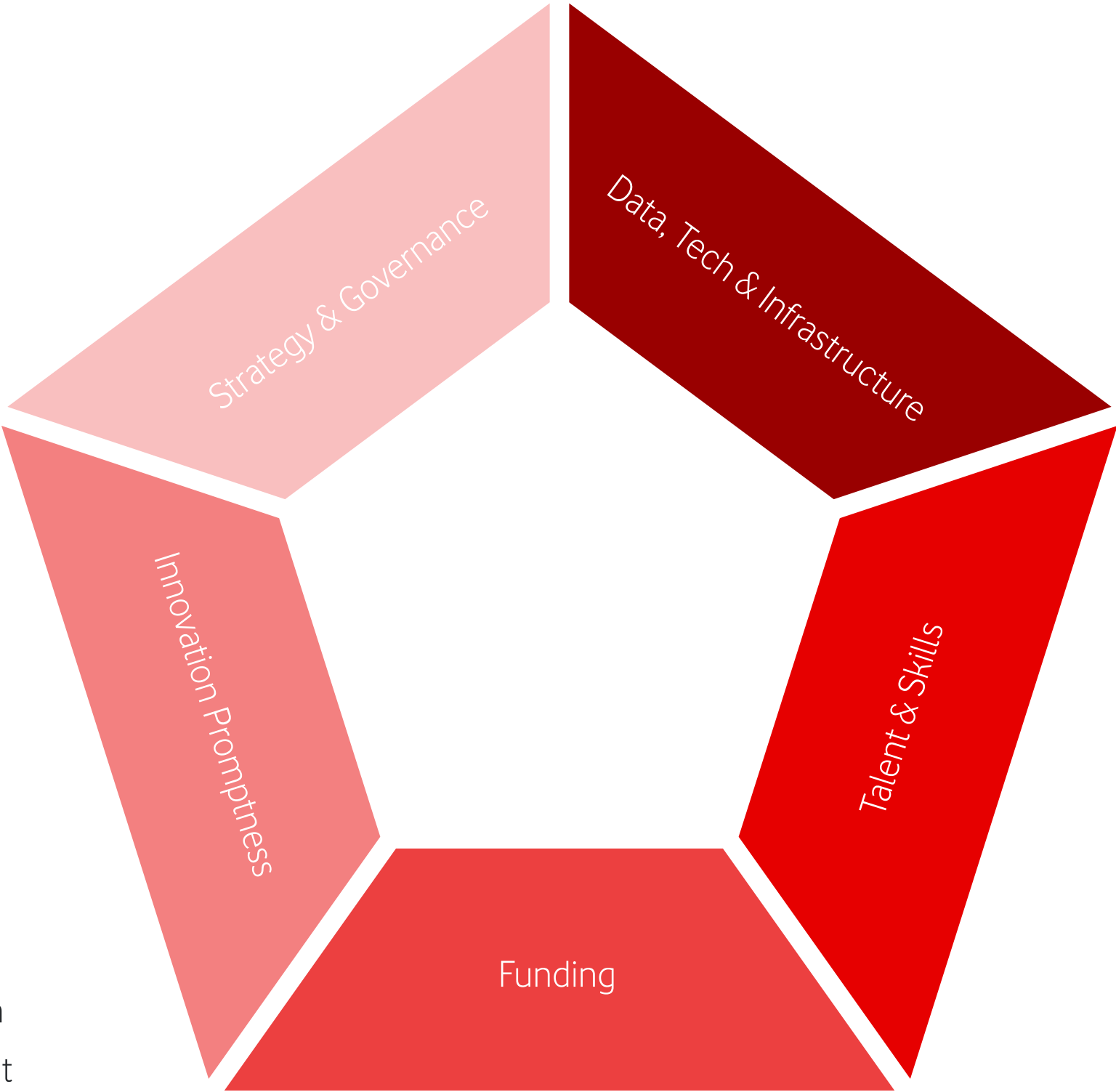
Data, Tech & Infrastructure

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

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

Approach

Selection of survey questions to assess cities performance on each pillar.

> Performance on each pillar assessed on a scale from 1 to 6. Negative points are given if a city reports facing barriers in that pillar.

> Conversion of the previous results into a qualitative scale (high, medium and low).

