



Inspire Policy Making with Territorial Evidence

DIGISER

Digital Innovation in Governance and Public
Service Provision

Report // August 2022

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Table of contents

Abbreviations	7
Executive Summary	8
1 Introduction	11
1.1 Grand challenges	12
1.2 Digital innovation in Europe.....	14
2 Digital transformation in European Cities: an overview	20
2.1 A Digital Public Service Value Index (DPSVI)	20
2.2 Case studies - complementary information on cities' paths towards digital transformation	21
2.3 Key challenges addressed by DIGISER.....	22
2.3.1 Changing the government structure	23
2.3.2 Building government capacity	26
2.3.3 Changing government processes, service design and delivery	29
2.3.4 Scaling governments and markets to take full advantage of the digital revolution.....	31
3 Policy recommendations to overcome barriers to digital innovation in local public authorities	34
3.1 Changing the government structure	34
3.1.1 Recommendations on improving policy making, and sustainable and long-term strategies	34
3.1.2 Recommendations on improving the level of service embedment and organisational change.	37
3.2 Building government capacity	40
3.2.1 Recommendations on building institutional capacity	40
3.2.2 Recommendations on improving procurement.....	43
3.3 Changing government processes, service design and delivery	44
3.3.1 Recommendations on improving data management.....	44
3.3.2 Recommendations on adopting advanced technologies.....	47
3.3.3 Recommendations on adopting advanced methods and principles on digital innovation	50
3.3.4 Recommendations on improving societal engagement.....	51
3.4 Scaling governments and markets to take full advantage of the digital revolution.....	53
3.4.1 Recommendations on managing change	54
3.4.2 Recommendations on integrating global challenges into local level policies	56
3.5 Summary policy recommendations	57
4 Conclusions	60
5 Glossary	63
6 Bibliography	67

List of maps, figures, charts and tables

List of maps

Map 1 - Cities' proneness to change to engage and support digital innovation	24
Map 2 - Cities' Institutional Capacity	28
Map 3 – Cities' capacity to engage the local society in service design and policy making	30
Map 4 – Cities' ability to manage organisational change	33
Map 5 – Cities' ability to leverage digital transformation to create public value	61

List of figures

Figure 1 - Levels of digitalisation of public services	15
Figure 2 - Data collection and analysis path.....	21
Figure 3 - Obstacles to digital transformation.....	26
Figure 4 - Sharing digital solutions between cities	32
Figure 5 - Organisational changes enabled by digital innovation	35
Figure 6 - Impact of COVID-19 on the digital transformation of cities	36
Figure 7 - Usage of online and offline public services	38
Figure 8 - Data driven innovation in public services	39
Figure 9 - Data use and re-use.....	45
Figure 10 - Data sharing strategies	46
Figure 11 - Adoption of innovative technologies.....	48
Figure 12 - Use of open-source alternatives (Left graph: population. Right graph: GDP-per-capita)	50
Figure 13 - Diffusion of interoperability standards	51
Figure 14 - Methods and practices of societal engagement through digital platforms	52
Figure 15 - Strategies for social inclusion in co-design activities	52
Figure 16 - Role of networks in sharing digital solutions	55

Abbreviations

API	Application Programming Interface
DESI	Digital Economy and Society Index
DIGISER	Digital Innovation in Governance and Public Service Provision
DIGISURVEY	The survey deployed during DIGISER with 255 respondent cities
DPSVI	Digital Public Value Service Index
EAB	European Advisory Board
EDCI	European Digital City Index
EIF	European Interoperability Framework
EU ODP	European Union Open Data Portal
FUA	Functional Urban Areas
GDC	Green Digital Charter
GDP	Gross Domestic Product
GDPpc	Gross Domestic Product per Capita
GDPR	General Data Protection Regulation
ICC	Intelligent City Challenge
LAU	Local Administrative Units
LEA	Learning Technology Accelerator
NUTS	Nomenclature of Territorial Units for Statistics
OECD	Organisation for Economic Co-operation and Development
OGD	Open Government Data
PA	Public Administration
PCP	Pre-Commercial Procurement
Q_	Question (in Digiser Survey)
SDGs	Sustainable Development Goals
SEM	Structural Equation Modelling
SI	Service area Index
T-LL	Triple-Loop Learning
UNDP	United Nations Development Programme

Executive Summary

Digital Innovation Challenges

In view of the increasingly intense pressures on the public sector to address the challenges of our time, governments and other public entities are gradually adopting digital innovation, seeking to promote quality public services. Digital technologies and capabilities create opportunities to re-organise public service innovation and delivery in ways that **reduce cost and increase quality, proactiveness and citizen-centricity**.

Multilevel governance, networks and other collaboration systems (at local, regional, national and international level) are gaining importance as key drivers of this process of digital innovation and transformation. The link to the innovation ecosystem, including all sectors of activity, both private and public (e.g., academia, industry, business, citizens and governments) appears as fundamental in all phases of the creation, development, implementation and maintenance of public services and policy making. Information and communication technologies are conceived as essential elements to support the creation and sustainability of these collaboration processes.

In an era in which information gains relevance in the management of the territory and allows new power relations, the expectations of citizens are increasingly demanding and specific. Considering the developments of recent years, such as the economic, social and health crises, the pressure placed on the resolution of global challenges is progressively transferred to the scope of cities. There are several elements that contribute to the **importance of cities in the digital innovation transformation process** namely buying-power, being closer to citizens and being able to work across different sectors. In fact, urban territories increasingly represent a greater number of citizens - in Europe, for example, they correspond to 75% of the population - have greater autonomy in management, worldwide they contribute to 80% of the global GDP and have the potential to provide a major contribution to the resolution of global challenges.

The balance between change (promoted by the digital innovation strategies) and stability (driven by organisational inertia) needs to be handled carefully. The transformation process has to be based on a long-term strategy and to occur in a sustainable way, by focusing on learning experiences and knowledge and technology transfer, while being sensitive to the local context to ensure improvement.

At the European level, the Digital Transition has been considered a main goal for the next decade. The EU launched the **European Green Deal and Europe Fit for the Digital Age**, a twin initiative, which links green and digital transition. The vision for the EU's digital decade is reflected in the Digital Compass 2030 and includes 4 cardinal points: skills, government, infrastructure and Business. With the aim of having 100% of the key public services online by 2030, the digital compass ensures that digital will contribute in a positive way to improve citizens quality of life while reducing the resources spent. To support this vision, and by understanding the importance of community-led data-driven solutions and the potential of collaborative approaches, several initiatives are being implemented. The Living-in.EU movement, for example, points out the European Way' where multi-level governance and co-creation processes support the development of a cohesive digital Europe in the path towards digital transition. Another initiative contributing to this strategy is promoted by Open & Agile Smart Cities which is connecting cities through **Minimal Interoperability Mechanisms (MIMs)** - "a set of practical capabilities based on open technical specifications that allow cities and communities to replicate and scale solutions globally". The MIMs contribute to the creation of the European Single Market by providing a common technical ground for the procurement and deployment of urban data platforms and end-to-end solutions in cities.

Main findings

Within this context, the DIGISER project analyses the transformation of the public sector and its service provision through digital innovation while taking into consideration the diversity of the European territory in terms of socio-economic, cultural, and environmental endowments in different cities, municipalities, and regions. The project has collected and analysed extensive data from across European local public authorities through (1) the DIGISER survey, that collected primary data on the spread of digital innovation in European public authorities, (2) case study interviews and data processing exercise underpinning a deep-dive analysis of ten European cities, (3) Advisory Group sessions, and (4) a literature review on the topic.

It is important to underline that the term “digital innovation” may refer to a product, a process, or a business model that is embodied in or enabled by ICT, is perceived as new, and that requires some significant changes in both adopters and providers. In this respect, digital innovation is the result of a process that requires profound organisational, behavioural and infrastructural transformations which are enabled by technologies. On the other hand “digital transformation” describes the combined effects that several digital innovations (both radical changes and incremental ones) can create in government operations, internal and external processes, and structures, to achieve greater openness and collaboration, including a more customer-driven perspective and requiring far-reaching and cross-cutting organisational change in addition to the implementation of digital technologies (Cochoy, Hagberg, McIntyre, & Sörum, 2017). The implementation of “digital transformation” requires, therefore, a set of aligned strategies and projects promoting an integrated perspective.

The challenges related to the adoption of digital innovation in the public sector are numerous. The main question that regroups all these challenges, identified in this study lifetime, can be summarised into: **how to change government to meet the 21st century needs and expectations through digital innovation?** Based on this question and aiming at covering the main challenges faced by European cities in this domain, the DIGISER study has identified four key areas as presenting major challenges to achieve digital transformation in public authorities. These relate to (a) **changing government structure**, (b) **building institutional capacity**, (c) **changing government processes, service design and delivery**, and (d) **scaling governments and markets to maximise the benefits of digitalisation**. The following paragraphs discuss the main messages and findings of the project addressed in the report.

To achieve sustainable digital transformation, a public authority needs to develop and implement a **long-term digital vision and an adaptable framework of actions**, namely by ensuring that a city’s digital infrastructure design is agile and allows for onboarding of new innovations. Evidence from case studies such as Porto, Aarhus, and Helsinki points to the central role of dedicated digital teams to ensure better coordination and collaboration among departments to implement digital strategies coherently, rather than on an ad-hoc basis. As found in the Milan case study, giving particular importance to policies consistent with **long-term impact and productivity-unlocking strategies**, e.g., those relating to interoperable systems and scalable solutions, provides cities with opportunities for incremental innovation as they improve upon existing solutions and add new capabilities technologies.

Breaking silos within the government structure, creating a cross-sectoral approach, is essential in this transformation, and, for example, data management policies can play a pivotal role by requiring inter-departmental and cross-organisational data use and re-use. According to our findings, larger population public authorities are more likely to encourage the use and re-use of data across stakeholder interactions. The lower populated towns and cities still need to improve these processes. The creation of partnerships or the promotion of networks can be useful to **improve data use capacity in smaller cities**, to leverage the power of scale and the capacity of larger peers, many of whom retain long-term partnerships with technical specialists in the private sector. The de-siloing process can be supported by the promotion of an innovation culture, the creation of new communication channels and networks.

This capacity for data use and re-use by stakeholders as well as citizen participation in data initiatives or the facilitation of networks for exchanging solutions across authorities, can be measured by the Service embedment - which refers to the scale of adoption of digital innovation by the public authority and its partners as well as the extent to which it is driving change in the organisation and in the broader city. According to our study, the service embedment levels are stronger in bigger public authorities with at least 250K in population. Even though service embedment impact is stronger on the local area and within the organisation, there is weakness related to the sharing of solutions across organisations which can be solved by promoting a **networked approach** (between cities, cities and regions, countries or at European level, promoting a multilevel governance exchange) tackling common challenges and sharing experiences. In fact, survey data also shows that **belonging to networks of cities has one of the strongest positive effects on a public authority’s digital transformation**. Partner networks that specifically include capital cities among their members are more likely to be up to date with the type of technologies needed by public authorities. Capital cities are more likely to be **originators of digital innovation solutions (35% capital cities versus 29% non-capital cities)** and to **co-develop digital solutions with other public authorities**.

Local policy should be harmonised and aligned with higher governmental level policy when possible and relevant. In fact, implemented policies have an impact at different levels of government. A multilevel governance approach can ensure this alignment through networks or by setting up intergovernmental

exchange and interoperability strategies. This multilevel relation is relevant in different fields and optimising synergies between local, regional, national and EU level can be particularly important in topics such as funding. For example, **joint procurement** between public authorities offers a viable solution for funding issues. Indeed, survey results show that about 30% of cities have used alternatives to standard **procurement procedures**, including within EU and domestic funding schemes.

In this collaboration process to design innovative solutions, besides the multilevel network, the engagement of innovation ecosystems and citizens is particularly relevant in cities today. 72% of cities are directly involved in innovation ecosystems. Furthermore, over 70% of public authorities use platforms to engage citizens in public consultations, showing the increased need to implement co-creation processes.

Another general finding is that scale is more relevant than wealth. In fact, **large public authorities tend to benefit from economies of scale**. In the case of institutional capacity, for example, related to the skills and capacity challenge, it is better in larger public authorities with a population size of at least 500k, and in general it ranks highest in the Iberian Peninsula and the Baltics and lower in the Mediterranean and Eastern Europe. Over 65% of the larger public authorities with at least 500k residents have formally approved and published their digital innovation strategies compared to about 50% for less populated public authorities with 50k - 100k residents.

In general, cities rank strongly on having an innovation strategy and access to skilled labour. However, this is not reflected in the tendency to **experiment with advanced technology** where only about 30% of public authorities have experimented with AI and IoT systems. This number drops even further in what concerns tools such as blockchain and wearables.

In the path towards digital transformation, **data management policies** are essential and should provide for the adoption of emerging technologies such as APIs, open data systems, and urban data platforms to improve **automated communication and real-time data exchange** between a public authority's systems and outside users. These technologies are also more suited for **handling big data with minimal human intervention**. In general, **wealthier public authorities are generally better at data management**, nevertheless there is still a long way to go. For example, in the case of big data only 35% of cities report using or producing big data. Currently, only 35% of public authorities operate or work with **urban data platforms**. This rate rises to 58% for capital cities but drops to 31% for non-capital cities. Clearly, this is one area where effective coordinated facilitation by national governments and the EU can help struggling public authorities to improve. Lack of adequate finance and limited institutional capacity are the top two key obstacles faced by public authorities related to digital transformation, so these should be considered critical for solving.

From the results of the survey, we can observe that most cities have data platforms, although the platform quality remains low in cities with under a million inhabitants. **Data strategy** focuses on public authority capacity on data management strategies, e.g., relating to data sharing, data standards, business models impacting data platforms, interoperability frameworks, and the FAIR principles¹. With only 21% of respondents having an **interoperability² framework**, and a small share of administrations adopting holistic data governance strategies on automated data management and publication, the benefits of data are not being maximised.

This report presents policy recommendations for public authorities to address these challenges, with the aim of ultimately achieving digital transformation in their local areas and beyond. These recommendations are further developed into a handbook providing *guidance for policy intervention relevant for digital innovation*.

¹ FAIR principles include Findability, Accessibility, Interoperability, and Reuse of digital assets

² Interoperability is a characteristic of a system, devices or products which are able to connect and communicate (connect and exchange information) in a coordinated way

1 Introduction

The **digital transformation** in the European governments, businesses and industry has been profoundly reconfiguring the ways in which services are provided and knowledge and value are generated. The public sector is inevitably being required to address the growing **complexity of challenges and the increasing demands of citizens**, who expect more flexible, agile and innovative services that respond to their specific needs and wishes. Digital transformation has been a key driver of **public sector innovation and service provision** in recent decades. Digital technologies and capabilities create opportunities to re-organise public service innovation and delivery in ways that **reduce cost and increase quality, proactiveness and citizen-centricity**. Many governments at all levels, particularly at local level, have launched digital initiatives from pre-existing operational baselines of ‘brick and mortar’ administrations. By doing that, the public sector often runs into challenges of siloed infrastructures; lack of interoperability; lack of data sharing across boundaries; competence and skills gaps resulting in unfavourable risk profiles; mismatched funding programmes and procurement processes; and a ‘do-first, govern later’ approach that has occasionally resulted in lock-ins or unpleasant discoveries of legal impotence to act in the public interest due to legacy “blind spots”.

The usage of terms such as “digitisation”, “digitalisation”, “digital innovation” and “digital transformation” can be often confused or used interchangeably in different contexts. Nevertheless, each one of these terms refers to a specific concept, which is important to clarify for the reader before moving forward. “Digitisation” consists in the conversion of analogue material into a digital format (Larsson & Viitaoja, 2017). On the other hand, “digitalisation” is related to the process in which a computer or digital technology is adopted or its usage is significantly increased by a stakeholder (Castells, 2010). It is important to underline that the term “digital innovation” may be a product, a process, or a business model that is embodied in or enabled by ICT, is perceived as new, and requires some significant changes in both adopters and providers. In this respect, digital innovation is the result of a process that requires profound organisational, behavioural and infrastructural transformations which are enabled by technologies. In this respect, digital innovation is the result of a process that requires profound organisational, behavioural and infrastructural transformations which are enabled by technologies. The last term, “digital transformation” describes the combined effects that several digital innovations (including both radical changes and incremental ones) can create in government operations, internal and external processes, and structures, to achieve greater openness and collaboration, and a more customer-driven perspective, and requiring far-reaching and cross-cutting organisational change in addition to the implementation of digital technologies (Cochoy, Hagberg, McIntyre, & Sörum, 2017). The implementation of “digital transformation” requires, therefore, a set of aligned strategies and projects promoting an integrated perspective.

Despite the willingness and efforts of governments and public institutions, in implementing strategies for digital transformation, the results do not always match the original goals. And whilst progress is certainly being made, many challenges remain for local public administrations. Public institutions are frequently not fundamentally reshaping their own way of working, often leading to a multiplication of ‘digital’ profiles at various levels. Data sharing between governmental levels is still often limited in scope, and even in the face of increasing public distrust in institutions, the ‘transparency switch’ is insufficiently used, for a variety of considerations. Although many public administrations are increasingly finding their role as a digital ‘platform of trust’ for their citizens and legal persons, most are still form-finding the translation of that capability into the support and orchestration of data and service ecosystems as engines for economic growth. But perhaps the most pertinent area of attention, and one the current pandemic has certainly re-emphasised, is the slow and reluctant adoption of the vast potential of shared and interoperable digital tools and real-time data as capabilities for swift and decisive policy making. Intelligence for policy makers on all levels, but particularly local levels, needs an upgrade.

To address these issues several European, national, transnational, regional and local policies are being developed. The process of getting a societal grip on digital transformation and striking a balance between oxygen for innovation and the protection of European rights and values has certainly made strides under the leadership of the European Commission, particularly in recent years, and notably with the recent **Digital**

Markets (DMA) and Digital Services Acts (DSA)³, both representing a culmination of sustained collaboration and broad consultations across the communities and stakeholder groups of Europe. The von der Leyen Commission has now also put forward the **Digital Compass**⁴ providing a vision to ensure Europe's leadership in digital transformation by 2030. In addition to these, in May 2022, the **Data Governance Act** was launched, seeking to support the development of common European Data spaces in strategic domains, gathering public and private stakeholders.

While large-scale statistics bodies (e.g., Eurostat, OECD) have started to measure the impact and governance of digital transformation on a national level, data on local levels is scarce. Existing initiatives are therefore not able to measure the complex relation between digital transformation and its impact on innovative governance and public services delivered by local and regional public administrations. DIGISER aims to close this gap, working alongside European partners in a variety of initiatives such as Living-in.eu and the LORDI initiative, the 100 Intelligent Cities Challenge, the Connecting Europe Facility, among others. DIGISER's ambition is to better understand the potential and limitations of existing approaches for gathering data, monitoring and measuring the extent and the impacts of digital transformation at the local level. Thus, DIGISER analyses the transformation of the public sector and its service provision through digital innovation while taking into consideration the diversity of the European territory in terms of socio-economic, cultural, and environmental endowments in different cities, municipalities, and regions.

In this report we start by contextualising the Grand Challenges faced by the public sector, particularly in the digital field, as well as the state of the art of digital innovation and transformation in Europe, identifying the main initiatives undertaken. In chapter 4, we present the framework used in the DIGISER study with a focus on the tools implemented: the Digital Public Service Value Index (DPSVI), the case studies and key main challenges that were identified within the project. Chapter 5 suggests a set of Policies, based on the DPSVI, the case studies and the literature review, to support the cities' path towards digital innovation. The main conclusions of the project are summarised in the last chapter of the report and the findings can be further explored in the annexes.

1.1 Grand challenges

Considering the strategic role of the public sector as catalyst of innovation, this report identifies and investigates the features of public value generated through digital innovation – where public value describes the value that public organisations can bring to society as societal benefits in the perspective of relevant Grand Challenges.

Governments and the public sector play a fundamental role in the definition of the transformation and adaptation of contemporary societies in their process of addressing the **Grand Challenges of our time** (Misuraca & Viscusi, 2014). The term Grand Challenges was first used by David Hilbert, a German mathematician, who created a list, more than 100 years ago, of the unsolved problems in the mathematics field (Daimer, Giesecke, & Marinelli, 2014). In 2003 the concept gained a new strength after proliferating in other fields (besides mathematics), through the **14 Grand Challenges in Global Health identified** by the Bill & Melinda Gates Foundation⁵. The term “Grand Challenges” has also gained relevance in the global political sector, namely with an initiative such as the one launched by President Obama in April 2013 calling out to the relevant stakeholders to join in the identification of the 21st century “Grand Challenges”. “Grand Challenges are ambitious but achievable goals that harness science, technology, and innovation to solve important national or global problems and that have the potential to capture the public's imagination.”⁶

³ The DSA and DMA have two main goals: to create a safer digital space in which the fundamental rights of all users of digital services are protected; to establish a level playing field to foster innovation, growth, and competitiveness, both in the European Single Market and globally.

⁴ The Digital Compass sets out digital ambitions for the next decade divided into 4 points to identify the main goals:

1. a digitally skilled population and highly skilled digital professionals;
2. secure and sustainable digital infrastructures;
3. digital transformation of businesses;
4. digitalisation of public services.

⁵ <https://www.gatesfoundation.org/ideas/media-center/press-releases/2003/10/14-grand-challenges-in-global-health>

⁶ <https://obamawhitehouse.archives.gov/administration/eop/ostp/grand-challenges>

In Europe, the term was suggested by the **European Research Area Expert Group** (European Commission, 2008) and, since the **Lund Declaration** (2009) - which highlighted the need to find solutions to respond to specific problems in fields such as energy sources, global warming, or ageing societies – has gradually integrated within policy discourse. The study provided by the Joint Institute for Innovation Policy (JIIP), to assist the European Research Area Board, in 2012, presents the following definition for Grand Challenges “combination of major public and private interests, [that] are seen as key for realising future economic growth and are concerned with important social and/or environmental problems” (Amanatidou, Giesecke, Jarmai, Loikkanen, & Warnke, 2012). The EU has since then adopted the term **Societal Challenges** (a term with more tradition in the OECD), in its policy documents and programmes, particularly in the Horizon 2020.

The initiatives to tackle Grand Challenges depend strongly on their nature and on what the main stakeholders consider as key points of leverage. In fact, the definition of the Grand Challenges is dependent on elements such as the context, the social perception, communication and negotiation making them a matter of “more or less deliberate choice” (Kuhlmann & Rip, 2014). In the European Union, since Horizon 2020 the “Societal Challenges” were identified as the main priorities of the programme. These integrated seven challenges to be addressed to provide impact on society and benefit citizens:

- Health, demographic change, and wellbeing
- Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bioeconomy
- Secure, clean, and efficient energy
- Smart, green, and integrated transport
- Climate action, environment, resource efficiency and raw materials
- Europe in a changing world - inclusive, innovative, and reflective societies
- Secure societies - protecting freedom and security of Europe and its citizens.

In September 2021, these priorities were reviewed for the next 10 years and resulted in the launching of **five missions** providing new instruments under the **Horizon Europe Programme**. These missions aim at bringing together the public and private sector with an emphasis on the involvement of local communities and European citizens to ensure the societal uptake of the solutions developed (European Commission, 2021). “The missions are commitments to solve some of the greatest challenges we are facing today: fighting cancer, adapting to climate change, protecting the ocean, seas and waters, living in greener cities and ensuring healthy soil and food. It is a set of actions - research and innovation projects, policy measures and legislative initiatives, citizens' involvement - to achieve concrete goals with large societal impact. We want to deliver solutions to key global challenges by 2030!” (Margrethe Vestager, Executive Vice-President for A Europe Fit for the Digital Age⁷). These missions are directly related to the priorities established by the EU such as **Europe fit for the Digital Age, European Green Deal, Europe’s Beating Cancer Plan, An Economy that works for people, and the New European Bauhaus**.

Based on previous experiences worldwide, the **European Innovation Partnerships** (EIP) appears as an instrument to raise economic prosperity while addressing key societal challenges. One of the main focuses of this programme is to promote a collaboration between all relevant stakeholders across policies, sectors, countries and regions, to promote the consolidation of innovation ecosystems. The procurement of innovative solutions namely for cities aim at being facilitated by this programme, enabling a transparent and expeditious process.

The Grand Challenges are **cross-sectoral and cross-level by nature**; consequently, they need to be addressed in a de-siloed and collaborative manner. Therefore, cross-sector collaboration has gained particular importance worldwide and, more specifically, across European countries (Mikhaylov, Esteve, & Campion, 2018). In fact, the delivery of public services is ever more the result of collaboration between different types

⁷ at https://ec.europa.eu/commission/presscorner/detail/en/IP_21_4747

of organisational forms - including public, private and non-profit stakeholders - and specialised entities in different areas of knowledge, research and business, looking for intersectoral synergies.

