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DIGISER

Digital Innovation in Governance and Public Service Provision

Annex 2 Handbook with guidance for policy makers // August 2022

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Inspire Policy Making with Territorial Evidence

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1 Introduction

Technology is transforming society at an increasing rate. Few innovations can claim to have had as far-reaching an impact on society, as the computing technology revolution has over the last four decades.

At the core of this revolution is a fundamental improvement in the capacity to process large amounts of data and create new innovative products from these data, for example, urban data platforms and digital twins which exploit links between digital and physical systems. The narrowing of the digital-physical systems divide is exemplified by the growth in systems for real-time monitoring of the performance of public infrastructure such as road conditions. These efficiency gains are in turn sparking further digital innovation in the public and private sectors.

Within the public service sector, modern digital innovations are increasingly being integrated into government system toolkits, resulting in improved internal operations, better relationships with external stakeholders, and better services delivered to citizens.

At the large scale we have digital twins and sensor-enabled smart city technologies whose rollout is improving the integration of city infrastructure, resulting in more efficient cities. At the small-scale end, we have digitalisation of services which is making them accessible to citizens any time of the year. Many public authorities of varying sizes and at different government levels – towns, cities, municipalities, counties, and regions – are increasingly turning to digital innovation to transform themselves and improve their service delivery.

The impetus driving the adoption of digital innovation in communities is coming from several sources, both from within and outside public authorities at the various administrative levels – local, regional, national, and international. Various factors, challenges, and innovation drivers are interacting horizontally and vertically to bring about these changes. At the European level, several programmes have been set up by the EU and its partner to assist towards community digital transformation and to influence Europe's long-term digitalisation trajectory so that it is consistent with the EU's strategic objectives, e.g., on the economy, the environment and territorial cohesion.[1]

The EU launched the **European Green Deal and Europe Fit for the Digital Age[2]**, a twin initiative linking green and digital transition with a goal to promote climate neutral and digital enabled solutions. 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 digitalising Europe, including its public services.[3] With the aim of having 100% of the key public services online by 2030, the digital compass aims for digital to contribute positively towards improving citizens' quality of life while reducing the resources spent. EU's programmes are already facilitating the testing of advanced technologies, e.g., the impacts of the local digital twins in the development of cities and communities considered under the DUET[4] and LEAD[5] projects.

Concerning the green deal, several initiatives are being implemented (e.g., the EU zero pollution action plan, the EU climate adaptation strategy, and the climate Neutral smart cities). These initiatives have also included strategies on how digital tools and usage of data can help achieve green goals. The Urban Agenda[6] is a European-coordinated approach designed to address EU and national policies and legislation of the urban dimension also contributes to promoting the digital transition.

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[1] https://ec.europa.eu/regional_policy/en/policy/what/territorial-cohesion/

[2] A Europe fit for the digital age | European Commission (europa.eu)

[3] Europe's Digital Decade: digital targets for 2030 | European Commission (europa.eu)

[4] https://www.digitalurbantwins.com/

[5] https://www.leadproject.eu/

[6] The 14 partnerships developed within the Urban agenda can be consulted at https://futurium.ec.europa.eu/en/urban-agenda

Such initiatives and support notwithstanding, public authorities, especially at the sub-national level, still face enormous challenges in their efforts to maximise the potential benefits of digital innovation. The project, *digital innovation in governance and public service provision* (DIGISER), to which this handbook contributes, has undertaken extensive analysis of digital innovation in European local public authorities, and identified several of these challenges.

Some of the major obstacles include lack of funding, the entrenched dominance of traditional silo-like organisational power structures that resist change, and the lack of institutional capacity. It is thus clear that European governments must address these obstacles if they are to achieve the desired transformation via digital innovation adoption. In this regard, the DIGISER project has developed a suite of recommendations (details in the DIGISER Main Report) to address the major challenges.

This handbook provides actionable guidance to local and national policy makers on implementing policy recommendations developed to address barriers to the use of digital innovation to transform governance and public service provision.