> Set of criteria and conditions defined to identify each city profile.

Criteria

New Explorer

- New Explorers are at the start of their transformation journey. Cities that have not yet adopted any solutions Therefore, in case of no solutions ere 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.
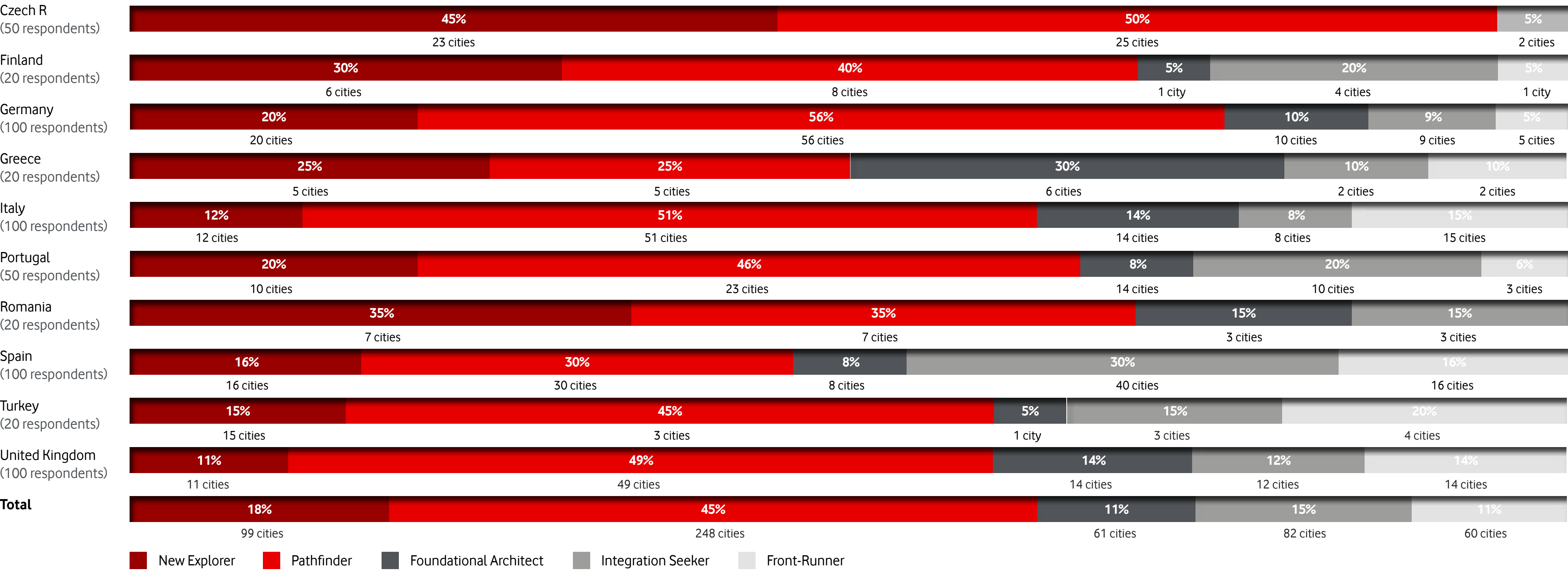
Front-Runner

- 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.

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.

Country	New Explorer	Pathfinder	Foundational Architect	Integration Seeker	Front-Runner
Czech R (50 respondents)	45% / 23 cities	50% / 25 cities			5% / 2 cities
Finland (20 respondents)	30% / 6 cities	40% / 8 cities	5% / 1 city	20% / 4 cities	5% / 1 city
Germany (100 respondents)	20% / 20 cities	56% / 56 cities	10% / 10 cities	9% / 9 cities	5% / 5 cities
Greece (20 respondents)	25% / 5 cities	25% / 5 cities	30% / 6 cities	10% / 2 cities	10% / 2 cities
Italy (100 respondents)	12% / 12 cities	51% / 51 cities	14% / 14 cities	8% / 8 cities	15% / 15 cities
Portugal (50 respondents)	20% / 10 cities	46% / 23 cities	8% / 14 cities	20% / 10 cities	6% / 3 cities
Romania (20 respondents)	35% / 7 cities	35% / 7 cities	15% / 3 cities	15% / 3 cities	
Spain (100 respondents)	16% / 16 cities	30% / 30 cities	8% / 8 cities	30% / 40 cities	16% / 16 cities
Turkey (20 respondents)	15% / 15 cities	45% / 3 cities	5% / 1 city	15% / 3 cities	20% / 4 cities
United Kingdom (100 respondents)	11% / 11 cities	49% / 49 cities	14% / 14 cities	12% / 12 cities	14% / 14 cities
Total	18% / 99 cities	45% / 248 cities	11% / 61 cities	15% / 82 cities	11% / 60 cities