With the aim of boosting the efforts that cities make to find digital solutions to address grand and interconnected challenges (including urban mobility, energy efficiency, and digital public services, while ensuring environmental sustainability in line with the European Green Deal), the **Living.in.EU movement** aims at pointing out a “European Way” where digital solutions help to create places where people enjoy living and working.”⁸. The “European Way” includes a citizen-centric approach, ethically and socially responsible data usage, co-creation with and engagement of citizens, and open and interoperable standards. Promoters - Open and Agile Smart Cities, Eurocities, The European network of Living Labs (ENOLL), Finland’s Presidency of the Council of the European Union, the European Commission and the European Committee of Regions (COR) - came together to build a declaration with principles for sustainable digital transformation of cities and communities of all sizes in the EU. Collaboration is the main key word of this joint movement which focuses on a citizen-centric, city-lead approach, involving open innovation ecosystems. In this process, technology is an enabler, built upon the premise that platforms and data should respond to open and shared standards promoting responsible access and usage. This movement is supported by more than 100 cities and 90 organisations. As part of this movement both cities and communities are encouraged to adopt, develop, use, and share reliable standards and digital solutions that help their citizens and businesses prosper, respecting their individuals’ digital rights.

To tackle Grand Challenges, policy makers are increasingly using **policy innovation in a challenge-led perspective** (Mazzucato, Kattel, & Ryan-Collins, 2020). In this new approach to challenge driven innovation, there is a strong attention to broad system transformation, demand-side policies and transformative changes (Coenen, Hansen, & Rekers, 2015).

Challenge-based policies aim at being less instrumental and require a combination of technology and social innovation, involving a diversity of stakeholders and being open to contestation (Kuhlmann & Rip, 2014). Grand Challenges policies also must deal with iterative processes, non-linearity, and divergences in developments (Kuhlmann & Rip, 2014). Clear examples of the design and implementation of strategies based in a challenge-led perspective are the European Union’s research and development programmes (e.g., Horizon 2020 and Horizon Europe) or the United Nations Sustainable Development Goals - SDGs⁹. Although there might not be a common definition for Grand Challenges, these examples show that there is a clear consensus that they have a growing impact on policy making and particularly on Science, Technology, and innovation Policy (STIP).

1.2 Digital innovation in Europe

To address the Grand Challenges in a context of tight budgets, complex societal needs, and small team structures, it becomes essential to use the advantages of digital innovation to promote and accelerate transformation.

Over the last decades, **digital services have had a fast growth and consequently a huge transformative impact in the economy and daily life in Europe**. Shopping online, looking for information or interacting with others has become a natural and daily action for the more than three-quarters of EU citizens that used the internet daily in 2019 (Oxford Economics, 2020). These numbers seem to have increased with the pandemic crises in the last 2 years, making digital services an essential tool for working and living in the EU. “Eight in ten Europeans think that by 2030, digital tools and the Internet will be an important part of their lives and bring at least as many advantages as disadvantages” (Vice-President Margrethe Vestager Speech by Executive Vice-President Vestager on the Declaration on Digital Rights and Principles, Brussels, 26 January 2022). This usage of digital technologies is putting an added pressure on the public sector with new demands and expectations.

⁸ <https://living-in.eu/>

⁹ <https://sdgs.un.org/goals>

In fact, the emergence of new and powerful digital technologies and infrastructures has largely transformed the panorama of innovation, both in the public and private sector, with clear implications in organisations, but also in the process of policy making (Nambisan, Wright, & Feldman, 2019). In the last years, the integration of technology in processes and services has, undoubtedly, been one of the main topics and investments of the innovation strategies in the public sector. In fact, in 2019, it was estimated by IDC (International Data Corporation) that the top 100 cities which invested in smart innovation made up just under 30% of the global spend in the industry. Although this seems to be more evident in big cities, it is estimated that 70% of smart city's growth potential is related to cities that invest less than 1 million dollars a year. According to a report on Global smart cities market this expansion, guided by the developments in the IoT sector and eased by government regulations, is estimated to double the global smart city industry market from \$410.8 billion in 2020 to \$873.7 billion by 2026. The effort to promote digital public services has also been increasing in the past decade. According to DESI 2021, in the field of digital public services available for citizens and businesses, Estonia, Denmark and Finland are the European countries that score the highest while Romania, Greece and Hungary have the lowest score. However, the evidence collected so far, despite recognizing the potential impact of the usage of technology, comes short in evaluating and providing a complete overview of the value generated in productivity and service provision (Nylén & Holmström, 2015).

Through the DIGISER study, we can see that within public authorities the level of digitalisation varies by service area, according to survey results in Figure 1. The pattern emerging is one of digitalisation being strongest in General administration and transport & mobility services, and weakest in healthcare services. Therefore, the approaches and methodologies applied should be customised to the needs and digital maturity level of the public authority and area in question.

How would you describe the level of digitalisation of services provided by the public authority in the following service areas?

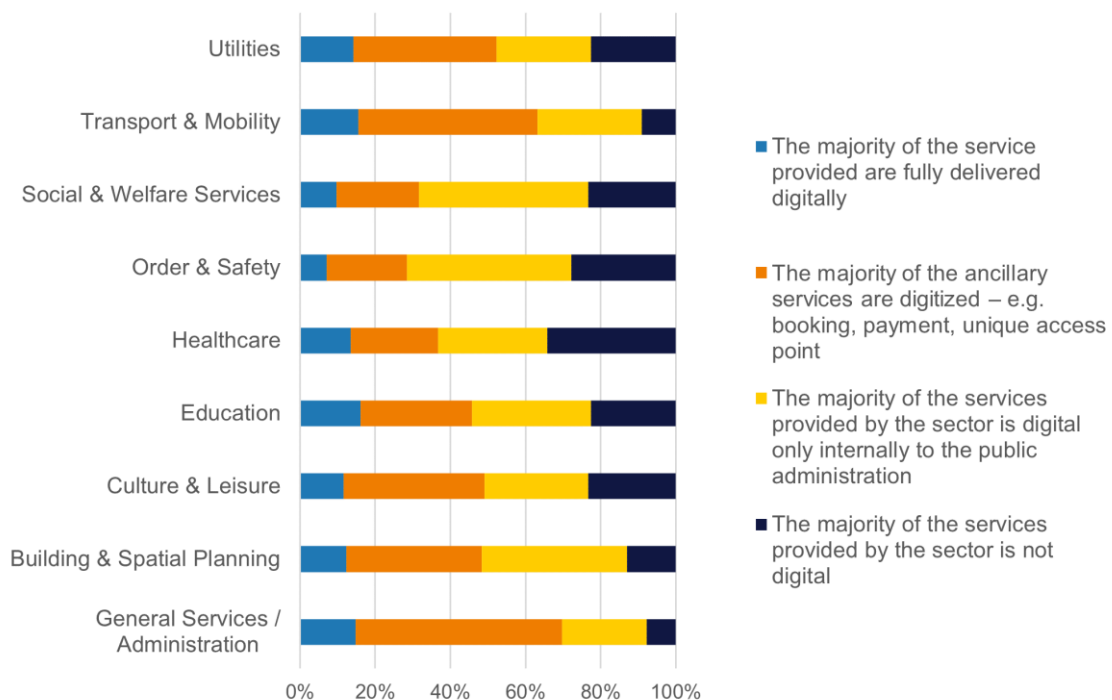


Figure 1 - Levels of digitalisation of public services

From the case study analysis undertaken, we can conclude that a growing list of major European cities such as Aarhus, Poznan, Rotterdam, Helsinki, Thessaloniki, and Ljubljana, are already deploying advanced systems such as IoT infrastructure and big data analytics as part of their smart city strategies. However, there remain hundreds of small and medium sized cities and towns in Europe for which the most advanced digital tool adopted is a basic website.

The plurality and complexity of the European context, society, economy, and challenges faced make it essential to establish a local, metropolitan, regional, national, and international collaboration. Integrating global “grand challenges” into local level policy and having a network of councils supporting the creation of common solutions (which must take the local needs into consideration when implemented) is only possible by changing management and the sharing of experiences, through standardised approaches, joint procurements or cities network collaborations (belonging to networks such as OASC, Eurocities and others) which correspond to identified challenges.

Dealing with increasingly digitised information and a different balance of power (between multiple stakeholders from the innovation ecosystem), the innovation field has opened a new concept of integration and collaboration where physical and digital components must be combined (Yoo, Boland, Lyytinen, & Majchrzak, 2012). Citizens and other stakeholders involved in the decision-making processes have increasingly gained more power to effect change. User-driven approaches are flourishing at a national level in several European countries (e.g., the Carpeta Ciudadana in Spain¹⁰ and Participation Citoyenne in France¹¹) but also at a local level (e.g. Porto Innovation Hub in the city of Port and the Mayor's Open Days in Ljubljana described in this report).

As the infusion of new digital technologies strongly impacts the nature of unpredictability, intrinsic to innovation processes and outcomes, it pushes for a radical change in the pursuit of creative attempts to address it (Nambisan, Wright, & Feldman, 2019). Therefore, to address the unique properties, sometimes unexpected or difficult-to-predict outcomes of the usage of rapidly evolving technologies in the governance process, the public sector needs to put in place dynamic, flexible and adaptable tools to manage the digital innovation efforts.

According to some authors and reports, the COVID-19 pandemic has largely contributed to the acceleration of the Fourth Industrial Revolution (Prodanov H. 2021; Khagram S.2020). This has resulted in the rapid digitalization of government and institutions all over the world. According to a study from McKinsey (global survey from 2020¹²) the pandemic has accelerated the digitalization process globally by 7 years. This moment of the world's history has revealed the urgent need for robust digital public services throughout Europe but has also unveiled some fragilities in the digital innovation process, namely at the local scale. The focus on the creation and development of a Digital Single Market aims to address this pressing issue of making available high quality digital public services that mix the physical and digital and biological areas. The path towards digital transformation remains a priority for the European States and cities. For this purpose, many of them plan sizeable investments to digitalize public administration through the Recovery and Resilience Facility¹³

The gathering of large amounts of data, by governments and public entities, has no precedents in history. This evidences the challenge to transform data into insights and the need to transform them into “policy intelligence” (Misuraca & Viscusi, 2014). Data is, therefore, at the heart of Digital transformation constituting a crucial element of the “Fourth Industrial Revolution”. This new revolution will have a strong impact on people's perception of reality and will contribute to the “blurring physical, digital and biological spheres” (Misuraca G. B., 2020).

With 46 member states and a population of 686 million in the Europe Region¹⁴, the European ICT market has been an example for the digitalization of policy development and implementation. This region has had rapid growth in many areas of ICT infrastructure. This is demonstrated by the way in which mobile network coverage reached around 100% in 2019 and internet use increased from 77.4% in 2017 to 82.5% in 2019 (Elmassah & Hassanein, 2022). From the local to the European scale, digital transformation has been a key driver of public sector innovation. Its influence on public services goes beyond the way in which they are conceived, organised, and delivered, redefining the boundaries and scope of public institutions as well as their governance mechanisms. For this reason, the report considers the urban ecosystem through a granular

¹⁰ <https://sede.administracion.gob.es/carpeta/clave.htm>

¹¹ <https://www.participation-citoyenne.gouv.fr/>

¹² <https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/how-covid-19-has-pushed-companies-over-the-technology-tipping-point-and-transformed-business-forever>

¹³ https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility_en

¹⁴ This number corresponds to the ITU Europe Region as defined under ITU Country classifications.

scale of observation and data collection. The **Europe's Digital Decade**¹⁵ strategy aims at having the key public services for business and citizens fully online by 2030. "Democratic life and public services online by 2030 must be fully accessible for everyone, and everyone must benefit from a best-in-class digital environment providing for easy-to-use, efficient and personalised services and tools with high security and privacy standards."¹⁶

Nowadays Denmark, Finland, and the Netherlands are in the forefront of this movement in what concerns e-government users¹⁷, having more than 90% of internet users (between the ages of 17 and 74) interacting with the public administration through governmental portals (European Commission, 2021). If we look at the Digital Public Service for citizens¹⁸ indicator of DESI 2021, Malta, Estonia, and Luxembourg perform the best with 95 points in 100 (European Commission, 2021). Things seem to be on the right track in what concerns the EU countries, but the question then becomes: What about European cities? How are they performing?

Cities have been frequently, over the centuries, at the forefront of transformation. In Europe, **cities are home to 75% of EU citizens** and important centres of economic activity, knowledge creation, generation of innovation and test beds for new technologies. There are several elements that contribute to the importance of cities in the digital innovation transformation process: (1) buying power (2) being closest to citizens and (3) being transversal. First, they are relevant economic centres, continuing to increase their power (UN Habitat, 2011). In fact, cities worldwide contribute 80% of the global GDP¹⁹. As a second relevant element, cities are the closest public entity to citizens. To ensure civic engagement, especially meeting their expectations and requirements for public service provision, citizens must be an active part of the service creation process. A third element that is key to the contribution of cities in their role of driving digital innovation transformation is the fact that they need to work transversely. To ensure that they address correctly the challenges faced, cities must work in a transversal and transdisciplinary way, no longer having the luxury of working in verticals.

To support the Digital Transition in Europe, the EU launched the **European Green Deal and Europe Fit for the Digital Age**, a twin initiative, which links green and digital transition. The goal is to promote climate neutral and digitally enabled solutions to address the new challenges faced. The vision for the EU's digital decade includes 4 cardinal points: skills, government, infrastructure and business. This **Digital compass 2030**, establishes the path toward the digitalisation of public services. With the aim of having 100% of the key public services online by 2030, the digital compass ensures that digital will contribute in a positive way to improve citizens' quality of life while reducing the resources spent. At the same time, several initiatives and plans are being implemented in the green deal, (e.g., EU zero pollution action plan, EU climate adaptation strategy and climate Neutral smart cities). These initiatives have a dedicated strategy on how digital tools and usage of data can help achieve the green goals. The Urban Agenda²⁰, a European coordinated approach, designed to address the EU and national policies and legislation of the urban dimension (with 14 partnerships in specific themes) also contributes to the digital transition as one of their verticals. This topic is addressed in a transversal way, identifying approaches, processes and tools that can be developed and adopted by cities in this transformation. To make sure to address all the dimensions of the digital transition, we also need to consider the EU work on Territorial Cohesion²¹ which focuses on "strengthening its economic, social and territorial cohesion, for an overall harmonious development". All these initiatives are linked to ensure common and joint effort in the path towards a sustainable digital transition.

The EU is working, naturally, to improve connectivity and infrastructure, but one of the main focuses is on ensuring the availability of real time, relevant, and quality certified data to support the process of decision making, managed through interoperability and open standard based platforms. On top of this structure

¹⁵ https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en

¹⁶ Proposal for DECISION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing the 2030 Policy Programme "Path to the Digital Decade", Eu Brussels

¹⁷ "This indicator considers out of all internet users, the percentage of individuals who used the Internet in the last 12 months for interacting with public authorities" (European Commission, 2021)

¹⁸ This indicator measures the extent to which a service or information concerning service for citizens is provided online, and via a portal (European Commission, 2021)

¹⁹ <https://www.weforum.org/communities/biodivercities-by-2030>

²⁰ the 14 partnerships developed within the Urban agenda can be consulted at <https://futurium.ec.europa.eu/en/urban-agenda>

²¹ https://ec.europa.eu/regional_policy/en/policy/what/territorial-cohesion/

impactful solutions such as the **Local Digital Twin** can be built. Local Digital Twins are the virtual representation of the city's physical structures, assets and processes by using data and machine learning to simulate models and scenarios in real time. There are several initiatives, being developed to test the impacts of the Local Digital Twins in the development of cities and communities such as DUET²² or LEAD²³ projects.

To support the development of a digital single market, the EU has launched the Joint Initiative on Standardisation²⁴, understanding the relevance of standardisation, as a strategic tool in improving the efficiency of European policies. The benefits of standardisation are numerous (e.g. reducing costs, anticipating technical requirements and increasing efficiency) and impact several areas of activities (e.g. industry, companies, governments and citizens). To be able to define these standards, it is essential to identify common needs and solutions to meet the users' expectations. By understanding the importance of community-led data-driven solutions and the potential of collaborative approaches, OASC is connecting cities with the aim of creating **Minimal Interoperability Mechanisms (MIMs)**. The MIMs contribute to the creation of the European Single Market by providing a common technical ground for the procurement and deployment of urban data platforms and end-to-end solutions in cities. Based on an inclusive list of baseline references MIMs consider the context and backgrounds of the cities and communities to achieve interoperability. The MIMs are technology-agnostic and vendor-neutral, able to integrate all existing systems and offerings. This enables an interoperability of data, systems, and services between buyers, suppliers, and regulators across governance levels around Europe. These efforts in interoperability frameworks in Europe have been developed by different actors, namely Connecting Europe Facility (CEF) building blocks (European Commission, 2021c), ISA² (Interoperability solutions for public administrations, businesses and citizens) refined eHealth European interoperability framework (ReEIF) or eHealth digital service infrastructure (eHDSI), but still constitute a difficult challenge to overcome²⁵. The **CEF Building blocks**²⁶ (also known as the Digital Service Infrastructure- DSI), for example, are a set of digital solutions that support users in the adoption of interoperable, EU-compliant services and products. The building blocks aim at facilitating the delivery of public services, through a core Service platform (with e.g., technical specifications, software sample) and generic services in the form of Grants (Funding for EU members).

As part of the **Digital Europe programme**, the EU is promoting the creation of **European Data Spaces**. With the aim of connecting presently fragmented and disconnected data ecosystems, these data spaces will create a safe and trusted interoperable IT environment for data processing. By addressing the legislative and administrative perspective of data rights and rules, these data spaces will each have a specific focus. Within this initiative, there will be dedicated data spaces for smart communities. Building a Data Space for smart communities relies on three essential elements: (1) Data governance; (2) Conceptual architecture and interoperability; and (3) Definition of priority datasets. The data governance element will focus on establishing and defining roles, responsibilities, and rights. With the aim of developing and consolidating an EU Digital Single Market, interoperability (the second element) becomes a key component for cities to establish a dialogue with the higher levels of government, cross-border public administration and the private sector. Additionally, interoperability and standardisation approaches, facilitate the wider adoption of connected technological solutions. The compatibility amongst devices and platforms, enables a broader development and deployment of services, across sectors, cities, regions, and countries. Through the EIF4SCC²⁷ (European Interoperability Framework Connection to the Smart Cities and Communities), the EC aims at supporting local administration and their local ecosystem (both private and public sector) to provide interoperable services to citizens and businesses. In this context, the relevance of initiatives such as the Living-in.EU is key.

The uptake of urban digital platforms, and the roll out of a set of technical standards such as the MIMs, will be a powerful tool to ensure the successful adoption throughout Europe.

²² <https://www.digitalurbantwins.com/>

²³ <https://www.leadproject.eu/>

²⁴ https://single-market-economy.ec.europa.eu/single-market/european-standards/standardisation-policy_en#:~:text=Standardisation%20has%20played%20a%20leading,improve%20safety%2C%20and%20enhance%20competition.

²⁵ espon.eu/sites/default/files/attachments/Thematic%20paper%20-%20Working%20together%20to%20deliver%20better%20digital%20healthcare.pdf

²⁶ <https://ec.europa.eu/digital-building-blocks/wikis/display/CEFDIGITAL/The+Vision>

²⁷ This initiative results from the collaboration between DG DIGIT as part of the ISA² Programme (2016-2020), and by DG CONNECT in the framework of the Living-in.eu movement

By focusing on the availability of quality, standardised and shared data and solutions, movements and projects in the EU are contributing to reinforce the digital market. One of the development fields is Artificial Intelligence (AI Strategy²⁸), divided into 2 main areas: excellence in AI and trustworthy AI. This set of rules aim at safeguarding the performance of markets and public sector and citizens' fundamental rights. The aim is to support cities and their ecosystems to make better-informed and transparent decisions to reach their common goals. Nevertheless, there are still some challenges being faced in the EU, namely in the field of data, which make it essential to find innovative solutions.

²⁸ <https://digital-strategy.ec.europa.eu/en/library/communication-artificial-intelligence-europe>

2 Digital transformation in European Cities: an overview

The DIGISER project analyses the transformation of the public sector and its service provision through digital innovation while taking into consideration the diversity of the European territory in terms of socio-economic, cultural, and environmental endowments in different cities, municipalities, and regions. The project has collected and analysed extensive data from across European local public authorities through (1) the DIGISER survey, to collect primary data on the spread of digital innovation in European public authorities, (2) the case study interviews and data processing exercise underpinning a deep-dive analysis of ten European cities, (3) Advisory Group sessions, and (4) literature review on the topic.

2.1 A Digital Public Service Value Index (DPSVI)

The digital dimension of local public services has been long interpreted as a driver of innovation and changes since it became evident that ICT represents a vital tool for urban governance. After the initial enthusiasm for a pure technology-driven approach to public sector transformations, in recent years a novel vision of the public sector activated using ICT in public services has emerged, where principles such as information sharing, transparency, openness, and collaboration became key concepts with relevant organisational and policy implications. This slow yet steady process has contributed considerably to making the reflection on governmental capacity more complex and demanding in terms of competences required, institutional/organisational arrangements and the responsiveness and appropriateness of policy actions.

An effective and in-depth observation and assessment of the role played by digital innovation of public services needs to be framed within a more complex and longer process of technology-enabled public sector reform, able to capture the complexity of the service creation process and its capacity to contribute to possible responses to global societal challenges. Making (digital) public services aware of the potential benefits offered by ICT advances represents, in fact, a crucial channel to make cities into protagonists of the very urgent transition that every public institution should be aware of and be responsible for.

The key question targeted in DIGISER is, therefore: are the growing potential benefits of ICT effectively adopted in the conception and provision of services and turned into opportunities for public sector reform and result in increasing the generation of public value at societal level?

The operational translation of such a “dilemma” results in three key research questions.

1. **How can digital transformation generate long-term innovation in public sector organisations?** This question refers to the capacity of the digital transformation of public service delivery to activate organisational change and innovation. The creation of new digital services or the digital innovation of existing ones is an opportunity for reflection and learning at the institutional level and challenges institutional organisations towards more flexible and open structures. Hence, being more collaborative, transparent, experiment prone, and capable.
2. **How does public sector organisational innovation generate public value in local contexts?** Within a transitional perspective, the digital innovation of governance and services are means to drive change in the practices and behaviours of everyday life. Coherently with the interpretation of innovation as a process of value generation, innovation should relate value generation to the situated perspectives of local contexts: local SMEs, public agencies, NGOs, citizens and their associations, are co-producers of such public values.
3. **What paths and key enablers can make successful innovation replicable and scalable?** Public administrations neither act alone nor in a vacuum. Their action spaces are strongly affected by political, cultural, and economic factors, by higher level regulatory frameworks, by experiences of similar public administrations, by their belonging to national or international networks enabling experience exchange and collaboration. In these dynamics, cities represent sources and drivers of the replication and diffusion of innovation.

To answer these questions, the research team of DIGISER deployed quantitative and qualitative research initiatives with the purpose of measuring and assessing the performance of cities in the digital age, focusing on the interplay between digital transformation of public services, organisational innovation, and creation of public value.

One of the main goals of DIGISER has been the development of a set of indicators capable of capturing and synthetically describing the performance of cities in the digital transition and their ability to drive this transition towards the creation of public value.

This work resulted in the development of the DPSVI, Digital Public Service Value Index (DPSVI). In summary, the DPSVI is conceived as a multi-level composite index, built upon primary data collected through a questionnaire (DIGISURVEY) targeting European local authorities. The questionnaire, structured around nine sections and including 128 questions, has been filled by a relevant sample of 248 unique local authorities representing the variety of European cities in terms of spatial distribution, population, and GDP per capita.

The primary data have been processed and combined to feed a system of composite indicators that provide a synthetic assessment of the performance of cities in relation to complex phenomena underlying digital transformation in European cities.