The guidance is built around the three phases summarised in Figure 1 which can be thought of as a process to rollout digital innovation projects.
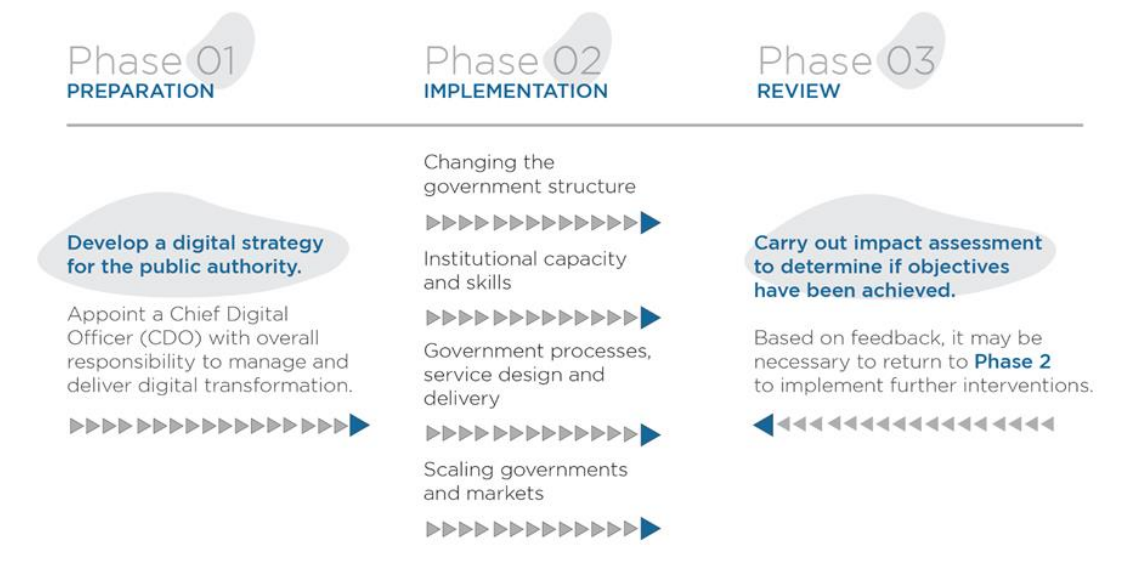
Figure 1: Proposed three-phased digital transformation process

Phase 1 focusses on the background preparation to assess and understand the organisation's current state and needs related to digitalisation, articulate a vision and develop a sustainable digital strategy, and appoint key staff to manage the digitalisation process. By setting the overarching agenda with a well-developed digital strategy guiding deployment, phase 1 avoids an ad-hoc approach to adopting digital innovations that would likely lose focus, become chaotic and fail to achieve its objectives.

Phase 2 provides guidance on tackling those challenges identified in the DIGISER study as barriers to the successful adoption of digital innovations in local governments – cities, towns, municipalities, and regions.

Phase 3 is part of good practice and is about reviewing the impact of the intervention. Review of actions and projects should not happen only in phase 3. Rather, throughout the whole end-to-end process there should be regular reviewing of processes and the impact of actions taken. Useful insights from these **reviews should feed back into updates to the digital strategy** and project implementation to allow for continuous improvement of outcomes. These feedback loops allow the digitalisation process to remain agile and flexible, and thus more responsive to adapt and adopt innovations as they emerge in a dynamic environment. We now look in more detail at the main challenges to digital transformation.

2   Challenges to advancing digital transformation in local public authorities

The DIGISER study identified four areas in which local public authorities are facing major challenges in their efforts to transform via digital adoption. These areas are related to:

- Changing the government structure,

- Building government capacity, e.g., on skills, strategy, and willingness to change,

- Changing government processes, service design and delivery, and

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

Addressing the underlying barriers linked to these challenges will increase the probability of success of transformative digital innovation adoption in European communities such as cities, towns, and municipalities.

These barriers are grouped under the areas defined above however, these groups are not necessarily mutually exclusive, with several barriers sharing common aspects. The rest of this chapter briefly discusses the relevance of these challenges, thereby providing the context and background for the guidance developed subsequently to address the barriers. Readers interested in a detailed exposition of the challenges should consult the DIGISER Main Report.

2.1   Changing the government structure

Changing the government structure is about orienting the public authority's systems and culture to make them enablers of digital transformation. Traditional government structures are not optimised for the agility and fast pace that digital government requires. They have evolved to serve an analogue government model, one operating at a much slower speed and generally organised around departmental power centres. There is a need to modernise government structures to improve governance and resource allocation in a way that addresses society's needs in the 21st century. This cross-sectoral challenge is characterised by the need to break down traditional silo-based work environments in favour of a more open, collaborative, and networked approach within and across organisations.

- A **policy making framework** that fails to develop adequate guidance for digital transformation in the organisation, e.g., by developing a holistic *digital innovation strategy*. In some cases, the strategies implemented have only short-term impacts and are not **sustainable over the long-term** due to being overly influenced by short-term political considerations such as the election calendar and the annual budget funding round. Digital transformation is a process that requires evidence-based policies and a multi-year strategy guiding how discrete projects fit together to achieve its objectives.