Legend: ■ New Explorer ■ Pathfinder ■ Foundational Architect ■ Integration Seeker ■ Front-Runner

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APPENDIX

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

New Explorer
99 respondents

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%

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

Strategy & Governance

Data, tech & infrastructure

Talent & skills

Innovation promptness

Funding

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%)
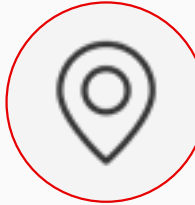
Smart Parking (13%)
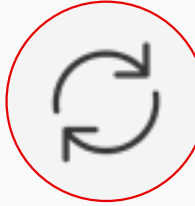
Mobility Operating System (13%)

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

What are the most prevalent enablers of digital transformation?

38%
Workforce training & digital empowerment

37%
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.

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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.

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Barriers

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.

55%

of New Explorer cities reported lack of funding, lack of strategy or both as a barrier.
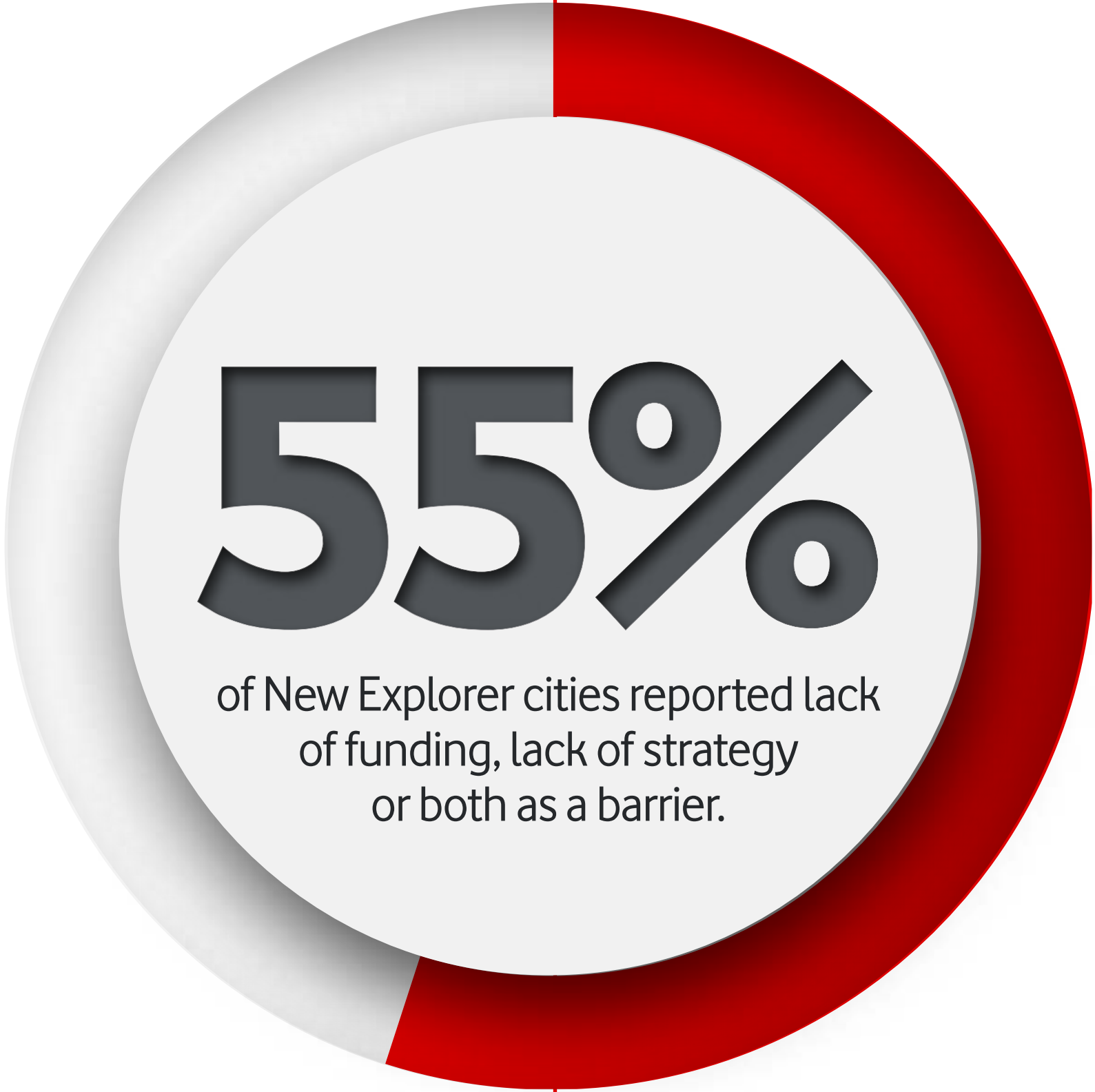
New Explorer