The DPSVI and its other sub-indices are meant to be a concise measurement of the performance of each city with respect to several phenomena, that are explored through the combination and cross-checking of the answers to several individual questions.²⁹

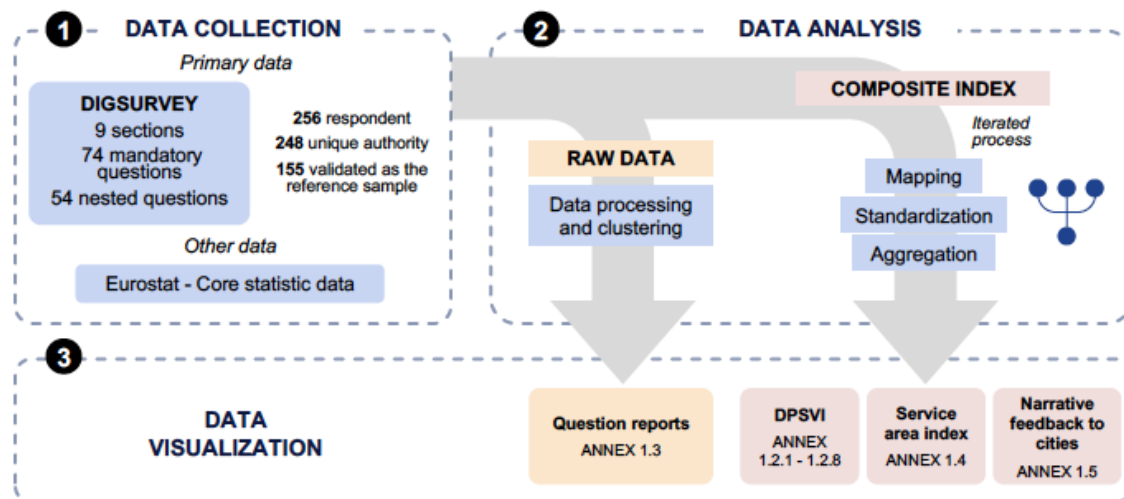


Figure 2 - Data collection and analysis path

2.2 Case studies - complementary information on cities' paths towards digital transformation

While the DPSVI provides quantitative information on the state-of-play of digital transformation in Europe, the case studies of ten European cities - Aarhus (Denmark), Helsinki (Finland), Ljubljana (Slovenia), Luxembourg City (Luxembourg), Magdeburg (Germany), Milan (Italy), Porto (Portugal), Poznan (Poland), Rotterdam (The Netherlands), and Thessaloniki (Greece) complement the analysis on digital innovation by taking into consideration the diversity of experiences and approaches of ten European cities of different sizes, geographies and stages of digital maturity. The case studies are aligned with the key components of the DPSVI to ensure consistency and relevance. They provide further information on lessons learned, success factors and bottlenecks faced by cities when progressing on digital innovation.

The case studies were drafted based on dedicated interviews with city representatives on the key dimensions linked to digital public service provision and additional meetings with stakeholders to look for additional details on the success factors and bottlenecks of specific initiatives, including the potential for scaling-up. Case studies also include a zoom-in on a specific digitally enabled service as a reflection of the efforts undertaken by each city in digital transformation. See the Annex 1.6 to explore the full case studies.

²⁹ The full methodology and results of the DPSVI are published in the Annex 1.1 – Extended Methodology and Annex 1.2 - DPSVI.

2.3 Key challenges addressed by DIGISER

Digital innovation has been at the core of discussion in different fields, both in theoretical and practical approach. This is still a blurry field of research to which the practice of policy making, particularly in cities can contribute. In contrast to traditional approaches, with traditional value chains, in digital innovation the value is created in a non-linear, shared management, and dynamic and flexible processes in connected environments (Holmström, 2018). These transformations imply that the public sector faces a set of **multi-level and cross-sectorial challenges to implement digital innovation strategies**. These challenges might start at the digitization level (one of the core elements of the digital innovation processes) but include, as well, other areas such as process management, capacitation, or procurement.

Adding to general challenges faced by both the public and private sector in the domain of digital innovation, such as expertise, funding and technological knowledge, the public sector must deal with its role as a catalyst of the ecosystem of actors involved in the public service provision. The complexity of relations amongst stakeholders, sectors and their connection to technology is one of the challenges of this process.

The challenges related to the adoption of digital innovation in the public sector are numerous. The main question that regroups all these challenges, identified during the lifetime of this study, can be summarised into: **how to change government to meet 21st century needs and expectations through digital innovation?**

This question regroups, gives sense, and at the same time, allows for an actionable reflection. Governments and public services may still be very dependent on the early organisational models of the second half of the last century, that slowly adapted and evolved responding to more efficient practices of the private sector. The Weberian model (Weber, 1999) of a highly specialised public sector, made of well established, stable and siloed structures, based its efficiency in the application of general principles by the public officials integrated in a hierarchical chain of command.

These bureaucratic models evolved giving place to more networked and agile organisations, more centred on the individual being served, more creative and more focussed on problem solving. The transition between **hierarchical and networked** organisations hasn't been an easy path, partially due to the conservative nature of governments and public administrations and we can argue that they are still at a very early stage. Cities are, therefore, at different stages of maturity in this transformation process towards a more collaborative and open approach.

The current adoption of a digital perspective, reflected in the notion of e-Governments or Digital Governments, is still often done by automating old structures and processes and not rethinking processes and extracting insights from the wealth of data to influence policy making. Also, the application of methods and approaches from the private sector into the public sphere, raised challenges regarding aspects of disaggregation (with the creation of agencies or quasi-governmental organisations), competition and incentivisation, which may have increased institutional and policy complexity.

With digital innovation, organisation structures have been challenged, as much as the traditional assumptions of value creation (Holmström, 2018). Understanding digital innovation as the use of a set of digital resources that are combined and recombined, both in design and use, in a value space framework (digital resources interlinked through connections established and dissolved by actors seeking to generate and appropriate value) (Holmström, 2018), reinforces its impact on organisations.

It is important for the public sector to answer questions on how to embrace and apply this new culture, practices, processes, and technologies of the Internet-era to respond to people's rising expectations for simpler, more empathetic and secure government. How can the public sector organise itself more productively in the way it designs, shapes, and delivers public services?

Simply putting "lipstick on legacy"³⁰ – i.e., as an example, automating manual processes, creating websites, digitising paper forms – a good first step into the digital era a few decades ago, is no longer enough to ensure the digital transformation needed. The embedment of digital technologies and the potential for transformation goes much beyond this and has to be driven by upskilling people, rethinking processes and the adoption of

³⁰ Reference to the "Digital Lipstick on a Legacy Pig !: A Practitioner's Personal Notes on Digital Transformation" book by Vaasu S Gavarasana

tools and advanced technologies. However, most government “digital reform” has focussed on minor improvements to existing organisational processes and front-end websites, not on a fundamental redesign from policy to delivery. The focus has been on digitising current services and transactional interactions, instead of rethinking how best to achieve outcomes and better service provision in the internet age.

It may be considered that, over more than 20 years, too much time and considerable expenditure at all levels (from the broad EU to the local level) may have been wasted on well-meaning but, ultimately, trivial tinkering and automation of the past. Technology used in this way has become an expensive displacement activity from the “real work” required to update and modernise our public services, which need to be centred around the users (both citizens and businesses). This calls for an open community of real collaboration that enables the sharing, distribution and communal ownership of informational resources, services, and technology across the public sector. This is where the concept of wide “governance” amplifies the traditional notion of government, in the sense of fostering a real partnership with civil society and the other actors that usually are associated with notions like the **quadruple helix ecosystem**³¹. There are several examples of approaches that incorporate the quadruple helix model. Within these, there is the Living Lab approach, which entails a user-centred innovation environment in a real-life context or the Service Design approach which aims at designing the experience and the strategy to develop a service.

There are several evident opportunities in (re-)creating new institutions with digital values, design thinking, sentiment, business models and culture at their basis. Not just because it will have better, cheaper, more efficient and empathetic public services that meet user needs, but also because those institutions will provide a new foundation, a new digital infrastructure-based notion of public service, serving the whole of society.

However, reinventing the public sector and services for the internet age will be a significant undertaking. It will require a remarkable act of political vision and courage.

To have a clear definition of the DIGISER study, a collection of key challenges was made with the collaboration of policy makers and synthesised in four key challenges as described below.

2.3.1 Changing the government structure

It is urgent to change government structure, by optimising systems, organisations, processes, and work culture, supported by digital transformation strategies, to better respond to the demands and context of the **21st century and the societal, environmental, economic and political needs**. This transformation in structure has impacts in governance, collaboration policies, proneness to experiment, and the budgetary capacity to access skilled workers and to procure digital technologies. This key challenge is a **cross-sector challenge**, characterised by elements such as the need for de-siloing the traditional structure and the transformation towards an interdisciplinary and multidisciplinary approach.

In 2016 the United Nations' (UN) New Urban Agenda³² identified the need for cross-sectoral and cross-level integration as an essential requirement for policy and institutional change. For the European Commission this is also a key dimension for policy cohesion between policy areas, levels of government and across different territorial scales. To effectively implement a cross-sectoral integration approach it is important for the administration to agree on the forms of collaboration and responsibilities (Handbook of Sustainable Urban Development Strategies³³

In fact, siloed structures are not able to effectively communicate, share data, expertise, and capacities with one another. This appears as an issue in the process of creating and scaling up good practices and solutions, both within governments and vertically (between local, regional, national and EU level). At the same time, these siloed approaches **duplicate activities and costs, consuming much time and budget**. Administrative functions and processes, located across both public and private sectors, frequently unwittingly extract “rent” from frontline public services and public employees to address other challenges. This is the case whether we are talking about “in-house” or “outsourced public services.

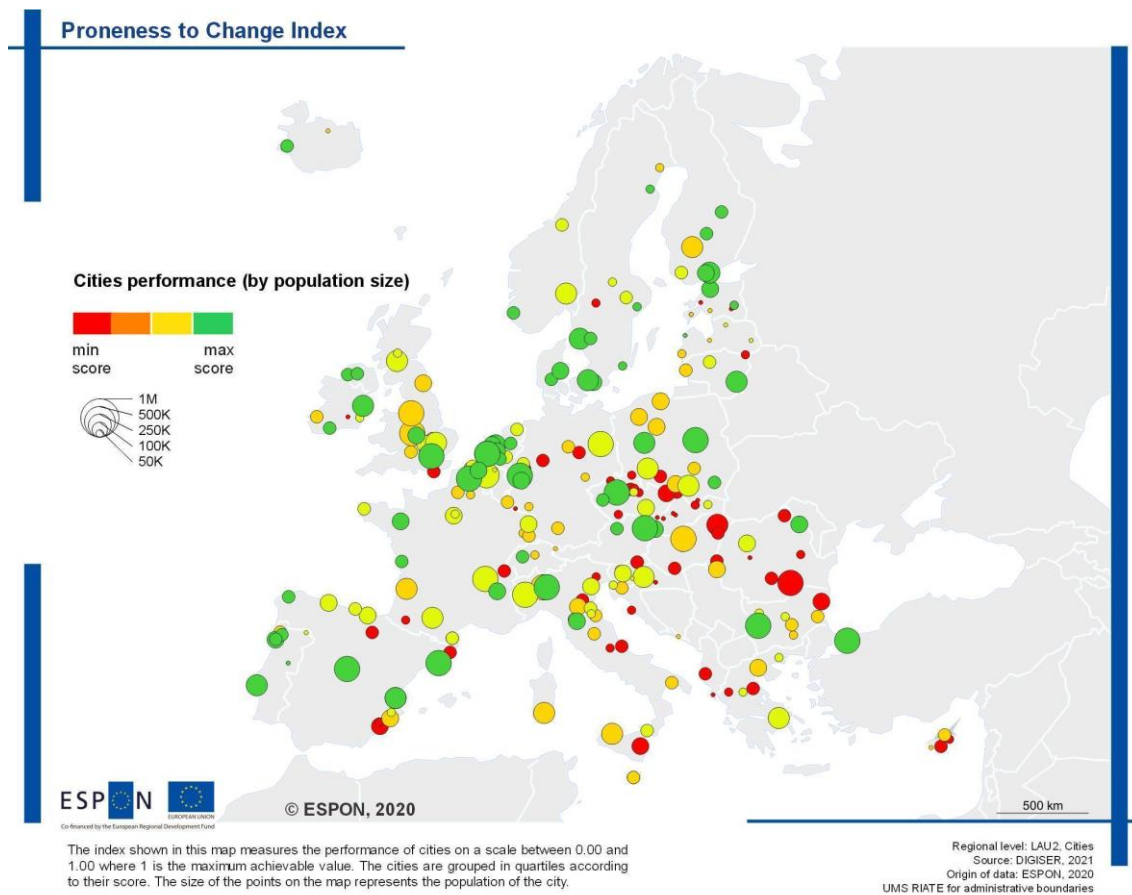
³¹ the quadruple helix includes: academia, policy, industry, and society

³² <https://habitat3.org/the-new-urban-agenda>

³³ <https://urban.jrc.ec.europa.eu/urbanstrategies/>

The key challenges faced by societies are new, complex and multifaceted affecting different areas of traditional structures and including transformations in organisations, processes and outcomes. To deliver **long-term integrated strategies**, it is essential to adopt clear visions and missions that need to be communicated in a straightforward way to the public entities and to the citizens. The administrative structure, with the creation of new roles corresponding to new forms of governance, needs to face change to improve processes fighting bureaucracy and redesigning them to obtain the simplification of administrative functions.

To better understand how this challenge is being addressed by European cities, DIGISER created the index “Proneness to change” obtaining a clear vision of the state of the art as shown in Map 1. The analysis confirms that European cities have faced **challenges related to ineffective government structures** that undermine opportunities for collaboration, experimentation or sharing data, just to name a few. The main motivations driving changes in government structures are to address existing silos, to consolidate scattered internal efforts to increase cross-department collaboration on digital topics, to set common objectives and align the implementation phases as part of a city’s long-term vision, and to better connect with the innovation ecosystem of the city.



Map 1 - Cities' proneness to change to engage and support digital innovation

The **Proneness to change** Index explores the capacity of cities to engage and support digital innovation. This index represents an attempt to measure the capacity of cities' governments to define and pursue long-term "missions" related to specific and urgent societal challenges, and the autonomy in setting and pursuing a consistent policy agenda, aligning day to day operations to a broader long-term strategy.

This map allows us to observe two trends that are detectable in most of the DIGISER's indexes concerning the organisational transformations of the urban authorities that govern the cities.

The first is the direct correlation between the measured performance and the size of the city: here as in most indices, the larger the population, the better is the performance. The causal link between size and performance is however ambivalent, since on the one hand larger cities can exploit economies of scale, greater availability of economic and intellectual resources, and often a privileged position within national institutional systems. On the other hand, larger cities themselves face more complex organisational challenges, stimulating at the same time the innovative capacity of their organisational structures.

The second is a spatial trend that sees cities with good or excellent performances in the Baltic countries, in the Netherlands, followed closely behind by cities in the Iberian Peninsula, while a block of cities with low performances are located in the Mediterranean area and in Eastern Europe. In between, are the cities of the largest countries such as France, Germany, Italy, and Poland that are often closer to the statistical average performances. It is important to remember that these trends cannot be generalised directly at the scale of each country, as the sample available in smaller countries is too limited. At the same time, spatial trends can also reflect the biases of national institutional systems on the performance of cities.

From the Case Studies we can observe that **the lack of centralisation or coordination of digitalisation efforts** in a single department, unit or team may negatively impact the success and sustainability of projects. In addition, the absence of a vision for digital innovation may lead to a perception that digitalisation is an "IT issue" solely linked to IT systems or infrastructure, while in fact it should be seen as an enabler for new innovations and services in the city. Gaps in digital maturity across departments may lead to difficulties in coordinating and undertaking new services to citizens.

In **Thessaloniki**, the fact that the responsibility for the digital transformation of the city did not fall under one single city department or unit meant that some initiatives led to disconnected projects which hampered a coordinated effort for large-scale projects or structural reforms. As the City's digital strategy³⁴ covers actions involving several departments, spontaneous and not fully coordinated projects started moving forward, **without a clear alignment** between them. However, in 2021 the City promoted a re-shape of its internal structure, with the creation of a new entity, directly under Mayor's supervision, dedicated to coordinating all digital actions.

The lack of a central coordinating entity and the distinct levels of technical know-how and maturity within municipal departments also lead to an onerous process of coordination of projects to develop new applications or automated services, as shown in the **Luxembourg City** case study. There are examples of departments such as construction, water, and mobility/transport with a high-level of digital maturity whereas other departments e.g., in the social and cultural domains, may be significantly less developed. Consequently, many administrative procedures between departments are not digitalised which also negatively impacts the possibility to offer digitalised services to citizens. The absence of a smart city strategy setting out objectives and an implementation roadmap for new applications and digital services that is supported by a clear governance structure also slows the digital transition of the City. To overcome this, Luxembourg city has launched the process of developing such a strategy.

Siloed structures impact sharing and re-using the data in cities. The City of **Helsinki** believes some bottlenecks remain for sharing and re-using the data. Accordingly, the development of a Data Strategy³⁵ was justified because of insufficient sharing and data aggregation between the City's divisions, City-owned companies, and group companies. In part, the City of Helsinki believes this is an operating cultural aspect, but it is also due to the "lack of shared guidelines for promoting cooperation within the City". The City's vision is that **"the data generated by Helsinki is the most usable and used city data in the world by 2025"**.

³⁴ [Ψηφιακή Στρατηγική 2017-2030 \(thessaloniki.gr\)](https://www.thessaloniki.gr/psifidiki-stratigniki-2017-2030)

³⁵ [The City of Helsinki Data Strategy - Digitaalinen Helsinki](https://www.helsinki.fi/en/digital-strategy)

2.3.2 Building government capacity

The capabilities, working conditions, resources and motivation of the public servants have a **high impact on the efficiency of public services**. The quality of governance also depends on the **value culture and skills**, as well as the capacity to develop and reinforcing abilities, skills processes, and resources to empower public organisations to deal with change. Part of the issue in public administration resides in the ability to identify problems and acquire the necessary skills and tools and create a methodology to integrate them instead of taking the option of subcontracting. This challenge is related to the multilevel approach and networking processes that can be used to ensure the attraction and retaining of skills.

To be able to address the new roles emerging in the public sector, it is important to invest in capacity building, resources, but also remuneration and operating costs to ensure motivation and opportunities perceived as attractive for the public servants. Besides ensuring the attractiveness of jobs, it is also important to provide the basis for sustainability. For this purpose, the challenge is to create systems and tools for management, monitoring and reporting to develop the key priority of capacity building methodology and activities. Another issue is that the capacity building strategies must be implemented frequently into non-collaborative and siloed structures. To develop horizontal units, competence centres, innovation hubs/living labs, within or across cities, requires tackling the challenge of integrating all the innovation ecosystems and improving the resilience capacity of the public administration. This challenge is mainly related to the need to **improve institutional capacity by training public servants and promoting education in the field of digital technologies**, but also to the need of improving the procurement processes to make sure the right knowledge and skills are in place to address societal needs.

There are many reasons why a public authority may struggle with digital transformation, with lack of finance and limited institutional capacity identified by local authorities as the top two barriers, according to the survey results shown in Figure 3. Such challenges must be addressed for public authorities to embrace digital transformation and deliver value to citizens, employees, businesses, and society at large.

Please indicate the key obstacles that your public authority is experiencing:

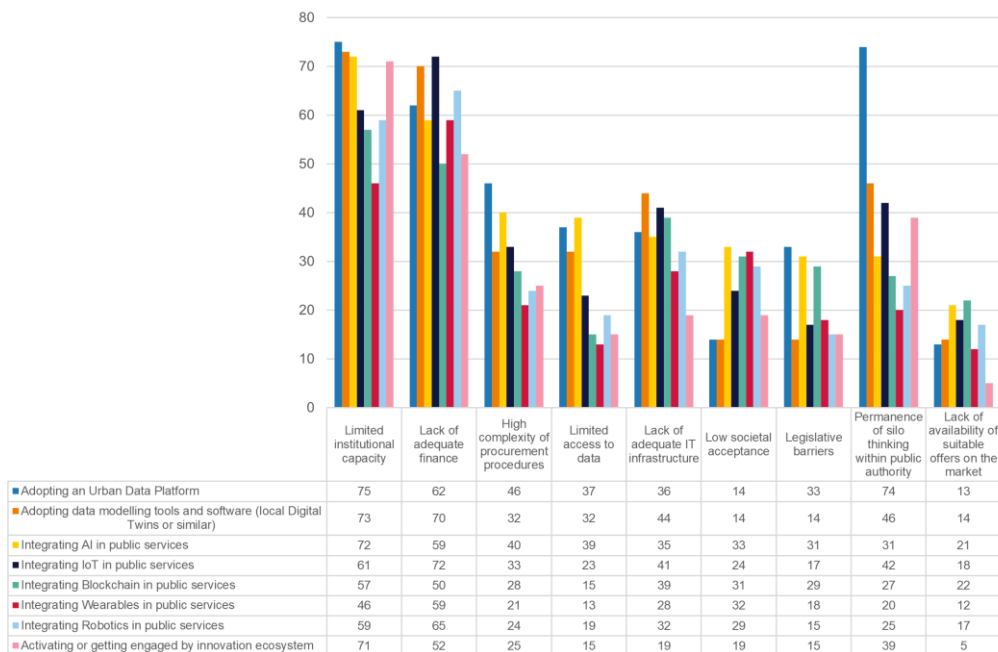


Figure 3 - Obstacles to digital transformation

Cities featured in the case studies recognise the **need for investing in capacity-building** to be able to conduct, develop and implement new digital innovation initiatives, both internally and/or in collaboration with the innovation ecosystem and other cities. Becoming a more agile administration is identified as a challenge

because it requires a new mindset for experimentation within civil servants to address citizens' needs and to manage complex IT projects, especially when different parties are involved.

For example, the City of Poznan **recognized the lack of important competencies to become a Smart city**³⁶. Therefore, the City's strategy³⁷ included training initiatives for civil servants accompanied by a communication package to overcome the internal resistance to change. To this end, since 2018, the Municipality has offered courses on several topics (e.g. foreign languages, cybersecurity, communication with customers), via an internal **e-learning platform**. An example of a mandatory course, cross-cutting all divisions, was the training on the **Agile methodology** to manage complex projects, particularly IT projects, including how to handle and promote a close collaboration between several parties. In addition, in partnership with a university in Poznan, the City launched the program "**Change Leaders**", as the City believes that digital transformation must be accompanied by a change in the mindset of civil servants that still remains somewhat "silo-oriented".

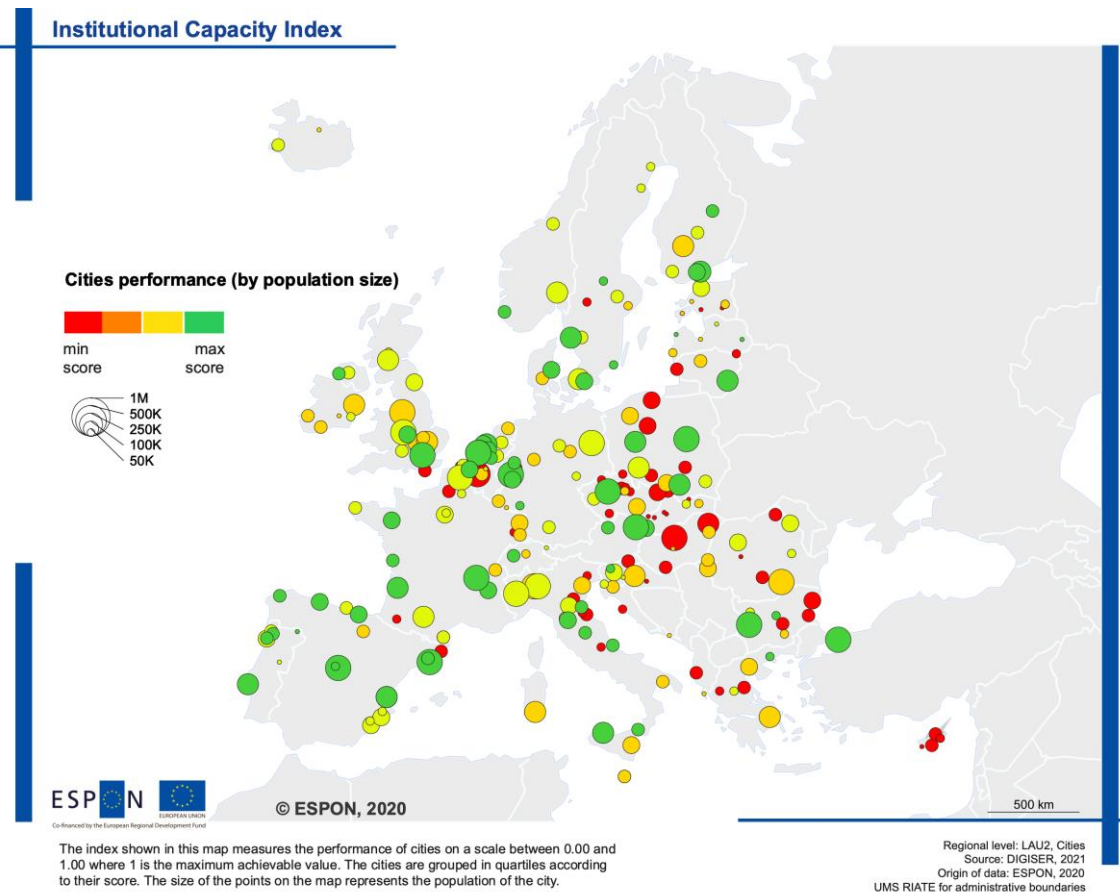
Public entities also often struggle to attract highly competent professional developers for the public sector as limited budgets make it difficult to offer competitive salaries, as asserted by **Ljubljana** City officials. However, this need can be solved by involving private partners in certain activities linked to technology and digitalisation, as long as their reliability and respect for data privacy is ensured. Hence, Ljubljana believes that public-private collaboration can provide good results by merging the specific and technical competencies of the private sector with the strategic priorities of the City.