- A weak **level of service embedment and organisational change** characterised by digital innovation impacting only parts of the organisation and its relationships with stakeholders. Weak service embedment also manifests in how digital innovation spreads unevenly through the organisation, with some departments being more digitally advanced while others retain traditional analogue ways of operating.

- Breaking down silo structures involves dismantling non-cooperative working systems and cultures to replace them with networked systems both horizontally and vertically. Horizontally, a local authority benefits from increased coordination across its departments, e.g., from sharing of resources to reduce replication of services such as when data is managed centrally. Such horizontal resource optimisation can also be implemented between local authorities at the same government level, e.g., adjacent towns to pool resources to offer digital services that would otherwise be too expensive for a single to offer on its own. Vertical integration also offers opportunities for local authorities to achieve digital transformation. For example, local, regional, national, and European level governments working together by sharing resources and coordinating on policy strategy and funding moves government towards a more networked system. Such cross-border cooperation, together with the supra-jurisdictional agencies enabling it to provide a platform for resource-constrained towns to leverage the

capacity of more resource-rich counterparts to improve local digital transformation (6AIKA, OASC, living-in.eu).

2.2   Building government capacity

The DIGISER study also identified gaps in institutional capacity related to digital innovations adoption among the main challenges that public authorities need to address. Institutional capacity can be reflected in an organisation's access to skilled workers with expertise in relevant knowledge areas, its access to financial resources to purchase innovative technologies, and its work environment culture being open to adopting new and better ways of working.

The DIGISER study found that institutional capacity varies considerably across Europe, with cities in the Iberian Peninsula such as Barcelona, and in Baltics ranking ahead of peers while below average cities are concentrated in eastern Europe and Mediterranean countries such as Larnaca in Cyprus.

Public administrations such as the Magdeburg, and Poznan featured in DIGISER analysis recognise the need to invest in capacity-building to be able to carry out digitalisation initiatives. Administrations must become more agile to manage the complex IT projects that are central to digital transformation.

Public entities also often struggle to attract highly competent professional developers for the public sector due to limited budgets to be able to offer competitive salaries. Implementation of a data strategy requires specialist IT capabilities in data science and engineering that are hard to find and attract to funds-constrained public administrations.

Some initiatives for capacity-building are still operated on an ad-hoc basis rather than in structured or systematic form and are in many cases driven by outside directives such as when higher level authorities at the national government ministry enforce the use of new digital platforms and tools, as DIGISER found in the case of the City of Thessaloniki in Greece.

Traditional procurement processes can also be challenging and may not be suitable for the more innovative – and often riskier – projects since these traditional approaches tend to demand upfront a high level of certainty on expected project results that is not always possible for innovative projects which can have a large exploratory component. Aligning procurement policies with climate ambitions is also a need identified as important by cities towards sustainable procurement, for instance, by applying carbon footprint criteria to increase policy directionality as is the case in the City of Helsinki. The absence of a national competence centre may limit the exchange of good practices on procurement that could address common challenges.

- **Financing capacity** is important to purchase technologies but also to attract and retain skilled employees. Oftentimes, public authorities are competing against the private sector for a scarce pool of information technology specialists who must be well remunerated and motivated to perform efficiently. There is room for improvement in procurement processes so that funds available to public authorities can purchase more than is currently the case. Notably, joint procurement of technology products and the sharing of digital service across public authorities allows for the cost burden to be shared across several entities.

- **Skills and training capacity** are a core part of institutional capacity. There are indications that ambitious skills targets[7] for 2030 set by the EU under the Digital Compass may not be achieved.[8] This will likely affect the pace of digitalisation across European public services. Organisations need to provide a continuous learning framework with digital skills training for civil servants to match the fast pace of innovation common in digital technologies. As the technology sector develops innovative solutions, new role needs arise in public authorities, and it is important that these positions are filled with competent staff. This, rather than short-term sub-contracting to outside entities, is likely to lead

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[7] Digital skills and jobs | Shaping Europe's digital future (europa.eu)

[8] (Misuraca et al., 2021) Europe's digital decade and autonomy

to sustainable integration of the public authority into the innovation ecosystem as well as delivering resilient transformation in the long term.