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
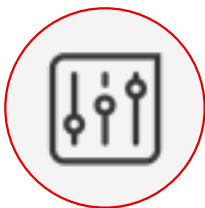
Smart operations
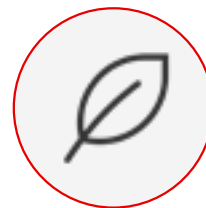
Energy monitoring

Communication infrastructure

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

**Pathfinder
248 respondents**

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%

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

Which areas would benefit from additional investment?

Connectivity (48%)

Governance (45%)
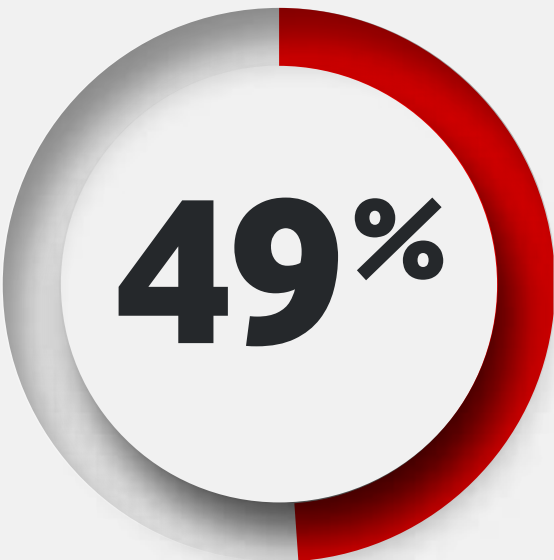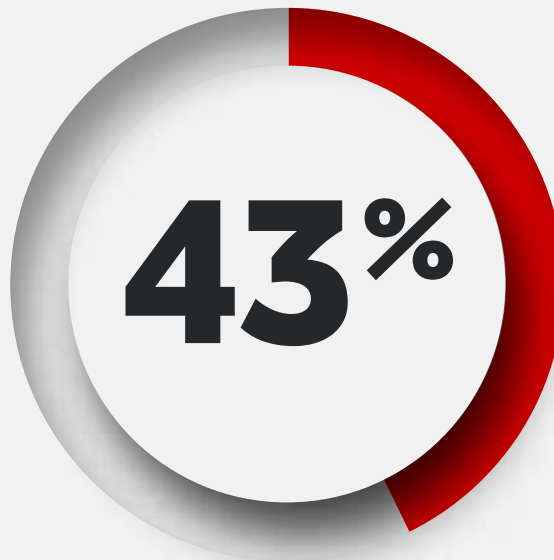
Distribution of Pathfinder's score by dimension

Strategy & Governance

Talent & skills

Data, tech & infrastructure

Innovation promptness

Funding

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%)

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

What are the most prevalent enablers of digital transformation?

49%

Workforce training & digital empowerment

43%

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.

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

Pathfinder

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.