In particular, **the implementation of a data strategy requires specific data capabilities that are hard to find and attract to local administrations**, as highlighted in the case study on **Helsinki**. Most employees proficient in statistical methods and tools are employed at the Urban Research and Statistics Unit. In the City's 3D team, there are professionals in charge of building simulation and visualisation models. Nevertheless, competences are scarce in the Municipality in terms of data science, data mining and machine learning. Accordingly, there is also a need for data engineers with an understanding of the cloud and data lake environments. Moreover, it would be beneficial for business administration departments to have some data & analytics expertise to realise the benefits of data. As a result, the City will employ data strategists to explore use cases based on data which will be complemented by training for business departments to enable their staff to get more familiar with the opportunities from data and digital technologies.

Public procurement processes can also be challenging and at times may not be fitted to more innovative (and riskier) projects since most of the traditional procurement processes demand upfront a level of certainty on the results to expect that is not compatible with innovative projects. This was highlighted in the Rotterdam case study, using the example of the digital twin under development. The difficulty of this innovative project lays on the uncertainty of the results.

³⁶ <https://www.poznan.pl/mim/main/en/smart-city-poznan.p.58326.58327.html>

³⁷ [Development Strategy for the City of Poznan to 2020+ - Poznan.pl \(www.poznan.pl\)](#)



Map 2 - Cities' Institutional Capacity

The **Institutional capacity Index** focuses on key drivers capable of influencing the management of the digital transformation of public services in cities. It is built on top of three elements:

- the digital skills and the training and educational activities offered to civil servants,
- the ability to develop and consistently pursue innovation strategies through policy tools and investment of adequate resources,
- the willingness to use and integrate advanced and experimental technologies in the management of public services and organisational processes

Even if it is not immediately visible on the Map, it is worth highlighting that the institutional capacity index has a considerable variability with respect to other indexes developed in DIGISER, indicating significant differences between European cities. There are strong direct correlations between the Institutional capacity Index and contextual variables as the population size and the GDP per capita, indicating that the institutional capacity of larger and wealthier cities is, on average, higher.

Observing the map, it seems possible to identify some spatial trends.

- Many cities in the Iberian Peninsula and the Baltic countries (excluding Norway) are in the top quartile, performing on average better than other European regions;
- The most populous countries (excluding Italy) such as France, Germany, England and Poland all rank in the second quartile, performing slightly above the average despite the great diversity of their national institutional systems;
- There is a block of negative results in the eastern and Mediterranean countries, where the institutional capacity of local authorities is more limited.

2.3.3 Changing government processes, service design and delivery

The policy making process involves the innovation ecosystem and it is not a linear process. From needs identification to the implementation of policies and service delivery, it is important to integrate innovative thinking and design strategies to be able to address the challenges faced.

Far too much effort has been focused on using technology to optimise what already exists. This digitization process has taken much more space than the investment in rethinking how to achieve better outcomes and public services. Paper forms, for example, have been repeatedly replaced by online forms since the mid-1990s but this transformation has little if any real impact in processes and therefore, in the improvement of the way governments work. The result of this has been that poor analogue processes and services have simply become poor digital processes and services instead. The transformative potential of innovation technology can be obfuscated by simply implementing digitization processes. This reinforces the need to redesign and improve services around citizens' and frontline workers' needs.

The involvement of the ecosystem as a whole, government, academia, industry, companies and citizens is a challenge that needs to be addressed to make public services sustainable. The tendency to inflict top-down political change without having first mapped the landscape and understood the problems is part of the reason why our (digital) public services still have a long way to go. Existing processes are usually very linear and traditional: (1). Write policy, (2). Guess requirements, (3). Procure IT system, (4). Inflict on users, (5). Operate. Each step of this process is operated by a different group of people and each group has its own hierarchy. There is an urgent challenge to address by reinventing this process, namely by implementing feedback loops in an iterative process.

Governments face a declining citizen satisfaction with the traditional approaches, motivated by polarisation of needs, and eroding public trust in the system. Many governments continue to design and deliver services based on their own requirements and processes instead of on the needs of the people they serve, leading to a higher cost and less efficient model. The challenge is to implement "Human-centric/citizen-centric" services while involving all the relevant stakeholders of the policy making process.

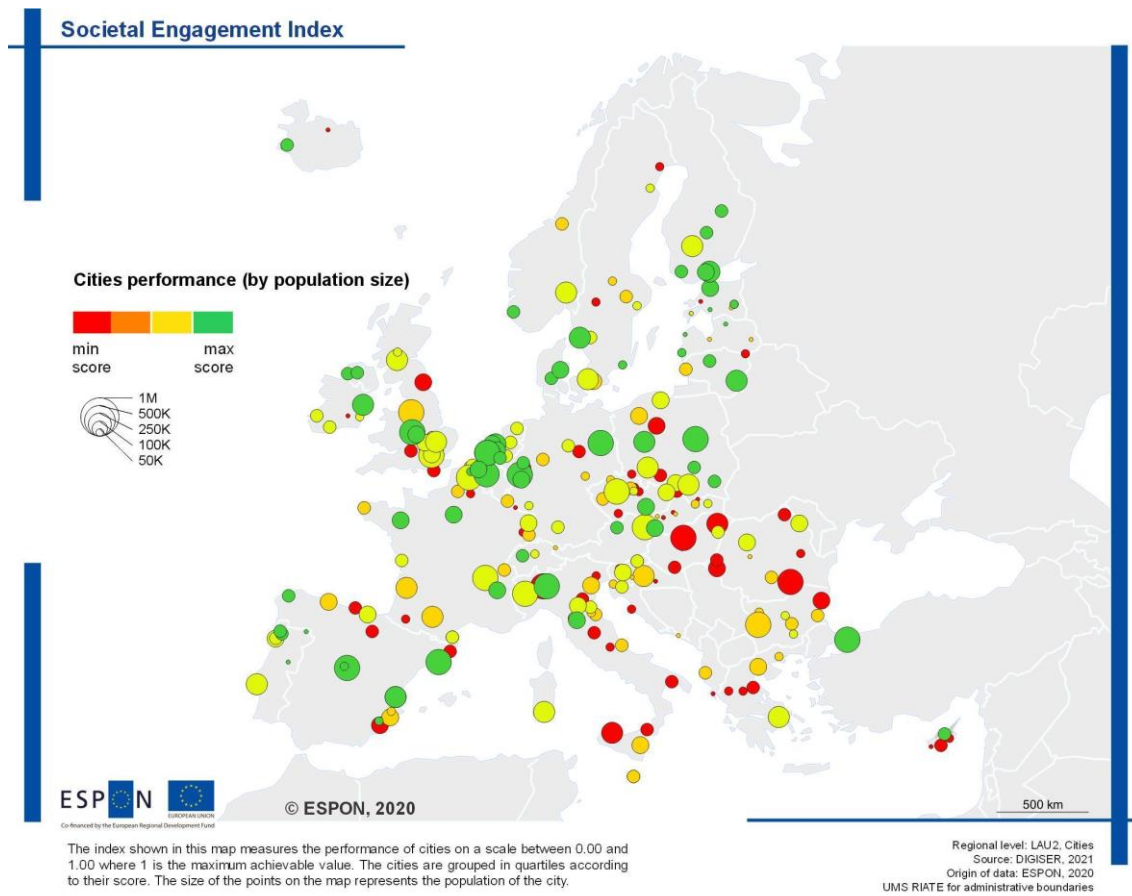
Governments frequently adopt methodologies to improve existing services and products, it is, nevertheless, essential to start developing innovative solutions, to address all the challenges, in a collaborative manner. Approaches and methodologies such as Design Thinking and Service Design focus on improving the problem definition, promoting a greater understanding of the citizens' needs and providing tools for designing solutions.

This challenge is, therefore, related to the need to "Re-think services and processes" as well as to "Improve collaboration and engage the private sector and citizens" with specific challenges related to data management and to innovative technologies usage or societal engagement.

DIGISER case studies point to the **need to create user- and citizen-centric services** more tailored to the needs of the population thus increasing the level of satisfaction and trust in local governments. Embedding citizen engagement at the core of a city's operations or even in the design process of new digitalisation strategies requires adapting city processes to more open, transparent, regular, inclusive communication channels with citizens. More recurrent approaches include not only digital channels - online participatory budgeting, web portal for citizen-driven initiatives and remarks, chatbots, mobile apps to report issues live, etc- but also physical channels- Open Days with the Mayor, specific offices for the elderly or people with disabilities, Challenge-driven competitions, etc. Additionally, user-centric approaches are also becoming more common in the process for the creation of new digital public services, either at the design, testing and/or implementation phase.

Porto's engagement with citizens is present not only through the services created but also in the initiatives promoted. **Desafios Porto** is a challenge-driven competition that starts by directly asking the citizens regarding the problems of the city. As a second step, the project establishes a bridge with the entrepreneurial ecosystem by challenging them to provide solutions for the issues identified. The first phase of Desafios Porto identified more than 300 challenges and involved around 100 local firms. Then, for each category of challenges- *Health and Well-being, Energy, Digital City, Mobility and Environment*-, the best ideas were supported through financing and mentorship, to be ultimately implemented in the city.

The City of **Helsinki** wants to turn the city into a **testbed for innovative solutions** and opportunities for businesses. A good example is the **Jätkäsaari Mobility Lab**³⁸ established in 2019, under the topic of smart mobility. This is a project of the City of Helsinki funded by the City's Innovation Fund, led by the City's Economic development division, and coordinated with Forum Virium Helsinki (primarily involved in the agile piloting course and the citizen engagement process), to test and prototype companies' solutions while addressing citizens' needs and enabling sustainable transportation in the city. A flagship is the project on on-demand electric boats. In 2020, in the **participatory budget**, as part of gathering ideas for how citizens want their environment to be improved, citizens pointed out the need for better connections between islands. At the same time, the mobility lab was aware of a company interested in testing on-demand electric boats which could improve the accessibility of Maritime Helsinki. As a result, the Mobility Lab matched the residents' need with the solution provider in the network.



Map 3 – Cities' capacity to engage the local society in service design and policy making

³⁸ [Jätkäsaari Mobility Lab - Helsinki's testbed for smart mobility](#)

The **Societal engagement Index** measures how the cities' governments promote and encourage the active participation of different actors and stakeholders in public decision-making processes, and their partaking in co-design and co-creation activities to generate public value. It considers the cities' governments commitment to implement innovative bottom-up initiatives that encourage the inclusion of society in developing innovation in a more transparent, interactive, and responsive way. Consequently, it provides an overview of the intensity and level of digitalisation of societal engagement initiatives, and their impact on public service design and innovation.

The overview of this index suggests that the cities surveyed tend to engage local society in only a limited manner with respect to the possibilities offered by e-participation tools and services (which in turn are very accessible and widely diffused in many cities). The engagement of societal actors of the quadruple helix seems to remain episodic and with a low degree of integration with the cycles of policy making and service designs.

Observation of spatial trends outlines a concentration of high-performing cities in French, Belgium, the Netherlands, and the Scandinavian countries, while cities in Central and Eastern Europe appear to be achieving lower performance. The direct correlation with the population size at least partially explains the trends described above.

An in-depth analysis of this index also suggests that larger cities have the capacity to deploy multiple channels for engaging with different actors, while smaller towns, even if capable of exploiting the proximity relations and then involving higher number of inhabitants, can't properly differentiate their engagement strategies.

2.3.4 Scaling governments and markets to take full advantage of the digital revolution

This challenge is related to the pressing need of European territories and organisations to understand **collaboration, multi-level integration, scaling and adoption** of developed and tested solutions and building **standardised and inclusive markets** as key elements to support local service delivery. This challenge is characterised, by the following elements: the need for sharing solutions, the importance of citycollaboration networks, and the importance of global challenges in local policy making.

There are currently 92,247 municipalities within the EU and clearly a one-size-fits-all approach will not work. Although all of them are characterised by health, social care, housing, emergency, and third sector structures, each of them has their own, often duplicated, infrastructure, suppliers, and institutional processes. Yet they frequently work to deliver almost the same services under the same policies and legislation (in national and increasingly also in EU contexts). While there are a variety of models of regional and local governance in Europe, they seem to have little reason to address matters in a different way from each another. Nevertheless, the particularities of the local context and needs make it essential for policies to consider local diversity while engaging with local, regional, national, and European stakeholders and challenges.

Currently, public authorities in the EU spend nearly 14% of gross domestic product (GDP) procuring services and products, playing, therefore, an important role in the supply and demand market. However, local administrations struggle to preserve, let alone boost, local digital economies in a world where the global forces of economy, technology and politics are very powerful. The market for digital services and solutions, which makes it possible to share solutions between cities that are facing similar challenges, while respecting their different cultural, economic, social, and technical structures, is still missing. Cities and governments struggle to ensure that it is as easy for smaller companies to work with cities as it is for larger companies and to create a market where it is easy to scale up - export and import best services and solutions.

Does your public authority benefit from sharing digital solutions, services or products with other public authorities?

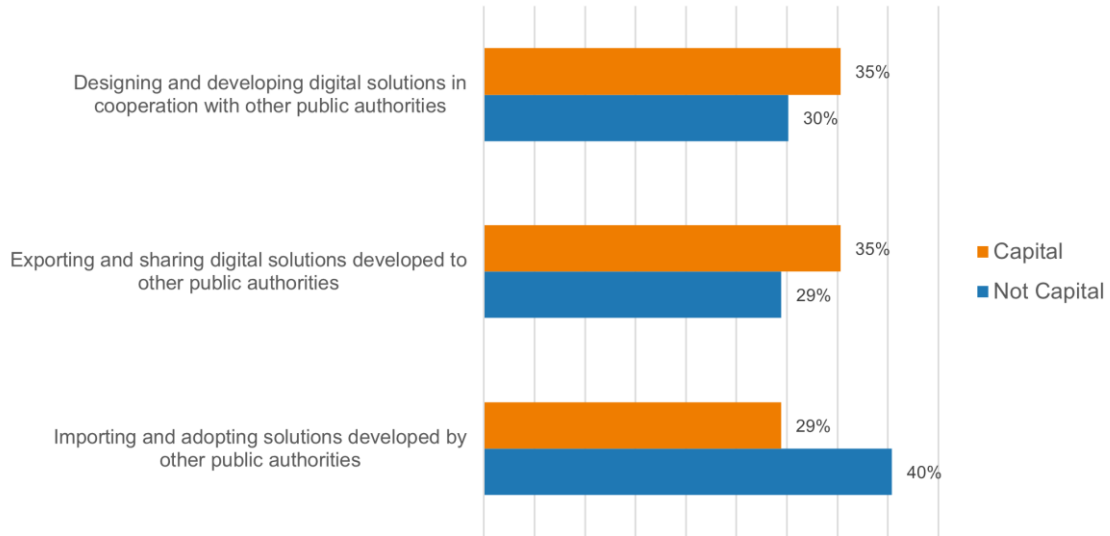
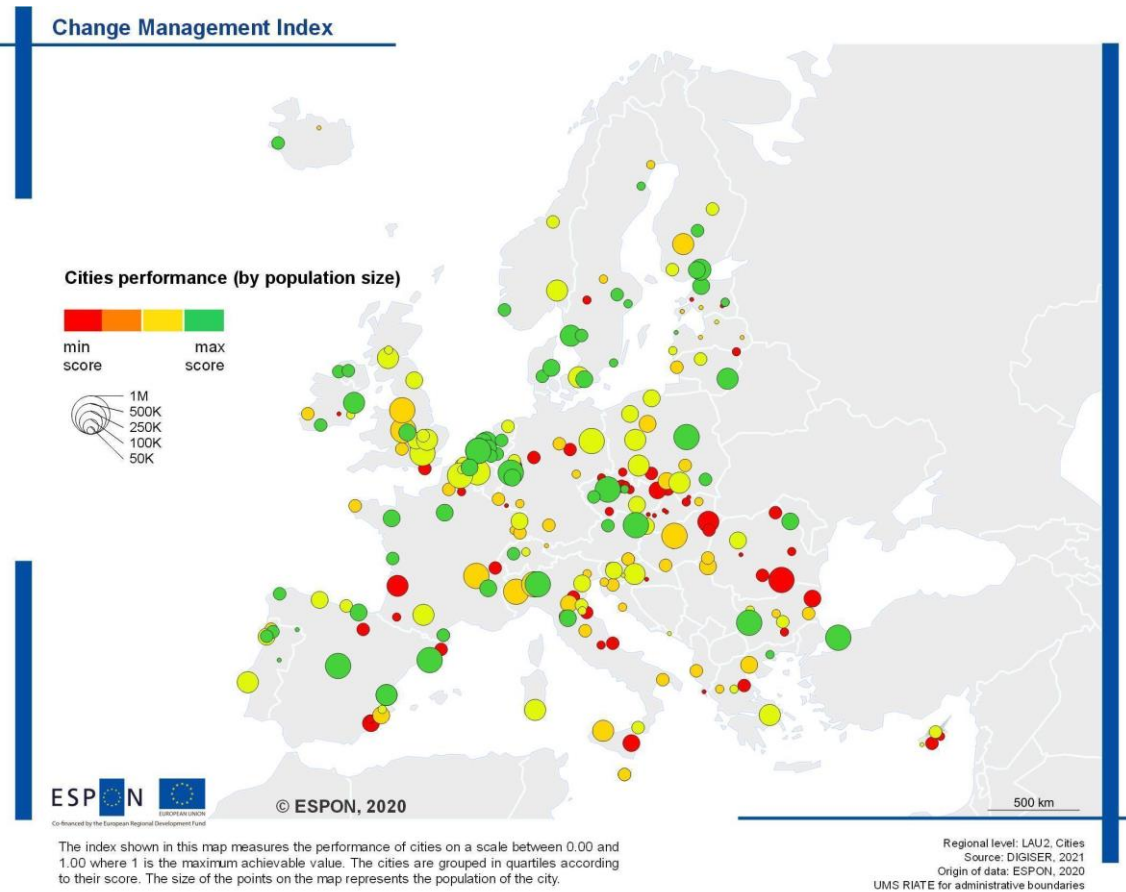


Figure 4 - Sharing digital solutions between cities

The DIGISER case study cities recognise that to address the challenge of scaling solutions and markets it is essential to engage with **European initiatives and networks** (e.g., OASC, Living-in.eu, EUROCITIES) and projects (e.g., funded under Horizon 2020) to share knowledge, develop pilots together, apply common standards for interoperability, revamp digital infrastructure, and so on, considering there are many common challenges between cities. This is particularly important considering the limited internal resources (human resources and budget) to design and implement solutions that are possessed individually as a city. Moreover, in some cities the coordination at the regional, metropolitan, and national level is also important to enable the pooling of resources, to develop projects of common interest and to achieve greater impact, even though it can be challenging to maintain the interest and keep a high level of active engagement from all the cities in the networks.



Map 4 – Cities' ability to manage organisational change

The **Change management Index** refers to the capacity of public administrations to deploy a set of actions, norms, policies, and tools, either to proactively support innovation in digital service development and provision, or to increase their capacity to detect and adopt innovation dynamics developed in different contexts. This indicator investigates the strategies for managing the transition of innovations through three different perspectives. First it analyses the ability to transfer innovation into local society. Second, it investigates the activity of collaboration beyond the local contest, generally framed as collaboration within international networks of public authorities. Third it measures the initiatives that predispose the organisational structure to the transposition of innovations and its cross-silo dissemination.

As Figure 2 illustrates, the inter-institutional cooperation seems to be a key strategy practiced by an increasing number of cities to access opportunities and resources to manage digital transformation, even if there are significant differences between cities and countries. Indeed, an in-depth analysis of this index (see also Fig 16) reveals the key role of national and regional networks as a means to access resources and opportunities for digital transformation, in particular for medium sized cities. Larger metropolis and capital cities tend to rely more on their autonomy and on their privileged role within regional and national networks of public authorities and are relatively more active in international networks of cities and public authorities.

Spatial trends observable on Map 4 show a concentration of high-performing cities in the Scandinavian, Baltic, and Netherlands, while critical areas can be observed in the south-east countries and in the heart of Central Europe. This suggests that the intensity of participation in international networks of knowledge and technology exchange could be higher in smaller countries, while medium sized cities in large countries like France or Germany seems to remain less involved.

3 Policy recommendations to overcome barriers to digital innovation in local public authorities

Various European public authorities, especially wealthy cities and regions with large population centres are, with varying success, already deploying advanced digital systems such as IoT infrastructure and big data analytics as part of their smart city strategies. However, there remain hundreds of small and medium sized cities and towns in Europe for whom these most transformative digital technologies are still out of reach. The following recommendations are aimed at assisting policy makers at the local, regional, national, and international levels to address barriers to achieving digital transformation in European towns, cities, municipalities, and regions.

3.1 Changing the government structure

Changing the government structure is about **orienting government systems and work culture towards enabling digital transformation**. This can be facilitated by strengthening and incentivising co-operation across silos and the setting up of multi-disciplinary teams, e.g., by highlighting the network effects of relevant technologies. Traditional government structures can entrench silos of change-resistant power centres at departmental level. This tends to maintain inefficient practices such as data hoarding and unwillingness to share or pool resources and innovative solutions across service areas. On the other hand, practices that enhance inter-departmental cooperation such as managing data centrally via an open data platform with a common data standard help to overcome the silo mentality. This enables the free exchange of ideas within and across organisations. Therefore, it is vital that government structures relating to policy making, strategy development, organisation, and services are optimised for the **establishment of digital government**.

3.1.1 Recommendations on improving policy making, and sustainable and long-term strategies

Policy making is a key government role that sets the strategic agenda through the formulation of guidelines on aspects such as standards and objectives on service delivery. The policies pursued can influence the pace of digitalisation as well as the breadth and depth of digital transformation that emerges. As such, implemented policies need to have clear and achievable short-term objectives as well as be consistent with a **sustainable and long-term strategy** for the digital innovations adopted to have lasting impact on the organisation and beyond.

One **challenge with the traditional policy making process** is that it has evolved to **serve a traditional government framework** which is not optimised to enable digital transformation. For example, it is not uncommon for government policy to be overly influenced by the election calendar, aiming for quick gains which tend to have short-term impacts. This can be at the expense of **well-thought-out policy initiatives** which may take longer to design and implement but produce better and sustainable impact.

To succeed at sustainable digital transformation, a public authority needs to develop and implement a **long-term digital vision and an adaptable framework of actions**. For example, ensuring that a city's digital infrastructure design is agile and allows for onboarding of new innovations as they emerge in future is, in the long term, better than having a non-interoperable system that needs replacing when a new version comes on the market every few years. Ensuring that policy clarifies this sustainability mission should incentivise stakeholders to align their actions accordingly, e.g., by developing business strategies that are consistent with both short- and long-term objectives.

To mitigate the negative impact of political cycles, elected officials should show strong political leadership by allowing (or consulting) digitalisation experts to decide on what digital innovation projects are best for the organisation's short-term and long-term goals. Instead of prioritising or aiming for only narrow short-term KPI results, policy makers should empower skilled staff to establish systematic mechanisms for rolling out digitalisation projects that are sustainable across time.

Digital innovation is already underpinning change in government structures, according to survey results in Figure 5. These changes are strengthening inter-departmental collaboration and simplifying administrative processes and functions.