- **Weak Institutional capacity** relating to a lack of ambition and a tendency for excessive conservatism in government can make public authorities resist change and less likely to try new innovative technologies. This is often exacerbated by a lack of access to skilled staff such as ICT specialists needed to integrate digital innovations into the organisation. An organisation's work environment culture affects employees' motivation and contributes to the organisation's capacity for delivering digital transformation. For example, having a strong culture of experimenting with innovative work approaches is likely to translate into a public authority that easily identifies emerging problems and solves them with internally available or externally sourced solutions. This propensity to trial and work with new solutions tends to be strongest in public authorities that are already active in networks of entities working on digital innovation issues.

2.3   Changing government processes, service design and delivery

This challenge is concerned with structural barriers to digital transformation as they relate to government processes and services delivery. Digital transformation requires going beyond simply digitising existing systems, e.g., creating online digital copies of paper forms, by rethinking fundamentally how the whole governance and service delivery architecture can be redesigned to achieve better outcomes.

The policy making process as it relates to the digitalisation ecosystem entails several steps from needs identification to policy implementation and service delivery. Therefore, it is important that innovative thinking is brought to bear to holistically integrate these seemingly disparate steps to effectively address the challenges faced.

This involves coordination across various actors and interests – government, industry, and citizens, among other stakeholders – which increases the complexity involved.

The tendency for 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) Use system for service delivery and operations. 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 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" while involving all the relevant stakeholders of the policy making process. This challenge is, therefore, related to the need to "Re-think services and processes" as well as "Improve collaboration and engage the private sector and citizens" with specific challenges related to data management and innovative technologies usage or societal engagement.

DIGISER case studies point to the need to create user-centric 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 as is done in Ljubljana, and specific offices for the elderly or vulnerable users such as those with disabilities.

Additionally, user-centric approaches are also becoming more common in the process for the creation of new digital public services, at the design, testing and implementation phase as evidenced by digitalisation in Helsinki, Finland. Some of the underlying challenges include raising sufficient awareness to motivate

people to engage in participation models and mechanisms such as public consultations shaping the future of the city technical and data privacy aspects to incorporate when creating platforms or apps for civic engagement or reporting on problems in the city, or ensuring that there is a significant sample of users to test a new solution in a real-environment (which may require a motivational reward), just to name a few. In terms of stakeholder engagement for new strategy design, it often becomes a bottom-up rather than top-down approach which means that sufficient time needs to be allocated through workshops and consultations to receive feedback from citizens.

The challenges faced relate to:

- Inefficiencies in **data management** policies in use today not adequately addressing key aspects on data use, data strategy, open data, big data, and data platforms.

- A hesitancy, and in some cases hostility, to trial and adopt **innovative technologies** such as AI and the IoT that are critical to smart cities. There is a failure to appreciate that adopting these technologies has the potential to bring about broad and systemic improvements in how an organisation functions and service delivery. For example, widespread automation is central to the smart city strategy that is a key part of the future economic growth.

- The tendency to stop at the easier-to-achieve but less impactful *digitisation* as opposed to undertaking the more difficult *digitalisation* of processes and services. Digitisation may be easier to implement but it is not as impactful or as sustainable as the more fundamental digitalisation of the organisation's ecosystem.

- Weak adoption of **advanced methods and principles** such as the once-only principle, open source software, common standards on data management. Such advanced approaches are key to maximising the benefits of digital innovation.

- **Societal engagement** not making full use of digital innovation opportunities to enhance communication and interaction between the public authority and its stakeholders such as citizens. For example, social media offers another communication channel while government-citizen co-creation of digital products over e-participation portals can enhance surveys results, leading to improved services.

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

The power of governments and markets can be exploited to increase the adoption of digital innovation in public authorities. Collaboration, multi-level integration, adoption of tried and tested solutions, and markets are not being leveraged enough to advance digital transformation.

The scale power of government, especially when coordinated across jurisdictions and geography, is currently under-utilised in impacting digital markets to address local government barriers.

While city collaboration networks exist to some extent, not all public authorities actively participate in exchanging solutions to common problems. Such intergovernmental exchanges can create network effects around solutions and lead to the establishment of common standards. Standardised solutions are a powerful tool to address, at less cost, global challenges such as the UN-championed challenge to improve connectivity, including at the local level. The challenges to address relate to:

- A **change management** mechanism that does not generate effective strategies needed to create the desired impact from digital innovation on the organisation and in the local society.

- **Integrating global challenges into local level policies** which is not happening fast enough. For example, the UN's Sustainable Development Goal on connectivity has the potential to enhance digital transformation in local communities and unlock broader economic growth via the creation of new products.

3 Policy intervention in action: a step-by-step guide for digital innovation

The approach in the following guidance is for an end-to-end policy intervention process which if considered holistically should result in the desired transformation. It starts with the public authority identifying a need for digital transformation, articulating its digital innovation vision and strategy, and implementing this strategy when rolling out projects.