33%
of cities with more than 500,000 inhabitants report problems with integration with existing systems as a key barrier. This barrier was the most cited by these cities.
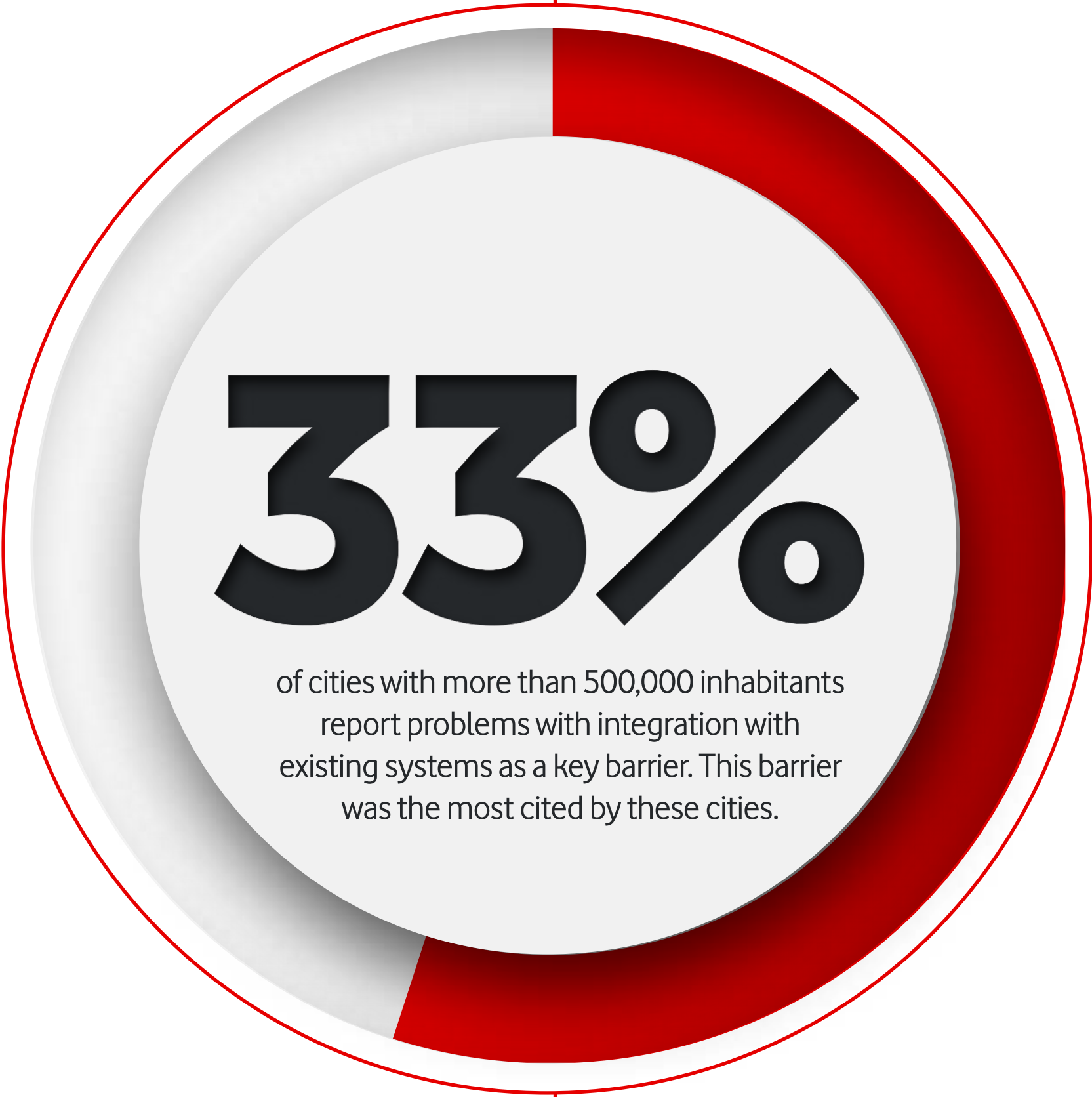
Pathfinder

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
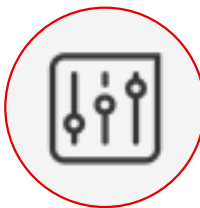
Smart Operations

Green spaces management

Communication infrastructure

Smart Communities

Integrated mobility & third-party business information

Smart waste collection & management

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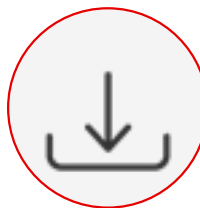
Foundational Architect
82 respondents

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

Strategy & Governance

Data, tech & infrastructure

Talent & skills

Innovation promptness

Funding

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?