Please select the option that best represents the organisational and administrative changes enabled by digital innovation in your public authority

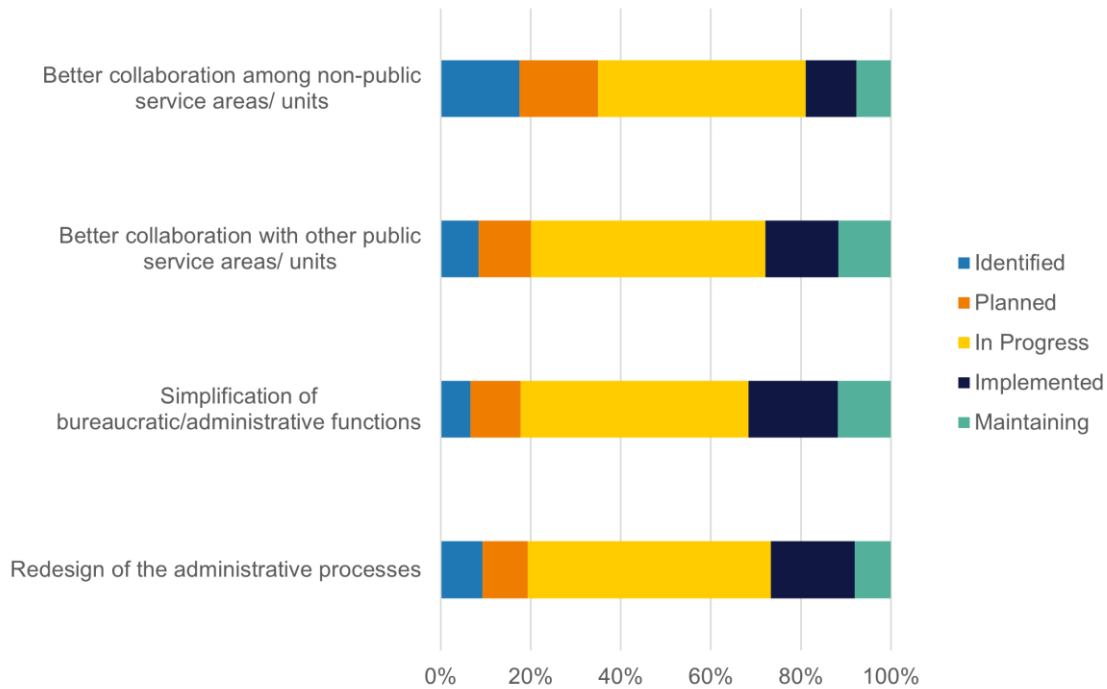


Figure 5 - Organisational changes enabled by digital innovation

As argued above, policies and strategies need to account for the organisation's long-term objectives. For example, data management policies can play a pivotal role in de-siloing service areas by requiring inter-departmental data use and re-use.

According to survey results (details in Figure 9), cities with larger populations are more likely to encourage the use and re-use of data across stakeholder interactions compared to smaller cities, suggesting a size-linked barrier to data exploitation.

The relatively low use of publicly available data by smaller towns and cities, either internally or in interactions with stakeholders, points to a need to adopt targeted data policies that enable these cities to benefit from data. A useful policy to **improve data use capacity in cities can involve forming data management partnerships**, including with peers, to leverage the power of scale and the capacity of larger resource-rich peers, many of whom retain long-term partnerships with specialist ICT companies in the private sector.

For example, Porto's Integrated Management Centre exemplifies a partnership of various city services providers that creates a **single-entry point for shared city services** such as mobility and civil protection. This coordination can provide real-time information on services use and on emergencies in the city, thus helping to establish an integrated and more efficient services system that benefits stakeholders such as citizens, businesses as well as city managers who run city operations.

While the COVID-19 pandemic significantly disrupted governments' programmes and stretched their ability to respond rapidly to large-scale social and economic shocks, several European cities, as shown by the case studies such as Magdeburg and Helsinki, used the crisis as a 'digital-accelerator' to improve their digital services. The pandemic led to more public authorities augmenting their ICT capacity by acquiring software licences for online communication platforms and purchasing ICT equipment such as laptops to enable staff to work remotely - see Figure 6 for details.

The pandemic also highlighted the importance of building a **resilient public sector** to cope with, and recover from, unexpected shocks. This will require developing agile digital systems that adapt to changing requirements. The pandemic has also pushed more of citizen activities and public services to move online. For example, tele-medicine is growing as shown by the growth in doctor consultations for minor ailments being provided remotely via video. These changes are increasing the need for **more ubiquitous and stable internet connectivity**. To meet this requirement, local governments need enabling policies to improve existing digital infrastructure to support the operation of essential digital services and keep people connected. Furthermore, policy also needs to prepare for the future by investing in the next generation of connectivity infrastructure such as 5G that are expected to further improve mobility, connectivity, and productivity, as well as leading to innovations involving new services.

How did the COVID-19 pandemic affect the provision of ICT infrastructure/equipment in your public authority?

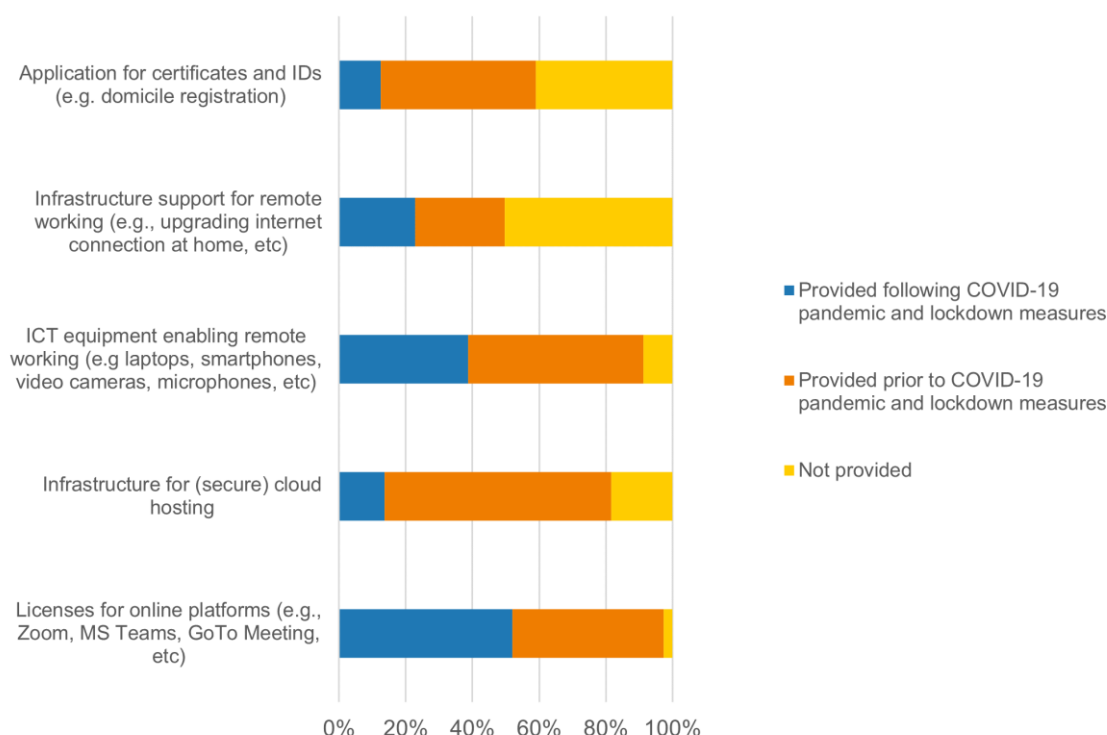


Figure 6 - Impact of COVID-19 on the digital transformation of cities

Summary of recommendations

- **Implement policies that are consistent with a long-term digital vision.** Avoid populist short-term initiatives which impede sustainable impact.
- **Breakdown silos around inward-looking and inefficient power centres** by incentivising co-operation across teams and departments. This can be achieved through strengthening communication channels and networks through which ideas and resources are shared across the organisation's teams and service areas, as well as with external stakeholders.
- **Agility should be designed into digital infrastructure** as part of the strategy employed to facilitate incremental improvements to the system and to allow efficient adoption of new innovations across time.
- **Align policy towards enabling digital transformation.** Review existing policies for their impact on digital transformation. Where they pose barriers to digitalisation, mitigating steps should be adopted to address them.
- The **policy making mechanism should be evidence-based and responsive to stakeholder feedback** in a way that allows for emerging innovative solutions to be adopted in a timely manner.
- **Local policies should be aligned with regional, national, and supranational policy priorities on digital transformation**, e.g., national government digital strategy and the Digital Europe

Programme, to avoid policy contradictions. Local policy strategy should also capitalise on relevant funding opportunities and support from alternative government budgets.

3.1.2 Recommendations on improving the level of service embedment and organisational change

The level of service embedment refers to the scale of adoption of digital innovation by the public authority and its partners, as well as the extent to which it is driving change in the organisation and in the broader city. This reflects the depth and breadth of digitalisation and can be seen in the strength of activity such as on data use and re-use by stakeholders, citizen participation in data initiatives, and facilitating the networks for the importing and exporting (or exchange) of solutions and ideas across public authorities.

Currently, cities vary in their levels of digitalisation maturity. Even within individual cities, there are still areas within these public authorities that are not sufficiently adopting digital innovation. The reasons for this are many, with the main ones being: an **absence of visionary leadership to guide the public authority** and a lack of adequate capacity to overhaul the legacy structures. The result is entrenching inefficient traditional ways of working.

Survey results show that service embedment levels are stronger in larger cities with at least 250K in population. Additionally, while service embedment impact is stronger on the local area and within the organisation, this impact is relatively weaker on the **exchange of innovative solutions across organisations**. This weakness in the sharing of solutions across organisations can be addressed by public authorities actively participating in relevant **networks of cities** tackling common challenges. In fact, survey data also show that **belonging to networks of cities has one of the strongest positive effects on a public authority's digital transformation**.

Benefiting from European, national, and local networks to adopt common standards and develop new solutions (Porto, Portugal)

Porto illustrates the added value from European, national, and local networks. The Portuguese City has a large involvement in national, regional, and local networks such as the Portuguese ICT Cluster (TICE.PT)³⁹, the Metropolitan Area of Porto (AMPorto)⁴⁰, as well as the internationally focussed Open & Agile Smart Cities.

The city has integrated projects to develop new pilots according to **common standards** defined at the international level. The implementation of pilot projects under SynchroniCity⁴¹ within the EU-funded Horizon 2020 programme, such as the Community Policy Suite and the Multimodal Transportation, improved the city's sensor network. This supported the development of **Porto's Urban data platform** based on open APIs, open data models, and open standards. The reference architecture is based on the Minimal Interoperability Mechanisms (MIMs), adopted by the OASC network to ensure interoperability between systems. In addition, the service "**Explore Porto**"⁴² also benefited from its participation in SynchroniCity through the Porto Multimodal Assistant pilot.

Interaction with other cities within this initiative enabled the selection of Helsinki as a partner in project development due to the advanced stage of development of Helsinki in mobility solutions and the fact that it uses open-source applications, e.g., Digitransit⁴³ and Open Street, that are scalable to other cities.

According to survey data (see Figure 7), where users have the choice between **online or offline versions of a public service**, the digital version is chosen by a majority of users except for Healthcare, Order & Safety, and Social & Welfare Services.

³⁹ [Introduction | tice](#)

⁴⁰ [AMPorto](#)

⁴¹ [Cities & Pilots | SynchroniCity \(synchronicity-iot.eu\)](#)

⁴² [Explore Porto - You're at the point of exploring the city](#)

⁴³ [Digitransit](#)

There are several reasons as to why the digital access option is not as popular for these three service areas, not least the sensitivity and personal nature of the data involved. Secondly, services such as Healthcare and Order & Safety are generally the responsibility of hospitals and the police, not the public authority at local government headquarters.

Low digital services use may also reflect the dominant profile of the services' main users who may be vulnerable or low-skilled and thus, less adept at using digital systems. To the extent that digital services add value for public authority operations and its stakeholders, digital services providers are urged to design digital platforms (and services in general) that cater to all **user ability profiles and needs**.

Services with the most popular online versions (Figure 7) also tend to use service-related data to improve their digital service offering (Figure 8). This suggests that **data on service usage by stakeholders should be analysed, with the resulting insights used to improve the design of digital services** to increase their attractiveness to potential users - citizens, businesses, governments as well as public authority front-end and back-end employees providing the services. Such intervention will improve the breadth and depth of digital services embedment across the public authority's ecosystem.

When a public service is provided online as well as offline, how many users are choosing the digital option?

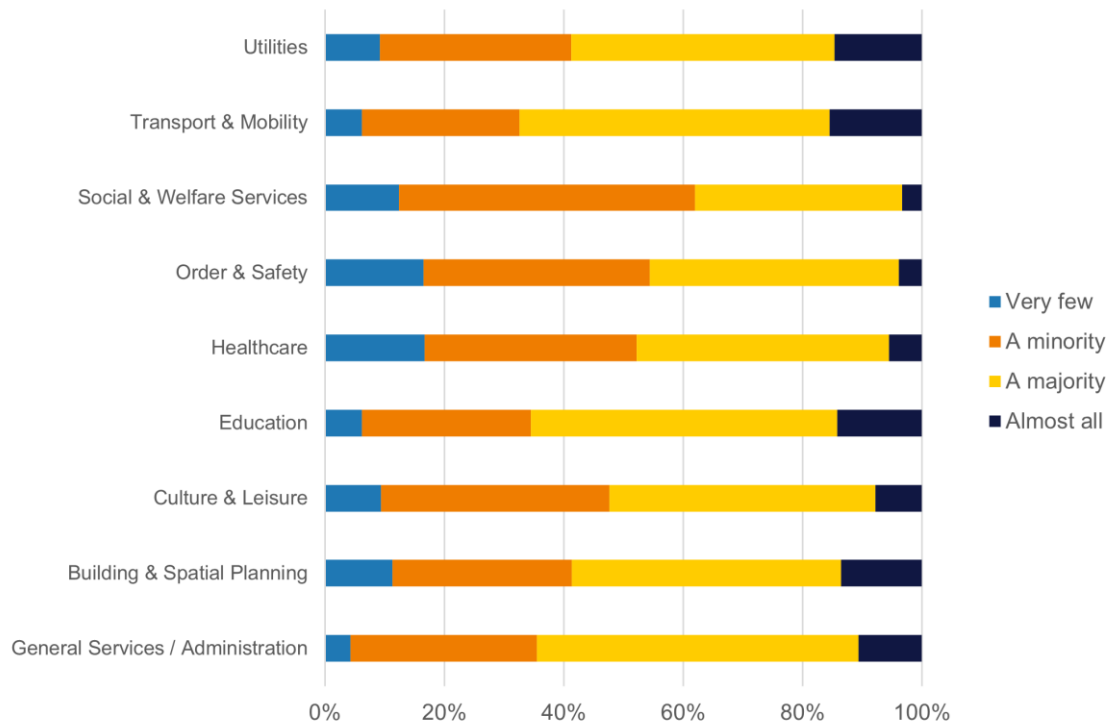


Figure 7 - Usage of online and offline public services

Does your public authority use service-related data to improve your digital service offer in the following areas?

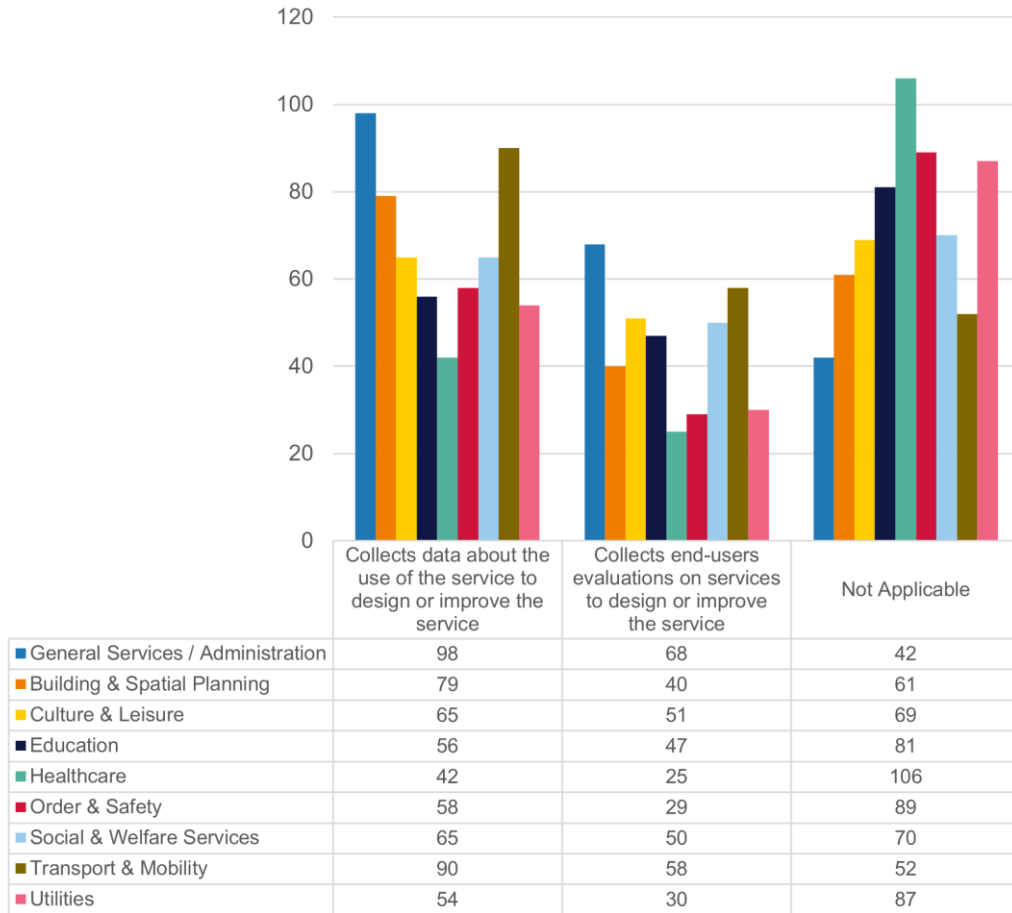


Figure 8 - Data driven innovation in public services

To improve digitalisation outcomes at the organisational level, there is a need to move away from an isolationist “silo approach” where digital innovations are conceived and deployed to address the needs of independent departments. What is needed is an integrated smart city strategy that steers digitalisation, holistically coordinating to address the needs of the whole organisation and its key stakeholders. This will contribute towards reducing the variation in digital maturity between departments.

Public authorities should change from a hierarchical organisational structure with silos, to horizontal and more open structures where information flows more efficiently within and across departments as part of the strategy to enable digital transformation.

Firstly, a collective vision should be formulated to **align the objectives and plans of different departments**, to avoid unnecessary duplication of roles and technologies and the related competition for scarce resources. To break down existing silos and promote cross-departmental cooperation, public authorities need to streamline their internal processes and promote system interoperability across departments, and if possible, cities. By doing this, operational efficiency and resource allocation improve, as does service provision.

Additionally, it is important to foster a **culture of adopting digital innovations** in the public sector. Public sector bodies should develop a long-term vision to promote data-driven governance and encourage technology innovation. Concrete targets should be set and reflected in departmental objectives, and a mechanism established to measure and communicate progress. As argued in (European Commission, 2020), it is possible in this way to gradually achieve deeper cultural change from the traditional top-down bureaucratic mindset towards embracing a more results-oriented approach to benefit from digital innovation.

According to insights from the case studies, a city looking to improve its level of service embedment should set up a **digital office focussed on coordinating digitalisation** across all departments and in the organisation's relationships with external stakeholders. Most case study cities, such as Helsinki and Rotterdam, have appointed a Chief Digital Officer to lead their efforts to improve digital innovation adoption. Clearly, leadership is a key part of bringing about the organisational change needed for digital innovation to be embedded in public service.

Summary of recommendations

- Public authorities should **actively participate in networks of cities and stakeholders** to address common challenges to nurturing and speeding up the sharing of innovative solutions and ideas across organisations.
- The **design of digital services and their access points should take account of the variation in users' technical abilities** because a considerable section of stakeholders (citizens, service providers, businesses etc) may still lack the skills needed to use digital services. If necessary, alternative access channels or training should be provided to those lacking these skills. This could increase the use of digital versions of the currently least popular services such as social and welfare services.
- Policy should proactively dismantle and disincentive the formation of **silos around departmental power centres**. Instead, more open structures with stronger inter-departmental communication channels should be promoted e.g., with the creation of open platforms and systems to facilitate the sharing of resources.
- **A culture of being open to adopting digital innovation should be cultivated proactively** with the recruitment of digital skilled staff to develop digital services and influence the organisation towards a sustainable digital transformation. Data on service usage should be analysed with resulting insights informing the design of digital systems that are attractive to citizens, public authority employees and other stakeholders. Cities must have the ambition to implement a transformative digitalisation programme as opposed to being content with digitisation that simply creates digital versions of existing services.

3.2 Building government capacity

This challenge reflects two aspects of capacity. The first is about building an interdisciplinary team by acquiring skilled staff to deliver digital transformation: developing a digital strategy and driving its implementation by the organisation. Second, it is also about the public authority's capacity regarding the procurement of digital technologies.

3.2.1 Recommendations on building institutional capacity

Institutional capacity is strongly related to drivers of transformation, influencing the adoption and management of digital technologies. Challenges around institutional capacity can manifest as not having skilled staff in the different digital areas, lacking a digital strategy policy, and unwillingness to experiment with advanced digitalisation solutions such as providing IoT services, robotics, AI, automation, predictive analytics, and blockchain.

Surveyed public authorities performed variously on these metrics. Inadequate institutional capacity inevitably results in a breakdown of the process through which an organisation identifies and adopts innovative technology solutions as they emerge, often due to a lack of financial resources or access to the skilled labour.

Survey results show that institutional capacity varies considerably across Europe, ranking highest in the Iberian Peninsula and the Baltics but weak in the Mediterranean and Eastern Europe. In addition, this capacity is also better in larger cities with a population size of at least 500k. Over 65% of the larger cities with at least 500k residents have formally approved and published their digital innovation strategies compared to about 50% for smaller cities with 50k - 100k residents.

Broadly, while public authorities rank strongly on having an innovation strategy, there is a low tendency to **experiment with advanced technology** - only about 30% of public authorities having experimented with AI and IoT systems, even less so when it comes to blockchain and wearables. This suggests that a culture of '*business as usual*' remains strong in local governments, therefore, simply throwing money at the problem will not produce the desired digital transformation. Rather, **stakeholders in the public service ecosystem need to be convinced of the benefits of digital innovation**. One way to improve stakeholder acceptance technology is for the mission leadership team to be more proactive in demonstrating, via workshops and

advertisements, the benefits of digital innovation - productivity gains, and the convenience of 24/7 access to digital services. Users should also be incentivised to use digital services, for example, via discounted pricing for online services compared to paper-based service.

Key senior staff such as the Chief Digital Officer are needed to lead interdisciplinary teams in co-ordinating the co-creation of user-centric digital products by both in-house and external innovators, as well as to drive the adoption of digital innovations in the public authority. Other government staff, e.g., in the back office and customer-facing roles, must also be well-trained to perform their digital government functions. In addition to traditional roles such as managing the organisation's IT support systems, staff increasingly must work in interdisciplinary teams with advanced and sophisticated computing systems at various levels.

It is important to have in-house digital specialists in advanced technologies such as big data, predictive analytics and AI given their importance to transformative applications, notably, digital twin and smart city innovations. In addition, in-house specialists also allow governments to manage the cost of keeping pace with technological progress without having to always rely on external consultants.

Over 90% of survey cities provide optional or mandatory **ICT training to employees**, such as on Microsoft Office applications. This is commendable coverage, especially since it is observed across cities of different sizes. However, the survey also shows that about 40% of public authorities do not provide employees with advanced ICT training, a skills capacity weakness that needs addressing.

Upskilling of staff, along with transforming organisations' culture towards willingness to experiment, can accelerate capacity building for widespread adoption of innovative digital systems. The city's digital strategists should identify the organisation's capacity shortages and build a team of interdisciplinary technical specialists (e.g., software engineers, network engineers, data scientists, and user interface designers to manage co-creation relationships etc) to support the delivery. Where a shortage of financial resources limits what a public authority can do on its own, joint procurement opportunities discussed above should be considered to reduce cost burden to the organisation. Several rural governments could pool resources to form a single technical IT team, especially where each government needs this team's services on a part-time basis. This can be facilitated via use of common standards across these public authorities.

To assess the state of internal governance, cities should implement periodic **quality control mechanisms across their departments**. Periodic monitoring of processes and the evolution of relevant indicators will identify where capacity is lacking. Cities can rely on established benchmarks such as complying with the international certification ISO 9001:2015 on quality management as is the case in Milan.

Defining an "internal dimension" in the digital transformation plan will ensure the integration and coordination of the **digital portfolio across all departments**, and an "external dimension" to harmonise and simplify services and interaction points with external stakeholders - citizens, businesses etc.

Local governments should enhance their capability and experience in digital transformation also through co-operating with and **learning from peer cities** and private sector partners through both national and international sharing networks. When a digital solution is developed by external suppliers, flexibility and interoperability should be considered and requested to avoid the risk of being 'locked-in' to a specific technology or a single supplier for the long term. To avoid the risk, it is important to have in-house digital experts who understand the technical side of the solution and can set the correct requirements in procurement and implementation. They should make sure the digital systems installed should be interoperable with other applications and be adaptable to future changes.

National and local governments should also allocate funding to support local schools, colleges or education centres to provide relevant digital courses and training to address the digital skill gap within the current workforce and improve **digital literacy**. They should also promote a cultural change within public sectors from being conservative about innovation to encouraging experimentation and embracing digital innovation.

Aligning priorities and pooling resources together to develop and scale-up solutions that address common challenges - Helsinki (Finland)

The experience of the City of Helsinki provides a good example of how **pooling resources together** with other cities (rather than competing against each other for funding) maximises impact and the scaling-up of solutions. This requires a well-structured governance for taking decisions and a good design of the different phases: from setting the foundations, to developing pilots and moving to project implementation and impact assessment. The **6AIKA (Six City Strategy)**⁴⁴ has been the first joint urban development strategy in Europe involving multiple cities⁴⁵.

More concretely, **6AIKA has been delivering public value for the six largest Finnish cities-** Helsinki, Vantaa, Tampere, Oulu, Turku, and Espoo-, following a decision back in 2014 to join forces and to pool resources together to gain more impact. First, it was important to **build the “foundations”**, i.e., the right capacity and knowledge base through spearhead projects - open data and interfaces, open innovation platforms, and open participation. These constituted the basis for the first big projects that were launched. The next phase was to conduct pilot projects across different thematic areas (e.g., smart mobility, learning, health, well-being, circular economy, and energy efficiency). It is currently in the phase of scaling the results because the 6AIKA project is about to end. Therefore, current efforts are in place to make sure each city that has participated can use the data and the knowledge that has been gathered over the years.

The Six City Strategy 2014–2020 and its projects have been funded by the European Regional Development Fund (ERDF), European Social Fund (ESF), the Finnish Government, the participating cities and project partners. The project established a **rule that at least 2 cities had to be involved in each project to incentivise collaboration and ensure scalability** of solutions.

Regarding the **governance**, in the beginning it took some time to build trust, not to compete, but afterwards the shared strategy/shared leadership approach solved the issue. The Ministry of Economic Affairs and Employment was at the top-level providing political buy-in. For economic development, the highest decision-making power is in the Management Group which consists of the top-level city representatives from the Economic departments of each city, working in close collaboration with the Steering group and the 6Aika Strategy Office. The latter handled the basic operations such as the opening of calls, what kind of themes should be in each call phase, etc. There were also 6AIKA coordinators in each city that acted like “the voice of the city” for co-ordinating the activities in each city and putting ideas forward to the group. Each city had its own steering group to make sure the decisions were aligned with city-specific strategies.

Another important priority for 6AIKA was to **build collaboration with companies** to develop solutions. Through such projects, companies have been able to “test the attractiveness and functionality of new or updated products, services and operating models in urban environments and gather feedback from users”. Moreover, people working on projects have been **learning from each other**. For example, if a company/start-up wants to work with different cities, the idea would be to have similar processes and transform the idea of “difficult administrations” thus smoothening the process of interaction with local administrations.

A workshop will also be organised to ensure the continuity of joint and needs-based development work in the six cities after the end of the program. The project will to some extent continue but under the configuration of **Innovation ecosystems**⁴⁶ across different thematic areas. Helsinki is joining forces with Espoo and Vantaa, including several universities and colleges and focusing on four different areas. The Innovation Ecosystem Agreement for Helsinki, Espoo and Vantaa will cover content related to Smart and sustainable urban solutions, Wellbeing and health technology, new learning environments and digital solutions of skills development, and Emerging trends and general ecosystem development.

⁴⁴ [Smart Cities Work Together - 6Aika](#)

⁴⁵ [6Aika results: Era of Cities - 6Aika](#)

⁴⁶ [Ecosystem Agreements - Ministry of Economic Affairs and Employment](#)

Summary of recommendations

- Having skilled employees is a key part of building institutional capacity. Therefore, a public authority needs to **build an interdisciplinary ICT team of well-trained staff** led by a Chief Digital Officer who, with the support of the organisation's political leadership, coordinates the digitalisation process. Access to skilled staff is key to developing and deploying the right digital strategy and helps the organisation identify useful innovations.
- Where financial constraints limit the organisation's capacity to access skilled workers as is often the case in small rural towns, **ICT functions should be coordinated at usually better resourced regional or higher government level**. Alternatively, similarly resource constrained local governments can pool their resources to **form a shared interdisciplinary ICT team**.

3.2.2 Recommendations on improving procurement

This concerns the public authorities' procurement capacity to facilitate the digitalisation process. A major obstacle that cities are facing is the lack of adequate funding (see Figure 3) which, along with the complexity of procurement procedures, inevitably affects their procurement of innovations.

One way for cities to address the funding challenge is to increase intergovernmental cooperation on digitalisation. The easy scalability of digital services means that closer horizontal and vertical cooperation between and across governments at the local, regional, national levels can unlock synergies and reduce the cost of innovation. For example, joint procurement of services could see several governments share a single digital team, thus enabling cities with limited budgets to access advanced digital innovations. Indeed, survey results show that about 30% of cities have used alternatives to standard procurement procedures, including within EU and domestic funding schemes.

Within cities, different government departments should work closely together to develop an integrated cross-departmental procurement strategy to reduce competing requests for resources, e.g., by combining duplicate functions. Government procurement policy should also support digital innovation by simplifying and standardising public procurement processes. To this end, the EU's ProcurCompEU framework provides guidance on public procurement covering 30 key competencies.⁴⁷ Governments should make use of such tools to build competent procurement teams.

The city of Rotterdam demonstrates the benefits to procurement of joining networks such as Procura+ network and the TRANS-FORM (Towards sustainable zero carbon transport through innovation procurement) project, a network of procurers on public procurement of innovative solutions. In addition to cooperating with peers, cities should also engage with the innovation ecosystem by co-developing experimental innovations, pilot projects, and project implementation as part of the drive to modernise procurement processes. A dedicated budget for digital innovation should also be allocated to finance the development of digital solutions.

⁴⁷ [ProcurCompEU– the European competency framework for public procurement professionals | European Commission \(europa.eu\)](https://ec.europa.eu/eip/eip-procurcomp-eu/)

Towards innovation procurement practices (Rotterdam, The Netherlands)

At the local level, **public procurement in Rotterdam** is organised around two specialised teams that help in identifying the most adequate procurement process to adopt in each situation. The City recognises that traditional procurement is often not optimised for more innovative projects given that traditional procurement typically demands upfront certainty on the results to expect, a requirement that is not compatible with many projects involving innovation. This can be illustrated with the example of the Digital Twin of the city, as the difficulty of agreeing this innovative project was because of the uncertainty of the results. According to the City, one of the first steps was to determine the maximum level of uncertainty acceptable, considering the unpredictability of the results and the interests of all the stakeholders involved.

To find alternative practices and **exchange knowledge** with peers, the City of Rotterdam joined several networks and participated in different European projects. For example, in 2013, the City of Rotterdam joined the **Procura+ Network**⁴⁸, a network founded in 2005 by ICLEI – Local Governments for Sustainability and which is composed of several European public authorities and regions, to “connect, exchange and act on sustainable and innovative procurement”. The City has become a reference on innovative procurement practices in the country, with its efforts being recognized as the **winner Procura+ Award of Innovation Procurement of the year 2018**⁴⁹.

Besides exchanges at the European level, innovation procurement is also a topic for discussion in the context of **Dutch city networks**, where the **concept of City Deals**⁵⁰ has also been promoted to procure joint solutions. The City Deals approach is also supported by the national government, which may also be involved in the agreement as well as companies, and other social organisations. There are already some examples of City Deals in which Rotterdam was involved, mostly on urban transformation, circular economy and climate adaptation. According to the City, as part of the city network **G40**⁵¹ (the network of 40 (medium) large cities in The Netherlands, which share the same urban issues), it is currently being studied how they could procure an Urban Platform and Digital Twin through joint procurement.

3.3 Changing government processes, service design and delivery

Here we focus on a group of challenges relating to data management, innovative technologies, digitalisation, advanced methods and principles, and the engagement between public authorities and society.

3.3.1 Recommendations on improving data management

Data is one of the most valuable resources in today's societies, given its role in modern innovation ecosystems. As such, having an effective data management strategy is becoming more and more an imperative towards better public services. Data is a powerful asset to guide governments in designing and tailoring their processes of public service delivery more effectively. The fast stream of new technologies continuously offers novel opportunities towards digital government, as well as towards transparency and openness. The production and access to data, and data-supported services play a key role in digital transformation and maturity processes. They are facilitated, for example, by the presence of data platforms, the adoption of strategies for data use and reuse, and the presence of open data principles common to several governmental institutions. Accordingly, data management is explored through five dimensions: data platform, data use and re-use, data strategy, open data, and big data. For these areas, the survey data shows:

⁴⁸ [Procura+ | ABOUT PROCURA+ \(procuraplus.org\)](https://www.procuraplus.org/)

⁴⁹ [Procura+ | AWARDS 2018 \(procuraplus.org\)](https://www.procuraplus.org/)

⁵⁰ [Slide 1 \(espon.eu\)](https://espon.eu/)

⁵¹ [G40 City Network | Joint advocacy and knowledge sharing for 40 major cities \(g40stedennetwerk.nl\)](https://www.g40stedennetwerk.nl/)

- Increasing use of urban **data platforms** to process data for internal and external use by stakeholders. While most cities have data platforms, platform quality remains low in cities with under a million inhabitants.
- **Data use or re-use** with respect to degree, purpose, and method of exploitation is stronger in western and northern Europe compared to Mediterranean and eastern Europe. Larger cities create more opportunities to use data, e.g., through forming partnerships with stakeholders as shown in Figure 9.
- **Data strategy** focusses on public authority activity regarding data management strategies, e.g., relating to data sharing, data standards, business models impacting data platforms, interoperability frameworks, and the FAIR principles. With only 21% of respondents having an **interoperability framework**, and a low percentage of administrations adopting holistic data governance strategies on automated data management and publication, the benefits of data are not being maximised. Indeed, public authorities are hardly beginning to stimulate the economic potential that could come from data exploitation. Figure 9 shows that, especially for cities with under one million in population, there is still a lot of work to develop and implement optimal data management strategies.
- Regarding the degree of application of **open data** principles and practices, public authorities of different sizes are increasingly providing stakeholders with access to their data, including via internet-based APIs, under open licences and easy-to-access formats. In addition, many public authorities, especially the bigger cities, are also using externally sourced open licence data to improve services, e.g., real-time traffic and weather analytics data from google.
- **Big data** offers many opportunities to public authorities that have the capacity to exploit it. Nevertheless, only 35% of surveyed cities are using or producing big data. Such a low score is potentially explained by capacity constraints, including skills, given the higher than basic ICT skills needed to process big data. At the service area level, big data production and use is strongest in Transport & mobility and General administration services but weakest for Healthcare. The benefit of big data to transport is easily observable, e.g., real-time updates on traffic conditions can guide drivers away from congested roads, so it is unsurprising that this service area is embracing big data. However, as already argued, Healthcare data is sensitive and is primarily managed by hospitals, not the city council.

How does the public authority encourage data re-use?

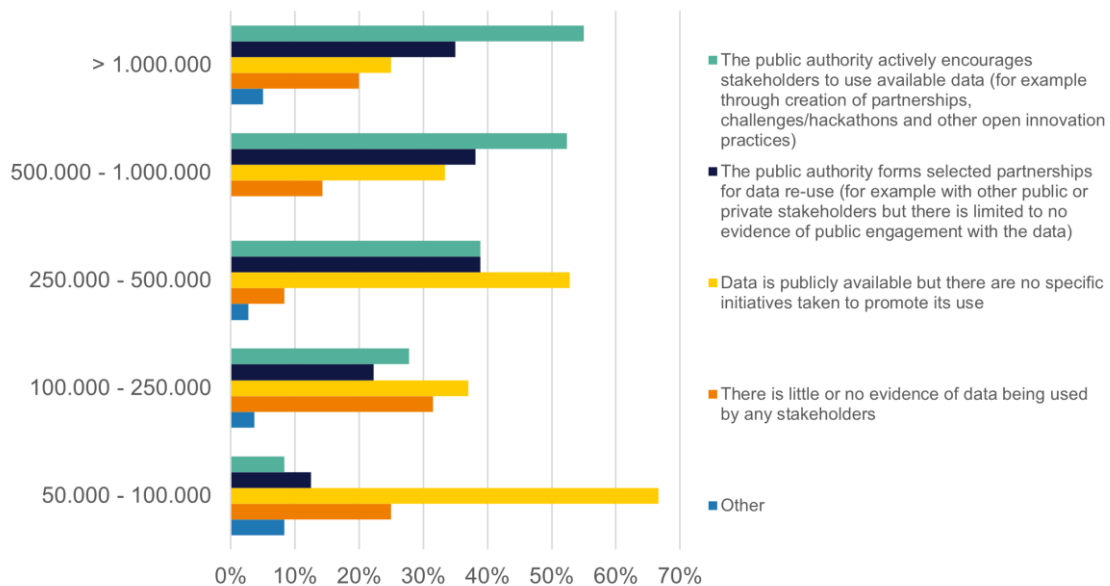


Figure 9 - Data use and re-use

Does your public authority apply strategies to govern, collect, store and share city-related data across the public authority?

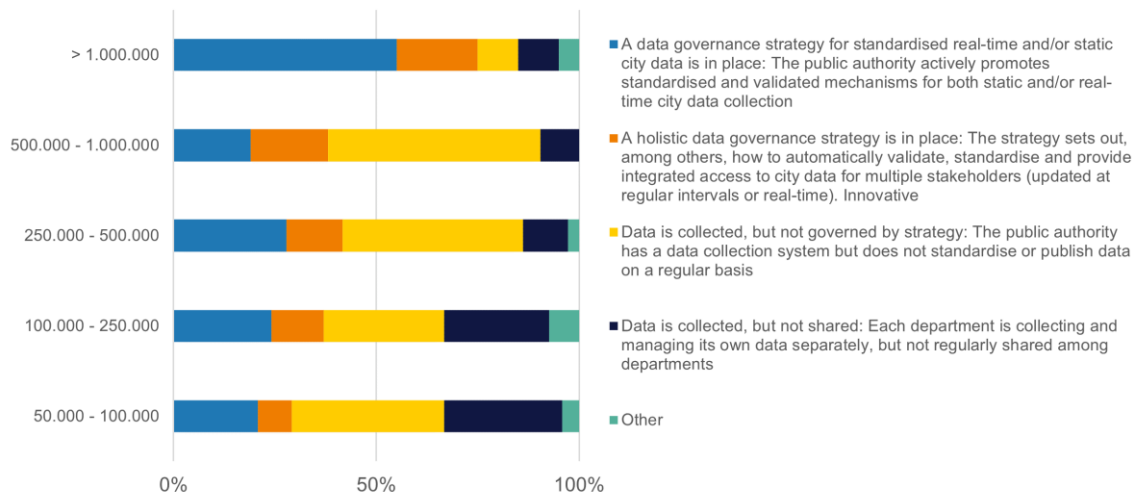


Figure 10 - Data sharing strategies

According to the survey, **larger cities** with at least 250K residents **score considerably better than their smaller peers** on data management. This variation by size pattern is also broadly reflected along public authority type: parishes and wards - *often of lower population and lower GDP-per-capita* - score lower on data management capacity compared to larger jurisdictions such as municipalities, metropolitan areas, counties, and provinces. Additionally, GDP-per-capita data shows that **wealthier public authorities are generally better at data management**, albeit within a narrower range, with a marked drop in score for cities with under 10K EUR in GDP-per-capita.

Data management policies should provide for the adoption of emerging technologies such as APIs, open data systems, and urban data platforms to improve **automated communication and real-time data exchange** between a public authority's systems and outside users. These technologies are also more suited for **handling big data with minimal human intervention**. Cities such as Luxembourg, Rotterdam, and Milan are already benefiting from investing resources into digital technologies, with projects in mobility data management, digital twins and energy data management. Currently, only 35% of public authorities operate or work with **urban data platforms**. This rate rises to 58% for capital cities but drops to 31% for non-capital cities. Clearly, this is one area where effective coordinated facilitation by national governments and the EU can help struggling public authorities to improve. Lack of adequate finance and limited institutional capacity are the top two key obstacles faced by public authorities related to digital transformation, so solving these should be considered critical.

The urban data platform is a key asset in improving **decision-making capabilities** and played a positive role during the evolution of the pandemic in several cities such as Porto by integrating data from multiple sources and topics and presenting it to stakeholders in an easy-to-use format.

According to insights from case studies, cities should adopt open data platforms to **enable the integration of datasets from their departments** within a logic of open government. The datasets can be organised around different topics, covering several city domains and service areas, such as environment, energy, transport and education. This approach can also facilitate data sharing between institutions and beyond, for example, when inter-jurisdictional cooperation is necessary to provide a service across multiple towns.

Governments at all levels should recognise the **potential value of data as a public good** which can be unlocked with a change in focus from software-driven towards data-driven innovation. To encourage civic-led digital innovation, data should be consolidated into easy-to-manage formats and published regularly on open data platforms for the benefit of interested third parties - app developers, research institutes, businesses etc. These data are important in building digital products, e.g., 3D models and digital twins of specific areas of the city. One example is the digital twins project in the Helsinki case study.

Where data is held by non-public sector stakeholders such as utility suppliers, these should be incentivised and encouraged to open-up and work within standardised open-source systems to facilitate broad digital

innovation. Within governments, negotiation is needed to **promote the integration of data across departments** to create a comprehensive source of information for public service delivery. In addition, governments should cooperate with their neighbours to support cross-border data exchange to facilitate the development of cross-border digital services.

To facilitate the sharing and efficient use of open data, an international or national **interoperability framework is needed to promote common data standards**. As a large proportion of data collected in cities is personal data, a legal framework and relevant mechanism is required to ensure personal information is transparently collected, properly used and well protected (European Commission, 2019).

Summary of recommendations

- Policies and strategies should facilitate a **data management system that is flexible and as ‘future-proof’** as possible so that emerging digital innovations can be adopted by the public authority easily.
- The huge amounts of data being generated require public authorities to improve their capacity to handle such data, e.g., via use of big data analytics systems.
- **Collaboration on exploiting data also needs to improve through promotion of open data principles and practices**, promoting minimum interoperability mechanisms and standards on data accessibility.
- The data management strategy should **discourage data silos but promote data sharing and incentivise data-based digital innovation** throughout the ecosystem.

3.3.2 Recommendations on adopting advanced technologies

Increasingly advanced technologies are available on the market which can address challenges that cities face - think of blockchain, wearable devices, 5G, IoT systems such as smart city monitors that inform government workers in real time that a streetlight is broken, or the use of AI to analyse city-wide traffic flows to optimise safety and network efficiency. Some of these **cutting-edge technologies** are starting to be adopted by public authorities but the pace and scale of **adoption remains low**.

As shown in Figure 11, about one-third of public authorities have implemented or plan to adopt IoT or AI technology. However, only 1% have implemented the relatively new blockchain technology which promises to improve efficiency in the management of legal contracts and records processing. Governments are advised to adopt these system-impacting technologies because they can trigger widespread productivity gains and are thus critical to maximising the benefits of the emerging data-driven economy. City business models should leverage public-private partnerships so that public authorities also benefit from technology innovation, for example, co-developing digital products with city resources, e.g., data used in testing could see the city earning a stake from the finished product.

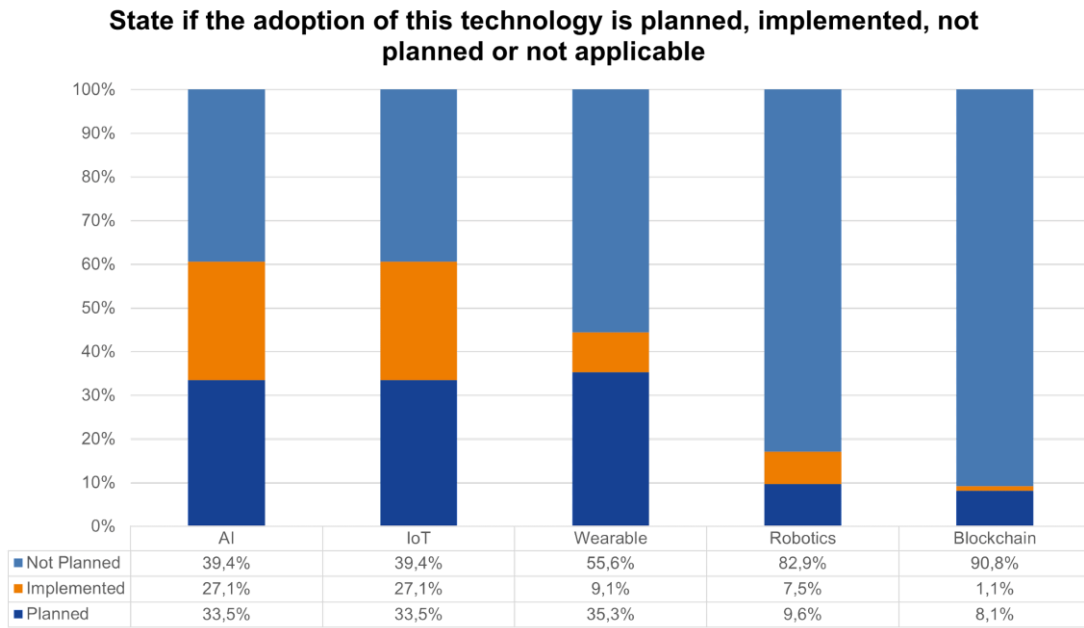


Figure 11 - Adoption of innovative technologies

The following text box presents digital twin technology being developed for the city of Rotterdam in the Netherlands. This technology creates a virtual representation of a city which can aid in the management and modelling of city operations. Digital twins improve the integration and connectivity between **physical and digital infrastructure**, resulting in better management and prediction analytics in key sectors such as transport, urban planning, and energy infrastructure management.

Towards a digital twin of the city (Rotterdam, The Netherlands)

For the City of Rotterdam, it was important to acknowledge that developing numerous smart city projects does not make Rotterdam a Smart City unless those projects are truly interconnected. The digital twin is under development⁵² and will become a smart 3D model of the city (with representations of its buildings, streets, and public spaces), complemented with real-time information, through sensor networks and data streams. Hence the digital twin is regarded by the City as the basis for smart solutions and an important component supporting digital transformation in the City. In other words, it enables the visualisation of all information of the city, thanks to data and technology, to improve decision-making capabilities.

The **combination of the digital twin with other cutting-edge technologies**, like artificial intelligence or the predictive power of big data, can significantly improve rescue operations in the city by providing detailed information on the building occupancy to firefighters, or monitoring of road traffic and water in canals to optimise the operations of opening and closing the city's bridges, just to name a few examples

The digital twin is a reference in data management as it applies **open data standards** and follows the **Minimal Interoperability Mechanisms (MIMs)**. The City relies on several existing data collection infrastructure, such as sensor networks. However, the distinctive aspect is that the digital twin aggregates all these sources of information and systems together under the same structure. This provides an updated and more complete overview of the city which increases the efficiency of its management and expands the possibilities of applications.

Although the solution is still under development, there are some indicators of its expected impacts in the future. The platform **enhances the possibilities of co-creation** with citizens. For instance, the city is currently relying on the present version of the digital twin to develop an app that allows citizen participation in the spatial planning process at any time or place. Additionally, the fact that it is an **open data platform designed for any third party to participate** and develop its own applications, provides new business opportunities, and will become a powerful resource for further innovations. For instance, a city pilot testing efficient and intelligent streetlights in buildings, that will also be monitored through the digital twin, estimates a potential city-wide reduction in the use of energy of around 30%.

Moreover, the current procurement process, through a procedure to find private partners to collaborate in the further development of the platform, also constitutes an innovative practice within the municipality.