82%
Citizen engagement platforms / apps

77%
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

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

Foundational Architect

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 o the average for all cities.

50%

of cities with more than 1 million inhabitants report lack of compatible offer of solutions on the market as a key barrier, being the most cited barrier for these cities

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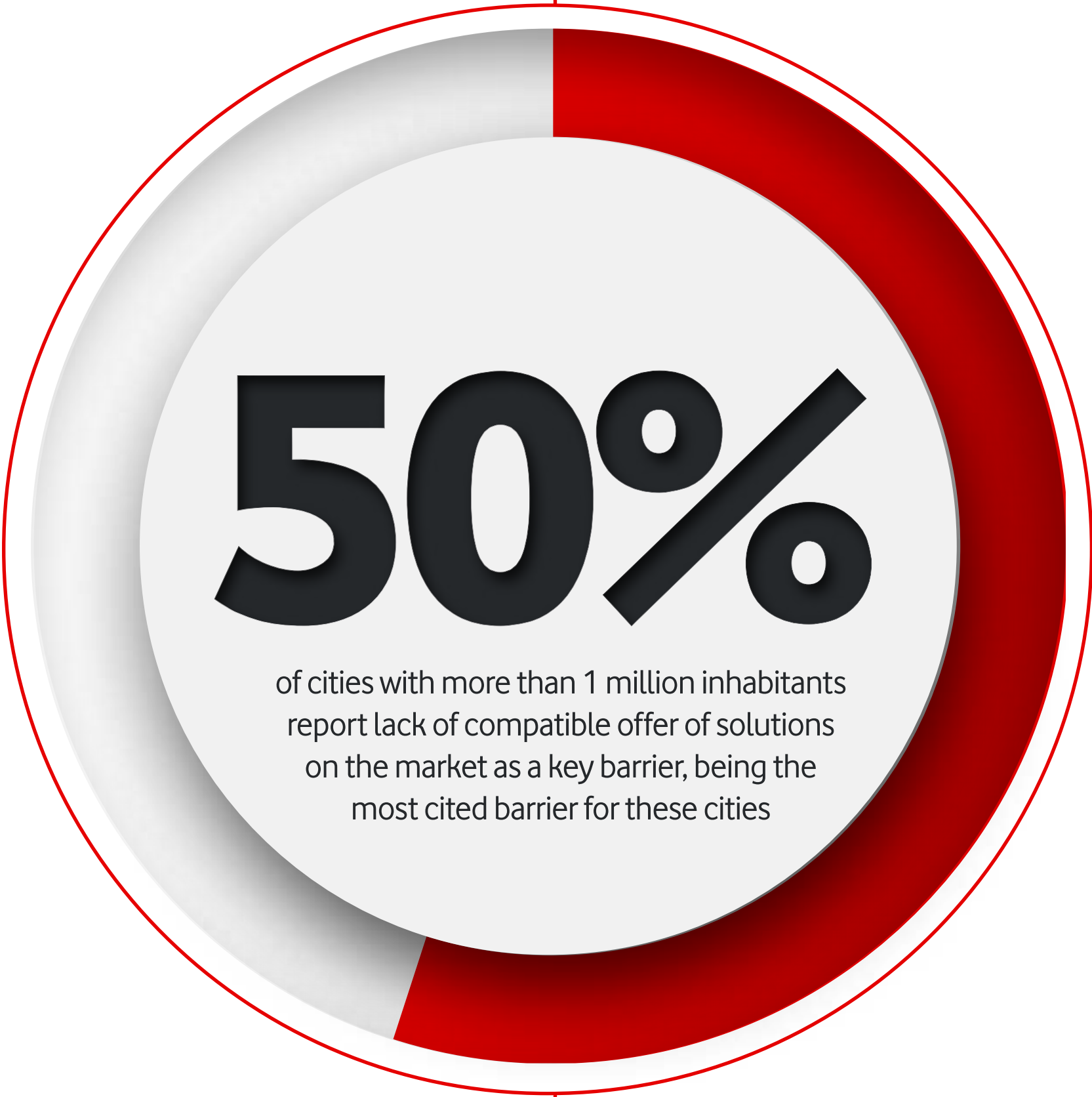
Foundational Architect