The City's participation in two Horizon 2020 projects, the RUGGEDISED⁵³ and the ESPRESSO⁵⁴ projects, has contributed to the development of a prototype for a 3D city operations platform that has paved the way for the digital twin. Both projects supported the research and prototype phases of the process, **minimising the risk for participating cities such as Rotterdam of testing and developing such solutions**, while scaling them up at the European level.

These advanced technologies have the potential to contribute towards solving broader societal problems such as mitigating the impact of climate change. By adopting IoT sensor technologies, governments can help in the collection of pollution data around the city, where the data can be used to guide human traffic from unsafe areas. More broadly, a working framework should be developed and adopted on how these technologies are to be used to develop solutions to broader societal challenges⁵⁵. It is important that procurement policies drive **investments into these innovative technologies** as in the Helsinki case study. This framework should also have regulatory support.

Governments at all levels should harness advanced technology to facilitate digital transformation as a matter of practice. Priority should be given to the deployment of systemically critical infrastructure from the start of the digital transformation journey. An example is connectivity infrastructure such as 5G, fast fibre **optic lines**,

⁵² Rotterdam Innovation City | Can Rotterdam be even more beautiful? The answer is yes, as a Digital City.

⁵³ [RUGGEDISED - Smart city lighthouse project | Home](#)

⁵⁴ [ESPRESSO Project – systEmic Standardisation apProach to Empower Smart citieS and cOmmunities \(espresso-project.eu\)](#)

⁵⁵ [digital-finland-framework.pdf \(businessfinland.fi\)](#)

and fast Wi-Fi which transmit huge volumes of data and are therefore critical to smart city IoT infrastructure systems, among other data-intensive users of advanced technologies. Secondly, governments should promote the **development of digital platforms and applications** on which innovative technologies rely. They should also take advantage of big data and advanced predictive analytics to turn data into valuable insights to support decision-making and public service delivery.

Governments should also promote the development of **standardised open-source software versions of these innovative technologies to interoperability across different digital platforms** and applications.

Summary of recommendations

- Governments should integrate innovative technologies such as IoT and AI into their operations to improve their own efficiency as well as the quality and range of the services they offer.
- The **digital twin tool is part of the smart city of the future**; therefore, the public authorities with complex needs will likely benefit from building one.
- Strategic rationale should drive what technologies are prioritised. **Systemically impactful technologies such as 5G connectivity should be prioritised** for deployment because they can unlock many other innovations relying on real-time access to huge amounts of data.

3.3.3 Recommendations on adopting advanced methods and principles on digital innovation

Advanced methods and principles are those practices and methodological approaches to digital transformation inspired by the paradigm of open innovation. These are characterised by innovations such as the once-only principle⁵⁶, open-source software, solutions sharing, system interoperability and common standards. Correct application of these practices impacts the pace and extent of digital transformation, as such, public authorities need to incorporate them in their digital strategies. For example, the currently under-utilised *once-only principle* should be built into services offered to reduce the level of complexity that users must deal with when navigating digital portals. Currently only 22% of public authorities apply this principle in their offered services.

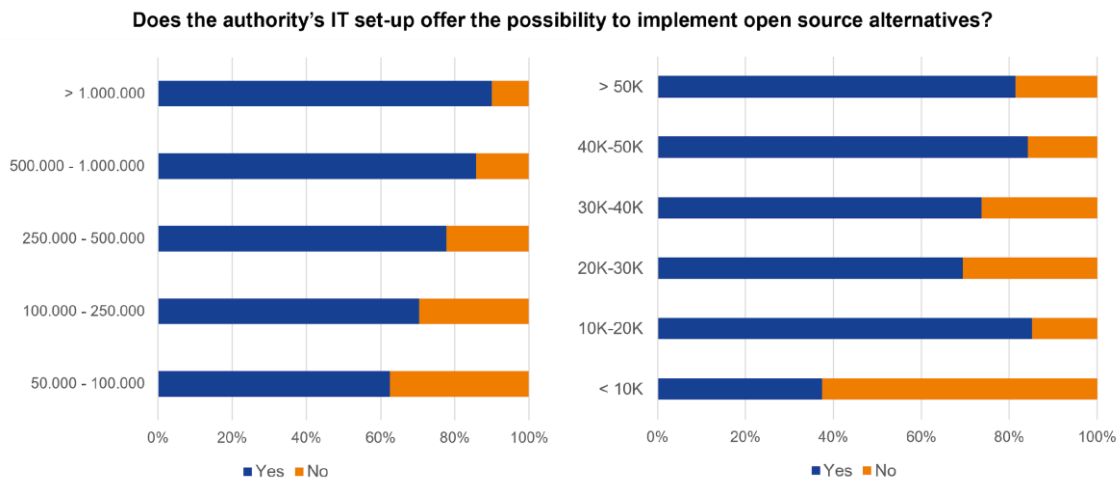


Figure 12 - Use of open-source alternatives (Left graph: population. Right graph: GDP-per-capita)

According to the survey, most public authorities' IT systems work with open-source alternatives, particularly in the larger and wealthier cities - see Figure 12 - but adoption of interoperable digital solutions remains (Figure 13). This points to an area where public authorities need to improve if they are to make use of complex big data which is increasingly processed in automated systems.

⁵⁶ See glossary page 67

Public authorities benefit from sharing digital solutions, therefore, activities that encourage cities to network and learn from one another should be promoted – nearly 30% of public authorities import and adopt solutions developed by other public authorities.

Public authorities should actively promote a **model of open participation and interaction** with citizens and other stakeholders contributing to services design. Stakeholders should also participate in European programmes that shape how to use these principles to address the needs of all user groups, especially those often ignored by the one-size-fits-all approach. **Stakeholder networking is encouraged and should present opportunities to demonstrate and promote these principles** during both city-led and civic-led activities across regions and countries.

Is your public authority making use of interoperable digital solutions or services (e.g. ISA2 programme, Connecting Europe Facility (CEF) Digital Building Blocks, OASC Minimal Interoperability Mechanisms (MIMs), FIWARE)?

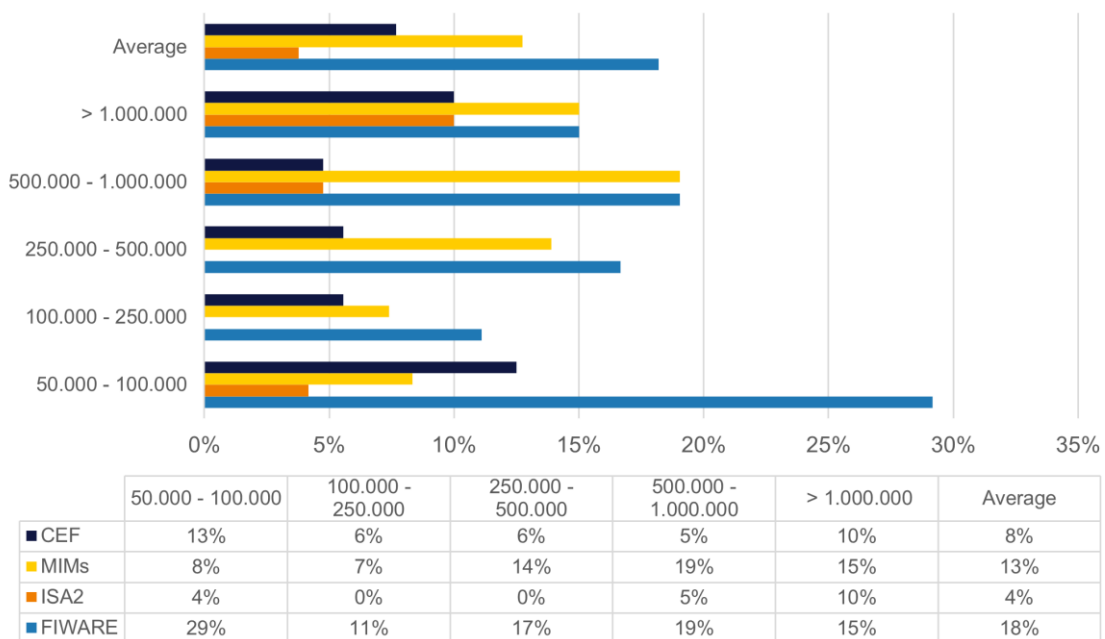


Figure 13 - Diffusion of interoperability standards

Summary of recommendations

- **Advanced principles** such as the once-only principle, open-source software, common (data) standards and interoperability principles should be part of a public authority’s long-term strategy and vision on digitalisation.
- **Participation in programmes and networks where feedback, ideas, and opportunities to collaborate on common interest projects shared** across the stakeholder ecosystem. Such networking with cities, civic participants, and businesses allows public authorities to learn about useful technology and potential network partners to influence the digital transformation process.
- Steps should be taken by public authority strategists and technicians to avoid being overwhelmed by digitalisation. Technology should serve the people, not the other way around. **Cities should take part in EU assistance programmes on digital transformation** and guidance where information is often available on best practices.

3.3.4 Recommendations on improving societal engagement

Societal engagement relates to the extent to which digital innovation is embedded in the interactions between public authorities and their stakeholders such as citizens, businesses and other institutions. The government-citizen relationship is increasingly taking place remotely over digital channels such as social media.

Increasingly, public authorities are using **digital platforms** to engage citizens in **co-creation**, public consultations, promote e-participation in government activities such as on data initiatives, and to establish a

social media presence as part of a communication strategy - see Figure 14. According to the survey, over 70% of public authorities use platforms to engage citizens in public consultations, an admirable level but one that can, and should, be increased to cover the whole population.

Does your public authority use platforms to actively engage with citizens?

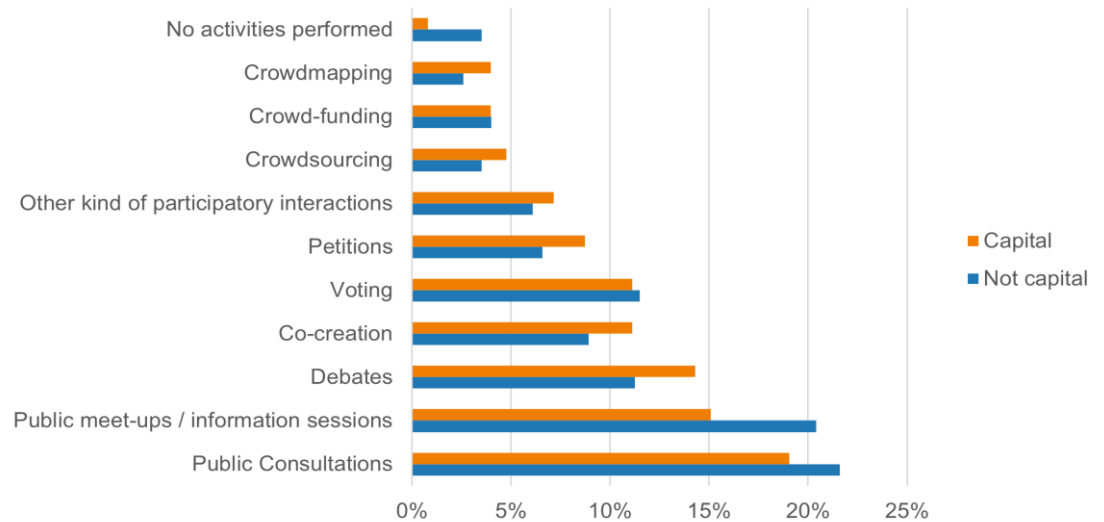


Figure 14 - Methods and practices of societal engagement through digital platforms

One area where public authorities need to improve on societal engagement is the consultation of often neglected groups - the elderly, people with special needs and so on - on the design of services that affect their quality of life. According to Figure 15, it is encouraging that the elderly, teenagers, and people with disabilities are being engaged in co-design activities, at least for cities in the 100.000-250.000 population range. However, more should be done to improve contribution from low scoring demographics as well as citizen participation in cities with low scores. Online-based platforms with easy-to-navigate user interfaces and convenient 24/7 access could incentivise more citizen participation in co-design and civic activities.

Are you actively engaging one or more of the following communities in your public authority's co-design activities?

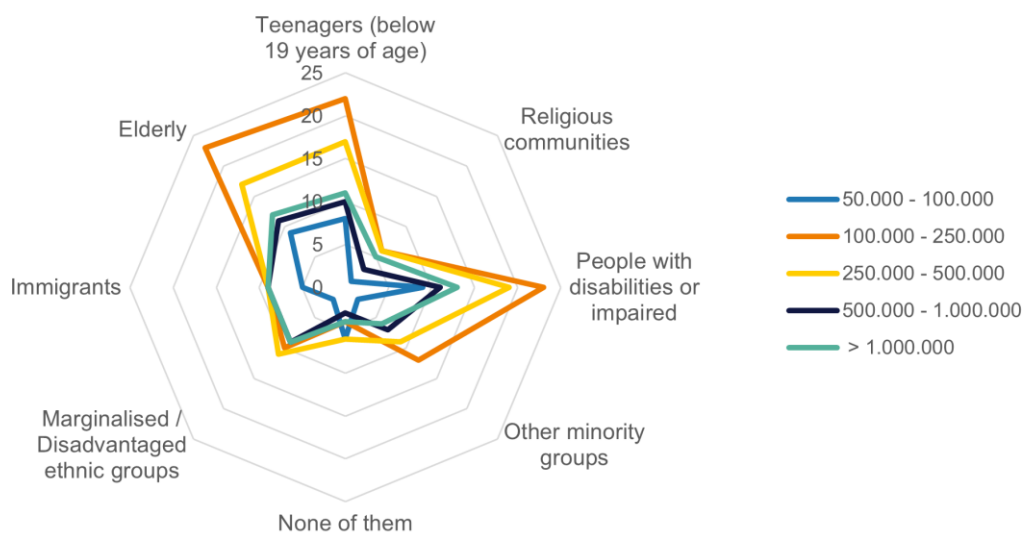


Figure 15 - Strategies for social inclusion in co-design activities

Cities should set up structures to co-develop roadmaps with citizens, to address current and future needs of citizens, workers, and visitors to cities. As exemplified in the Ljubljana case study, policy should also ensure accessibility of digital services to all, to avoid a “digital divide” that leaves parts of the population underserved - e.g., the elderly, people with disabilities, or minorities.

Additionally, events focussed on digital transformation should be used as opportunities for societal engagement. The *Digital Week* events held in several countries is a cornerstone of societal engagement focussing on the digital age. The week consists of a series of events to promote digital inclusion, digital culture, and sustainability.

Transparency about the budget can be improved by using digital tools accessible by citizens wishing to verify how the budget is being applied and managed in a city. For example, the City of Milan has developed a tool where anyone can consult the city’s budget with user-friendly and interactive features displaying information through dynamic infographics and economic forecasting data.

Public authorities should also engage the business community, academic institutions, and other stakeholders, especially on issues concerning digital transformation in society. For example, incubators and start-ups should be supported with funding and opportunities to establish contacts and networking with partners and potential clients, including at national and international levels. As found in the Luxembourg case study, public authorities can and should play an active role in the selection of projects that support their innovation journeys.

By opening up the public authority’s digital environment and infrastructure to innovators in society, **citizens are encouraged to participate in their communities’ digital transformation via their contribution of innovative ideas and solutions**. For example, citizens can participate in data collection through their use of digital applications and wearable devices. This data can be used to improve the accuracy of weather conditions in an area, a benefit to residents. By **empowering citizens in the digital transformation process**, it will help build a citizen-centric governance culture and civic-led innovation ecosystem.⁵⁷

Summary of recommendations

- The strategy on managing the social engagement process should benefit both the organisation and stakeholders. The framework for city-stakeholder **interaction should allow for a mechanism through which feedback flows** both ways to inform policy.
- City **strategies on societal engagement should be co-developed with input from the target of the engagement** e.g., demographics that are commonly neglected.
- Public-private partnerships, technology incubators, and coding hubs offer opportunities for cities to engage stakeholders from outside the organisation to co-create solutions to pressing tech problems. Societal engagement can be used to crowd-source solutions via these avenues.
- Social media offers cities channels to publicise their services on offer, so cities should use this medium to amplify their messaging.
- User-centric online-based platforms with easy-to-navigate user interfaces and convenient 24/7 access should be used to incentivise citizen participation in co-design and civic activities. The **design of digital services and their access points should cater to differences in users’ computing abilities** - some stakeholders will lack the skills needed to use digital services.

3.4 Scaling governments and markets to take full advantage of the digital revolution

There is a need to exploit the power of the scale of governments and markets to enable the multi-level integration necessary both inside and outside of organisations, to increase the impact of digital innovation. By sustaining collaboration networks, governments contribute towards the exchange and spread of useful knowhow on digital transformation. By participating in digital innovation markets, governments also contribute towards addressing global challenges such as connectivity, including at the local level. Our analysis finds that digital innovation can help solve structural problems such as lagging productivity, leading to better outcomes on public value creation than is currently the case.

⁵⁷ ESPON. (2019). [Policy Brief - Digital Innovation in Urban Environments](#)

3.4.1 Recommendations on managing change

Change management looks at the effectiveness of the strategies implemented to achieve the desired impact of digital innovation within and between public authorities, as well as in the broader society.

The challenge for many public authorities is they have operated legacy structures for a very long time and have grown comfortable to the extent that some are resistant to digitalisation. The change process to adopting digital transformation therefore needs managing with care to ensure cooperation from those attached to long established ways.

From the survey data, it is encouraging that most public authorities are active in **innovation ecosystems**, with 72% directly involved in ecosystems for innovation. Cities should actively engage in innovation ecosystems to influence emerging technologies that impact them to become more tailored towards their needs as opposed to taking finished off-the-shelf general products. These off-the-shelf products are in many cases developed for different contexts, and thus require costly customisation before use, as well as maintenance.

Regarding public authorities that lead on change, survey data show that capital cities are more likely to be **originators of digital innovation solutions** compared to non-capital cities based on 35% versus 29% of respondents, respectively. In addition, capital cities are also more likely than non-capital cities to **co-develop digital solutions with other public authorities**. This may be because capital cities tend to be economically wealthier which, together with their political importance, brings access to funds from the central government, allowing them to maintain close links to innovation ecosystems. It is recommended that public authorities, especially those that are resource-constrained, **join city networks with larger, well-resourced public authorities** to share solutions and learn best practice from one another. This active collaboration can in fact nurture a culture of embracing necessary change, a valuable trait for transformation.

Joint procurement tends to be less popular with smaller cities than with large population public authorities which are generally wealthier (survey question 3.7). One explanation is that the resources and the added value joint procurement are not aligned for cities of vastly different sizes. Large cities also have the resources to organise procurements in collaboration with fewer partners. However, a larger number of small cities would be needed to form a viable group - it is easier for two large cities to organise a joint procurement than it is to coordinate procurement across many small public authorities. One solution is for the numerous small towns with small-scale operations to organise their digital services via a higher administrative level (such as the region) or form 'consortium offices' to coordinate procurement when needed.

Building a **digital bridge** (such as joining the Open & Agile Smart Cities or other sharing programmes) can contribute towards advancing a city's digital transformation plan. Digital bridges with digital-mature cities and excellent global stakeholders encourage the sharing of best practices and a peer-to-peer learning process.⁵⁸

Cities should be actively involved in **working groups** both at the national and sub-national levels. This can be done through supporting initiatives and events involving citizens and companies such as hackathons and workshops on technology innovation.

Public-private collaborations can speed up the exchange of knowledge across the private-public sector divide, guaranteeing that whenever specific capabilities are missing from within the local administration, private partners can work together with the city and bring in the technical knowledge and infrastructure. In Ljubljana, the URBANA⁵⁹ mobile application was developed by Telekom Slovenija, the City of Ljubljana and the passenger traffic operator Ljubljanski potniški promet. This public-private approach guarantees that whenever there aren't specific capabilities within the local administration, the private partner can work together with the city and bring in the technical knowledge and infrastructure.

At the European level, **sharing and collaboration city networks** should be facilitated to encourage cities to learn from peers the best practices to overcome challenges. Successful local pilots and best practice approaches on digital innovation should be highlighted and promoted for scaling up to the European and global market. EU-wide programmes such as Living.in.eu should be supported as they work with cities and

⁵⁸ [Driving the Digital Transformation of Contemporary Cities \(itif.org\)](https://www.itif.org/)

⁵⁹ <https://www.ljubljana.si/en/news/mobile-urbana/>

communities to improve digital transformation. Cities learning from the best practices of others should adapt relevant solutions to their own local situations instead of simply copying. In addition, incentives should be created through EU or national funding channels to encourage collaboration among resource-constrained cities, to limit the impact of sub-optimal intra-city competition for public resources. According to Figure 16, membership of international networks while not insignificant is nevertheless very low compared to alternatives. In addition, cities in the 100.000 – 250.000 range report the highest number of memberships.

Is your public authority part of a (local, regional, national, EU) network of cities sharing operational digital solutions or open source code?

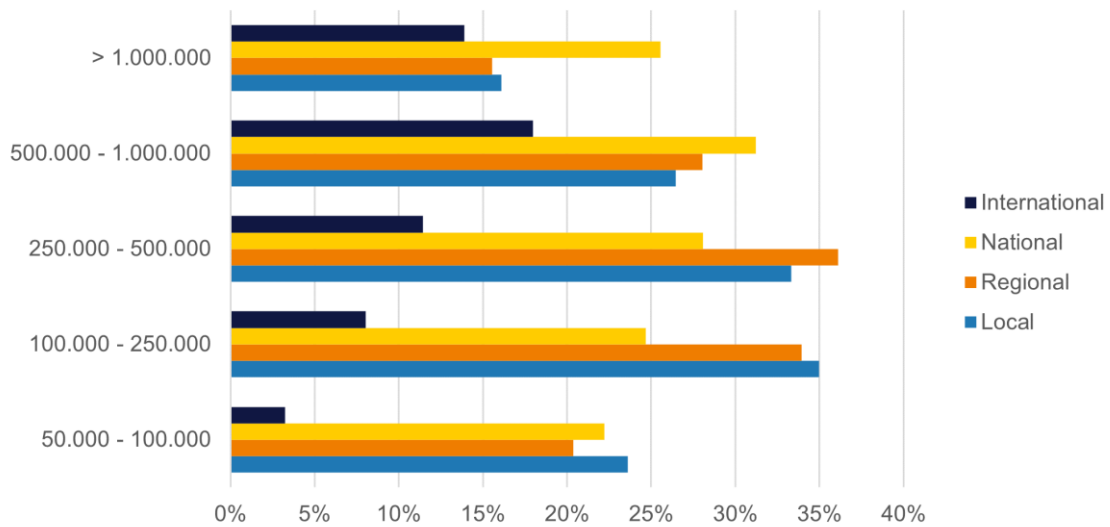


Figure 16 - Role of networks in sharing digital solutions

Collaboration with other stakeholders in the innovation ecosystem is a key part of establishing a beneficial relationship with technological change. At national and local levels, public authorities should adopt a **platform approach** (e.g., android-based platform) to facilitate digital products interoperability. Cities should open up the development of their digital environments, systems and services to the market. Cities themselves should serve as **testbeds or living labs** to facilitate the advancement of digital solutions. In this way, a wider range of stakeholders (e.g., citizens, innovators, businesses, NGOs, and academia) can get involved in the cities' digital transformation, which help foster a civic-led digital innovation ecosystem. To remove barriers for innovation, countries and cities can adopt a regulatory sandbox approach to facilitate innovators in trialing new digital products.

Testbeds and living labs for innovation and digital solutions (Aarhus, Denmark)

Dokk1⁶⁰ is an integrated part of the city area acting as a living testbed for new technology, managed by the Aarhus City Lab. The Aarhus City Lab resulted from a collaboration between several City internal departments. The team has diverse technological profiles and backgrounds on business development and communication. The Lab is an important point of interaction with the innovation ecosystem, as companies and academia are invited to test their technological solutions which may result in partnerships with the City.

For example, CityShark⁶¹ is a pilot project which combines different technologies to address the problem of pollution in the harbour. The pilot relies on several air and water drones to identify and collect garbage. It results from an international collaboration between Innovation, Technology and Creativity (ITK) organisation, the Aarhus Harbour, the Danish Agency for Data Supply and Efficiency and private partners-Ranmarine (from Netherlands), Ecosafe (from Denmark), Kinetica and Oracle (both from the United States).

The Lab is also relevant for the city dialogue with citizens, by sharing knowledge about the new technologies that are being developed in the city and with a room dedicated to debates around digital topics (e.g., data privacy, the moral limits of artificial intelligence). For instance, the Aarhus City Lab organised the Kids City Lab⁶², where 1,704 young people had the chance to learn about technology through workshops and other activities.

A **multi-level approach** is preferable for cities to embark on their digital transformation journey. In developing local digital strategies and action plans, cities should consider the local context and coordinate demand across sectors, but also align their objectives and plans with relevant regional, national and international policy frameworks. In implementing digital transformation, cities should combine both city-led and civic-led digital innovations, while also seeking to collaborate with counterparts at national and international levels to share and learn.⁶³

Summary of recommendations

- Before a public authority embarks on a major digitalisation project, **small-scale pilot projects should be run to test different strategies** until a refined strategy is developed to guide the organisation towards achieving its objectives.
- **Partner networks that have capital cities among members are more likely to be up to date with the type of technologies** needed by public authorities. Cities should join these networks to learn about the latest technologies.
- Local authorities should **proactively engage stakeholders in the ecosystem of technology innovation** as a co-creator and testing ground for start-up innovations that address digital challenges faced by public authorities.

3.4.2 Recommendations on integrating global challenges into local level policies

Local level policies must consider relevant **national programmes and policies on digital transformation** to ensure that the two initiatives are aligned. This is especially important where national policy directly impacts the city, for example, national law on data protection limits what the city can do with personal data.

Global challenges, exemplified by cross-cutting programmes such as the EU's Digital Single Market and the Digital Decade, as well as the UN's SDG on improving digital connectivity, need to be interpreted and addressed in the local context. However, it is not always possible for local policy to address such broad global challenges in isolation, especially because the financial and technical resources needed are often beyond the local authority's capacity. National, and in some cases international level co-ordination, is often

⁶⁰ [Om ITK | Dokk1](#)

⁶¹ [City Shark \(aarhus.dk\)](#)

⁶² [Kids City Lab | Dokk1](#)

⁶³ ESPON. (2019). [Policy Brief - Digital Innovation in Urban Environments](#)

necessary in such cases. Therefore, it is imperative that local authorities co-ordinate with national authorities with strategic oversight and capacity to ensure that these global challenges are addressed.

The COVID-19 pandemic demonstrated that communities the world over are interconnected, and their dependence on common digital services and applications to support citizens' daily lives during the pandemic shows that co-ordination on shared challenges can improve results. Therefore, **collective action is needed to tackle global challenges** such as climate change, pandemics, inequality, and cybersecurity. In developing digital strategies and policies, local governments must integrate major global challenges such as cybersecurity into their plans and explore workable solutions from the local level.

On climate change, **cities should promote the development of digital innovations to support decarbonisation** across sectors. On inequality, cities should **reduce digital exclusion by setting up targeted digital programmes** to improve digital literacy and access to the internet. On cybersecurity, public authorities should work with central governments so that the resulting legal framework regulating digital products (personal data usage, protect privacy) considers the needs of cities.

Acting at the local level contributes towards addressing global challenges for a city, but also motivates peer cities and municipalities with ideas and solutions to tackle their challenges, thereby scaling up the intervention.

Summary of recommendations

- **Local level policy should be harmonised and aligned with higher governmental level policy** when possible and relevant. For example, the national government may set data standards to facilitate intergovernmental data exchange and interoperability.
- **Public authorities should make use of EU programmes on digital matters**, including accessing EU guidance and funding to transform their digital services. Landmark objectives such as the UN's SDG on digital connectivity should feature in public authority visions and strategies.

3.5 Summary policy recommendations

The study has developed policy recommendations for public authorities to address these challenges, with the aim of ultimately achieving digital transformation in their local areas and beyond. These recommendations are further developed into a handbook providing *guidance for policy intervention relevant for digital innovation*. A summary of these recommendations includes:

- **Implementing policies that are consistent with enabling a long-term digital vision.** Avoid populist short-term initiatives which are inconsistent with sustainability. Review existing policies for their impact on digital transformation. Where they pose barriers to digitalisation, mitigating steps should be adopted to address them.
- **Agility should be built into the implementation process** as part of the strategy to facilitate incremental improvements and to allow adaption to new innovations as they emerge. The **policy making mechanism should be evidence-based and responsive to stakeholder feedback** in a way that allows for emerging innovative solutions to be adopted in a timely manner. For example, policy should facilitate a **data management system that is flexible and as 'future-proof'** as possible.
- Local policies should consider the impact from regional, national, and supranational policy priorities on digital transformation, e.g., the Digital Europe Programme to avoid policy contradictions. **Local policy should be harmonised and aligned with higher governmental level policy** when possible and relevant. For example, the national government may set data standards to facilitate intergovernmental data exchange and interoperability. **Public authorities should make use of EU programmes on digital matters**, including accessing EU guidance and funding to transform their digital services. Landmark objectives such as the UN's SDG on digital connectivity should feature in public authority visions and strategies.
- Public authorities should **actively participate in networks of cities and stakeholders** for addressing common challenges to nurture and speed up the sharing of innovative solutions and ideas across organisations. **Participation in programmes and networks where innovative ideas, feedback, and opportunities to collaborate are shared** across cities, civic participants, and stakeholders such as businesses allows public authorities to learn about useful technology and citizens to influence the digital transformation process. **Cities could take part in EU assistance programmes on digital transformation** where information is often available on best practices. **Partner networks that have capital cities among members are more likely to be up to date with the type of technologies** needed by public authorities. Cities should join these networks to learn about the latest technologies.

- The **design of digital services should account for the variation in users' abilities** because a considerable section of citizens still lack the skills needed to use digital services. If necessary, alternative access channels or training should be provided to vulnerable citizens or those lacking these skills. The city strategy should aim to **minimise complexity in the digital services** as part of the incentive structure to encourage the growth of digital government. This will increase the use of digital versions of Social & Welfare services and Healthcare which lag General Services & Administration. **User concerns on digitalisation should be addressed, for example, on data protection and privacy.**
- The **“silo approach” of building and defending power centres around departments should be dismantled and proactively discouraged**, in favour of more open organisational structures built around open data platforms with common standards that unlock productivity gains in the organisation. The **data strategy should enable data sharing and discourage data silos**, while at the same mitigating negative risks that may arise from easy access to data such as cyber security and threats to privacy.
- Adopt advanced technology that improves the efficiency and transparency of procurement processes. Adopt interoperable systems as part of a long-term strategy to facilitate future joint procurement and joint projects to reduce costs. Intergovernmental joint procurement can increase what public authorities can do individually. Where a public authority is resource-constrained and cannot afford to digitalise its procurement processes, it should **form partnerships with similarly positioned local authorities to form joint-procurement teams**, or out-source its procurement to a higher government level that is likely to have the necessary resources. Out-sourcing e-procurement activity to third-party platforms is another way to reduce the cost.
- The hesitancy of public authorities to experiment with new technology solutions is one of the barriers to building the institutional capacity needed for digital transformation. This can be addressed by a combination of a clearer **demonstration to decision makers of the benefits of digital innovation such as time saving, cost, and convenience**. Throughout the organisation a **culture of being open to adopting digital innovations should be proactively encouraged, with the top leadership leading by example to demonstrate political support**.
- Having skilled employees and multidisciplinary teams is a key part of building institutional capacity, therefore, public authorities are advised to maintain ICT teams with well-trained staff. Where skilled labour costs are beyond the organisation's budget as is often the case with small rural local governments, **out-sourcing ICT tasks to larger regional governments or forming joint ICT teams with similarly constrained governments** can address this barrier.
- Before a public authority embarks on a major digitalisation project, **small-scale pilot projects should be run to test different strategies** until a refined strategy is developed to guide the roll out of the large-scale project. Local authorities should **proactively engage stakeholders in the ecosystem of technology innovation** as a co-creator and a testing ground for applicable start-up innovations. Public-private partnerships, technology incubators, and coding hubs offer opportunities for cities to engage stakeholders from outside the organisation to co-create solutions to pressing tech problems. Societal engagement can be used to crowd-source solutions via these avenues.
- Governments should integrate into their operation's innovative technologies such as IoT and shared open data platforms to improve their operational efficiency as well as the quality and range of the services they offer. The **digital twin tool is part of the smart city of the future**; therefore, the ambitious public authorities will benefit from building one.
- The huge amounts of data being generated require public authorities to improve their capacity to handle such data, e.g., via use of big data analytics systems. **Collaboration on exploiting data also needs to improve through promotion of open data principles and practices**, promoting minimum interoperability mechanisms and standards on data accessibility.
- Strategic rationale should drive what technologies are prioritised. **Systemically impactful technologies such as 5G should be prioritised** for deployment because they can unlock many other innovations relying on real-time access to huge amounts of data.
- The **uneven spread of digitalisation through government service areas should be addressed with targeted policies** designed to incentivise adoption and to create measurable results rather than the generic one size fits all approach. Where users still choose to access offline services when digital versions are available, public authorities need to determine the underlying reasons for this choice. For example, if it is simply a question of habit, incentives should be used to encourage use of online services.
- **Advanced principles** such as the once-only principle, open-source software, and common (data) standards **should be part of a public authority's long-term strategy and vision on digitalisation**. Steps should be taken by public authority strategists and technicians to avoid being overwhelmed by digitalisation. Technology should serve the people, not the other way around.

- City **strategies on societal engagement should be co-developed with input from the target of the engagement**, e.g., demographics that are commonly neglected. The strategy on managing the social engagement process should benefit both the organisation and stakeholders. The framework for city-stakeholder **interaction should allow for a mechanism through which feedback flows** both ways to inform policy. Social media offers cities channels to publicise their services on offer, so cities should use this medium to amplify their messaging.

4 Conclusions

Technology is having a transformational impact on broad areas of society. Few innovations can claim to have had as far-reaching an impact on society as the computing technology revolution has done over the last four decades. In the public service and governance sphere, digital innovation is increasingly part of the architecture facilitating **citizen-government interactions**. Internal government operations as well as many citizen-focussed services are being transformed under the digitalisation wave spreading through the public sector.

At the core of this development is a fundamental improvement in the capacity to collect and process data, an efficiency gain which is sparking innovation in new products, in both the public and private sectors.

This study set out to analyse the factors affecting the spread of digital innovation in the public service sector, to identify barriers to adoption, and to develop policy recommendations to address these barriers.

The study has identified four key areas as presenting major challenges to achieve digital transformation in public authorities. These relate to (a) **changing government structure**, (b) **Building government capacity**, (c) **changing government processes, service design and delivery**, and (d) **scaling governments and markets** to maximise the benefits of digitalisation. Based on survey data, public authorities cite the two commonest barriers to digital transformation as funding and institutional capacity.

The study has made several other observations based on our analysis of survey data from which we highlight two. The first one is the correlation between the level of **digital transformation in a public authority and its capacity and attitude for innovation**. While this is not particularly surprising, it highlights the idea that digital transformation does not happen in a vacuum. That is, the culture in the public authority needs to be receptive to trying new approaches, it needs to be innovative.

Another commonly observed theme is that for digital transformation, **scale is more relevant than wealth**. Public authorities with bigger populations, which are not necessarily the wealthiest in per-capita terms, tend to adopt digital innovations more than smaller peers. One explanation for this is that the complexity of service provision increases with population size, hence, a larger public authority gains more from investing in digital technology to simplify the process. In other words, **large public authorities benefit from economies of scale**. As well as being active in networks of cities and other stakeholders, this is one of the main factors linked to digital transformation outcomes.

In terms of spatial trends across Europe, five patterns are observed. Global cities which are mainly large centres of commerce such as capital cities tend to be more digitally advanced compared to locally focussed peers. Their access to funding and skilled staff plays a major role in this. Geographically, the cities leading on digital innovation adoption are in the Netherlands, Baltic countries, and Scandinavia while follower cities are in Mediterranean and Eastern Europe. While the performance is stable for public authorities in the Iberian Peninsula, peers in central Europe are still struggling. (Map 5)

This diversity of stages of digital maturity in European cities is confirmed by the DIGISER case studies, and this has a direct impact on their preparedness and efficiency to address the Key Challenges defined in this project.

Over the years, cities have adapted government structures to address existing silos, to consolidate scattered internal efforts and thus increasing **cross-department collaboration on digital topics**, to set common objectives and align the implementation phases as part of a city's long-term vision, and to better connect with the innovation ecosystem of the city. In some cases, this involved a new horizontal institution, an internal team at the higher political level, or, more recently, the creation of the position of the Chief Digital Officer.

The **Digital Public Service Value Index or DPSVI** is the summary assessment of the extent to which the digital transformation and innovation strategies and initiatives planned and pursued by cities are capable of generating public value for society. The values of the DPSVI are calculated by standardizing and aggregating a large number of primary sources and measured using a cartesian plane where the x-axis is represented by the "Digital Maturity Index" and the y-axis by the "Proneness to Change Index". According to their performance, all the cities have been associated with one of the following four profiles, corresponding to their positioning in a semiotic square designed on top of the cartesian plane:

1. Transformative Pioneer

The transformative pioneer displays a high level of technical and digital-enabled organisational innovation in public service provision and delivery. Also, the pioneer uses digital technologies as an integrated part of government modernization and innovation strategies. This profile is aware and ready to actively support changes in organisational behaviour, attitudes, and procedures to face challenges related to digitalization, and to drive pervasive and transformative service innovation practices.

2. Prospective Champion

The prospective champion has a strong orientation to change, as it is inclined and ready to modify behaviours, visions, and practices to foster and amplify innovation, as witnessed e.g., by efforts made to enhance data management, societal engagement, procurement, or institutional capacity-building. The champion prospect, however, might need to work on its ability to actively support technological and organisational change and to improve the scalability and replicability of service innovation practices

3. Conservative Follower

The conservative follower has a low degree of penetration and maturity of technical and organisational innovation in public service delivery. Also, this profile does not seem to be particularly inclined nor ready to modify behaviours or attitudes to support organisational or technological innovation.

4. Deadlocked innovator

The deadlocked innovator displays a high level of technical and organisational innovation in public service provision and delivery. The deadlocked innovator, however, might need to overcome organisational, societal, and legal barriers that constrain its space for action and do not allow this profile to fully grasp its transformative potential.

This report allows us to better understand digital innovation in Europe and to identify possible future developments. To pave the way for cities to embrace digital transformation and promote more effective service design and provision we suggest complementary research should be developed.

The analysis concludes that Integrated open data platforms should be encouraged as they allow for a more seamless sharing of data compared to the traditional silo bureaucracy structure. However, this increases the risk to data protection, privacy, and personal liberties. More research is needed on how to minimise these risks, especially as the amounts of data generated increase exponentially.

The DIGISER project has provided a first step in collecting sub-national public authority data on digital transformation, based on which policy recommendations have been developed. It would benefit European public authorities if this survey is turned into a longitudinal study so that periodic analysis of the issues covered provides feedback into the design of digital innovation systems in public services in Europe.

Some further thought should be put into understanding the possible negative effects of digital transformation. Digital transformation is generally deemed to have a net-positive impact on government and society broadly. However, its potential negative impact on key principles such as democracy and human rights are yet to be assessed comprehensively. This is an undertaking that needs to be addressed.

5 Glossary

Term	Definition
Artificial Intelligence (AI)	Artificial Intelligence (AI) refers to systems that display intelligent behaviour by analysing their environment and acting — with some degree of autonomy — to achieve specific goals
Big Data	Big data refers to data that are: <ul style="list-style-type: none"> • huge in volume, consisting of terabytes or petabytes of data; • high in velocity, being created in or near real time; • diverse in variety, being structured and unstructured in nature; • exhaustive in scope, striving to capture entire populations or systems; • fine-grained in resolution, aiming to be as detailed as possible, and uniquely indexical in identification; • relational in nature, containing common fields that enable the conjoining of different data sets; • flexible, holding the traits of extensionality (can add new fields easily) and scalability (can expand in size rapidly).
Blockchain	Blockchain is a system in which a record of transactions made in bitcoin or another cryptocurrency is maintained across several computers that are linked in a peer-to-peer network.
Chief Digital Officer	Chief Digital Officer is the highest-ranking officer leading the strategic and operational management of digital policies in the public authority.
Citizen Engagement	The multifaceted notion of "citizen engagement" is used in this project as an umbrella concept to indicate the interactions between public authorities and non-elected citizens regarding the design, planning and delivery of public services. It includes both top-down and bottom-up interactions and encompasses a large variety of processual typologies including highly structured and regulated participatory processes and more fluid and less formal settings.
Citizen-Centric (public services)	Citizen-centric (or user-centric) public services are those services that have been developed to meet the requirements of citizens that are involved in the whole process of service delivery. A citizen-centric approach entails the active engagement of citizens in the design stage (which in some cases can also be combined with proper co-design sessions), in testing, and in providing feedback and monitoring the performance of public service delivery.
Co-Design of Public Services	Co-Design of Public Services is relevant for public services innovation because it implies that stakeholders (citizen, public authorities' employees, and eventual outsourced service suppliers) are involved in the process of service design as equals. This creates an opportunity for public authorities to accomplish needed changes by fostering a political force for organisational and cultural transformation.
Connecting Europe Facility (CEF) Digital Building Blocks	The Connecting Europe Facility (CEF) programme funds a set of generic and reusable Digital Service Infrastructures (DSI), also known as Building Blocks. The CEF Building Blocks offer basic capabilities that can be reused in any European project to facilitate the delivery of digital public services across borders and sectors. Currently, there are eight Building Blocks: Big Data Test Infrastructure, Context Broker, eArchiving, eDelivery, eID, eInvoicing, eSignature and eTranslation. https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/CEF+Digital+Home

Crowdfunding	Crowdfunding is an emerging source of financing involving open calls to the public, generally via the internet, to finance projects through monetary contributions in exchange for a reward, product pre-ordering, lending, or investment. For small businesses, access to this form of finance represents an alternative (or a complement) to more traditional sources of finance like debt finance. Crowdfunding platforms are websites where fundraisers such as SMEs can source financial pledges from the public. There are several crowdfunding types, the most common types used by profit-making SMEs and start-ups are peer-to-peer (or marketplace) lending and equity crowdfunding
Crowdsourcing & Co-Creation	Crowdsourcing is the practice of utilising the wisdom, knowledge, information, or data of a large set of individuals (crowd) for a precise goal. Usually, this term is used for a mass sourced collection of data, but it is also considered as a strategy when complex problems need to be resolved and in this case crowd-sourced is better referred to as co-creation .
Digital Innovation	Digital Innovation may be a product, a process, or a business model that is embodied in or enabled by ICT, is perceived as new, and requires some significant changes in both adopters and providers. In this respect, digital innovation is the result of a process that requires profound organisational, behavioural, and infrastructural transformations which are enabled by technologies.
Digital Innovation Strategy	Digital Innovation Strategy is any strategic framework approved by the public authority for diagnosing, improving, transforming, and innovating its digital infrastructure and the provision of public services.
Digital Transformation	Digital Government Transformation (DGT) is the introduction of radical changes, alongside more incremental ones, in government operations, internal and external processes, and structures, to achieve greater openness and collaboration within and beyond governmental boundaries, enabled by the introduction of a combination of existing ICTs or new data-driven technologies and applications, as well as by a radical reframing of both organisational and cognitive practices; it may encompass different forms of public sector innovation across different phases of the service provision and policy cycle to achieve key context-specific public values and related objectives such as, among others, increasing efficiency, effectiveness, accountability and transparency, to deliver citizen-centric services and design policies that increase inclusion and trust in government.
Digitisation	Conversion of analogue material into digital format.
E-Procurement/Digital Procurement	E-procurement (or digital procurement) is the process of rethinking the public procurement process with digital technologies in mind. This goes beyond simply moving to electronic tools; it rethinks various pre-award and post-award phases. The aim is to make it easier for businesses to participate in and for the public sector to manage their procurement. It eventually allows for the integration of data-based approaches at various stages of the procurement process. E-procurement relies on the use of one or more digital platforms to carry out the stages of the re-designed procurement process.
ESPON	European Spatial Planning Observation Network. ESPON is an applied research programme aimed at supporting the formulation of territorial development policies in Europe. At the EU level, the results of ESPON research efforts provide a source of comparable information that can be used to improve the Union's competitiveness and its sustainable development. https://ec.europa.eu/regional_policy/en/policy/what/glossary/espone

FIWARE Foundation	The FIWARE Foundation brings a curated framework of open-source platform components which can be assembled, and with, other third-party platform components to build Smart Solutions faster, easier, and cheaper. A simple yet powerful API (FIWARE NGSI) enables the integration of components and provides the basis for the interoperability and replication (portability) of smart solutions. https://www.fiware.org/
Free/Libre Open-Source Software (FLOSS)	Free/Libre Open-Source Software is any software whose licence gives users the freedom to run the program for any purpose, to study and modify the program, and to redistribute copies of either the original or modified program (without having to pay royalties to previous developers). https://dwheeler.com/essays/commercial-floss.html
Incubators	Business incubators are support structures that support entrepreneurs in business creation and development. The broad objective of a business incubator is to create and develop firms and improve their chances for success (Bruneel et. al, 2012). https://doi.org/10.1016/j.technovation.2011.11.003
In-house (service)	In DIGISER the notion of in-house services refers to those public services that are managed directly by the public authority through its own administrative structure, without the involvement of any other legal entities.
IoT	Internet of Things. IoT merges physical and virtual worlds, creating smart environments. IoT represents the next step towards the digitisation of our society and economy, where objects and people are interconnected through communication networks and report about their status and/or the surrounding environment.
Living-in.EU	The Living-in.EU movement is a joint effort among European networks, organisations and institutions driving a 'European Way' where digital solutions help to create places where people enjoy living and working. The networks include Eurocities, Open & Agile Smart Cities and the European Network of Living Labs (ENoLL). Living-in.EU has several subgroups, including a Technical Subgroup (developing the MIMs Plus technical specifications), a legal subgroup (includes topics such as procurement and ethical aspects of AI), a subgroup on monitoring and measuring (to which the DIGISER project is directly contributing) and one on skills and capacity building. One outcome of the Living-in.EU activities is recommendations for policy and technical standards. http://living-in.eu
Living Lab	Living Labs are defined as user-centred, open innovation ecosystems based on a systematic user co-creation approach integrating research and innovation processes in real life communities and settings. https://enoll.org/about-us/
Local Digital Twins	Local digital twins are a virtual representation of a city's physical assets, using data, data analytics and machine learning to help create simulation models that can be updated and changed (real-time) as their physical equivalents change.
MIMs	Minimal Interoperability Mechanisms (MIMs) are a set of practical capabilities based on open technical specifications that allow cities and communities to replicate and scale solutions globally. MIMs are developed by the Open & Agile Smart Cities network. https://mims.oascities.org/
MIMs Plus	The European technical specifications formulated by the Living-in.EU initiative, based on the MIMs, extending them with key European policies and initiatives, such as INSPIRE, GDPR and SAREF.

Once-Only Principle	The once-only principle is an e-government concept that aims to ensure that citizens, institutions, and companies only must provide certain standard information to the authorities and administrations once.
Open Data	Open data is data that can be freely used, re-used and redistributed by anyone - subject only, at most, to the requirement to attribute and share alike: https://opendefinition.org/
Open APIs	An Open API is a publicly available application programming interface (API) that provides developers with programmatic access to a proprietary software application or web service
Open Standards	Open standards are standards made available to the public that are developed (or approved) and maintained via a collaborative and consensus-driven process. Open standards facilitate interoperability and data exchange among different products or services and are intended for widespread adoption. https://www.itu.int/en/ITU-T/ipr/Pages/open.aspx
Outsourced (service)	In DIGISER the notion of outsourced services refers to those public services that are managed and provided by legal entities external to the public authority, under the regulatory power of the latter.
Public Authority	In DIGISER's survey the term "public authority" refers to the public administration that is observed/for which the answers are provided. It could be any kind of local government or other public administration with a direct responsibility on the provision of public services in the city, including municipalities, metropolitan authorities, parishes, wards, districts, union of municipalities, etc.
Quadruple helix	The quadruple and quintuple innovation helix framework describes the interaction among university, industry, government, public and environment within a knowledge economy. The Quadruple Helix model adds to the "university-industry-government relations" the fourth helix of a media-based and culture-based public, that also includes values and different value systems. This fourth helix is associated with 'media', 'creative industries', 'culture', 'values', 'lifestyles', 'art' and perhaps also the notion of the 'creative class'.
Urban Data Platform	An urban data platform - or local digital platform - collates, maps, stores and integrates data from different stakeholders of the city ecosystem (e.g., public entities, businesses, citizens, or other organisations). The data can be offered to other service providers, can be analysed, or visualised, and published.
Wearable technology	Wearable technologies are smart electronic devices (electronic device with micro-controllers) that are worn close to and/or on the surface of the skin, where they detect, analyse, and transmit information, e.g., body signals such as vital signs, and/or ambient data and which allow in some cases immediate biofeedback to the wearer. Wearable technology is an example of IoT.

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