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
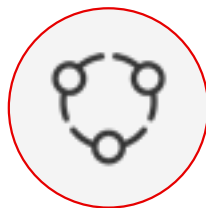
Smart Communities / Telemedicine

Smart campus / Classroom of the future

Mobility as-a-service
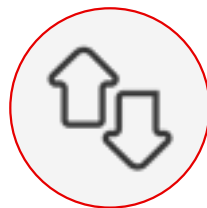
Urban Data Platform / Digital Twin

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 thesmart solutions they've implemented. They recognise this weakness and the importance of investing in connectivity.

Integration Seeker
61 respondents

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

30%

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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

Strategy & Governance

Data, tech & infrastructure

Talent & skills

Innovation promptness

Funding

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%)

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

What are the most prevalent enablers of digital transformation?

76%
Workforce training & digital empowerment

70%
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.

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.

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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.

50%

Integration Seeker cities with more than 1 million inhabitants identified a lack of adequate digital and technological infrastructure as a key barrier. This was the most cited barrier by these cities.

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 platformcan 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
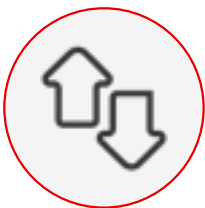
Urban data platform / Data analytics

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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.)

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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

Strategy & Governance

Data, tech & infrastructure

Talent & skills

Innovation promptness

Funding

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?

80%
Workforce training & digital empowerment
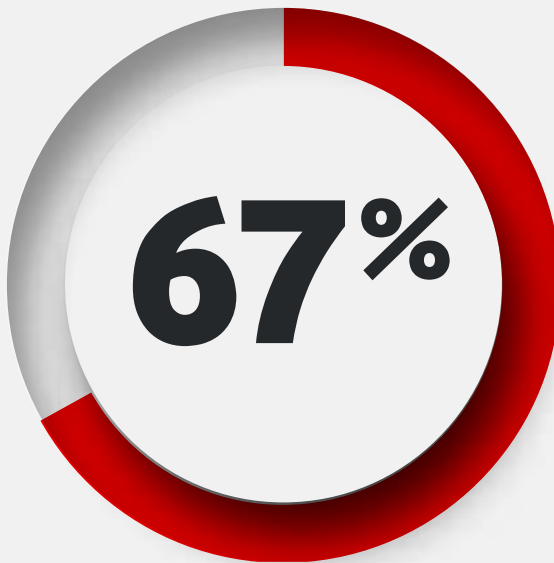
67%
Blockchain, AI or digital twin

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.

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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%
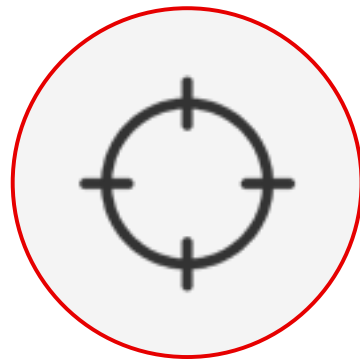
32%

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

27%

of Front-Runner cities reported lack of digital skills and tech literacy among citizens as a key barrier.
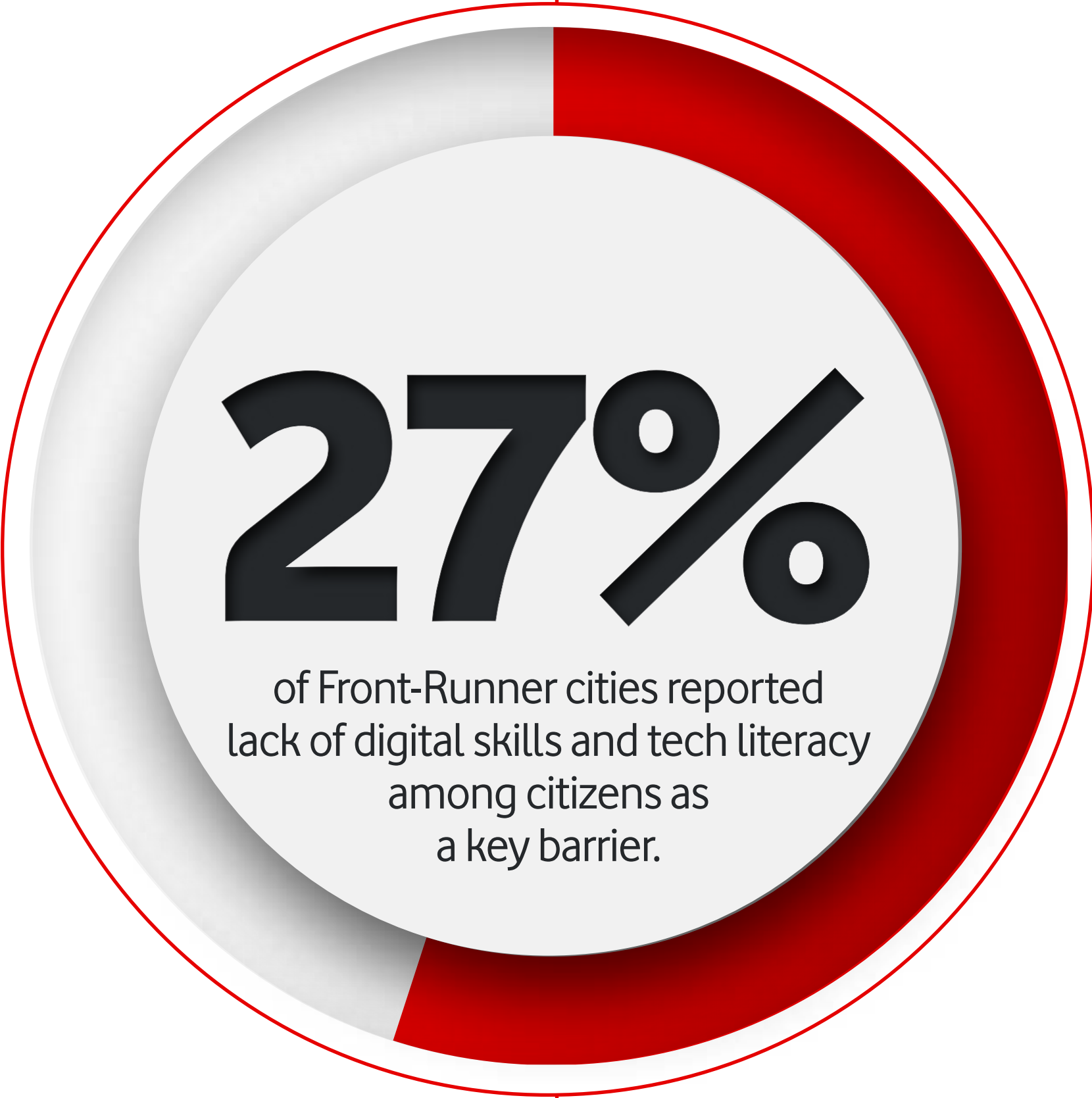
Front-Runner

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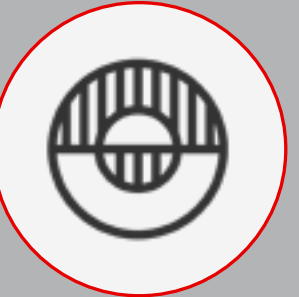
Smart city solutions assessed in our research cover a wide range of options in each cluster

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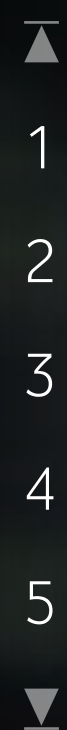
The EU has a set of initiatives to increase the uptake of public procurement and access to funding and financing opportunities

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	Green Procurement	Social Procurement	eProcurement	Recovery and Resilience Facility	Digital Europe Programme	European Urban Initiative	Horizon Europe
Increase demand-side innovation	Ensure products and services are environmentally-friendly	Make socially-responsible purchases	Increase transparency, savings and efficiency	National plans to foster green transition and digital transformation	Calls for the digitalisation of cities	Pilots in the field of sustainable urban development	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[72]

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[73] 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[74], 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[75] €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[76]. 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.