This guide is principally **aimed at policy makers at a sub-national government level** responsible for digital transformation. The target organisation may be a town, a city, a municipality, or a region. The guide may also be useful to stakeholders such as policy makers at the national and EU levels interested in understanding or addressing digitalisation issues in European cities and communities. Whoever the stakeholder is, the overarching objective remains an interest in improving digital innovation adoption in local government across Europe.

Any two public authorities are bound to differ at some level. The implication of this is that there are several types of government characterised by differences such as geographical size, economic size, and digital maturity. While there is no one size fits all guidance, here we focus on addressing the most common issues to make the guidance tractable. Public authorities are advised to customise the guide's prescriptions according to their specific needs and characteristics. Where possible, the guide clarifies when a step is relevant for a specific organisation.

The guide is meant to be followed in a semi-chronological order. Section 3.1 discusses the background preparation to be undertaken first before implementing a digital transformation, while section 3.6 is about the assessment of the impact of the policy intervention. Sections 3.2 to 3.5 address the challenges that were identified in the DIGISER project as major obstacles to digital transformation. However, the order in which these sections are presented need not be followed but should be tailored to the organisation's priorities and the level of its digital maturity.

Phase 1

3.1 Understanding the local context and laying the foundation for change

Action 1: Understand existing local challenges and priorities

For a public authority embarking on a digital transformation journey, the first step should be to develop a comprehensive and holistic understanding of its local challenges and priorities. This will inform the local government's vision of its future which should be articulated with digitalisation as part of the solution to address these challenges.

Within the organisation's internal operations, service provision and relationships with external stakeholders – for example citizens and businesses – there is likely to be potential productivity gain that can be unlocked by a successful digital transformation process.

This may be in sector service areas such as social housing, transport, and waste management, as well as in organisational structures within and between departments relating to inefficient working practices, poor data management, and inadequate procurement processes.

To generate evidence-based insights, extensive consultations of stakeholders should be conducted, e.g., through surveys and workshops. It is important to review existing local strategies and plans as part of a process to identify challenges to digitalisation and set priorities on action.

Action 2: Assess the public authority's digital maturity level

With the need for digital intervention confirmed and challenge identified, the public authority should develop an evaluation framework to assess both its overall and domain-specific current digital maturity levels.

Several tools and frameworks exist to support this GAP analysis, for example, the metric-focussed digital public service value index (DPSVI) which was developed as part of the DIGISER project, SWOT analysis which evaluates the strengths, weaknesses, opportunities, and threats or STEEP analysis which is takes a broader view to include social, technological, economic, environmental, and political factor. Determining the organisation's digital maturity level gives a sense of the scale of work to be undertaken during the digital transition process. Secondly, this information forms a basis against which to assess the impact of the intervention in future.

The evaluation framework should consider factors such as the adoption of digital tools, digital literacy, openness to innovation, services delivered, and data management. By building a comprehensive understanding of the organisation's digital maturity level, the public authority can then identify specific digitalisation challenge that require intervention.

Action 3: Identify funding resources available for digital transformation projects.

Access to funding is among the most common obstacle given for why public authorities are not adopting digital innovations, not least because new technology is often too expensive relative to what most public budgets currently allow. Therefore, local governments must be creative **in their procurement processes** to access these technologies.

Securing sufficient funding resources is a critical step for sustainable digital transformation. The public authority should review its own local budget to identify funds that can be made available for digital transformation.

The technology team should work with the procurement office to identify and eliminate **duplications in services and operations**. For example, centralising the organisation's data management under a single open platform database is likely to be cheaper than each department operating its own data system. Such a holistic and integrated cross-departmental approach will improve efficiency in the use of resources.

Alternative funding channels should also be made use of by towns and cities. External funding opportunities and other resources can be found at the higher regional or national administrative levels. For example, several European countries operate national competence centres tasked with providing practical support such as financial assistance to public procurers engaged in procurement of innovation.[9] International procurement assistance is also increasingly available, notably, EU programmes funding innovation procurement, including at the local government level. EU assistance such as the DIGITAL Europe Programme[10] can also facilitate pre-commercial procurements (PCPs) and public procurement of innovative solutions (PPIs) and should especially benefit resource-constrained local authorities who can form consortia to joint-procure digital technologies that are 35%-90% funded by the EU.[11]

In addition, local authorities, especially small or rural administrations with funding gaps, should explore match-funding opportunities with business partners from the private sector as well as co-funding for joint projects with counterparts from neighbouring areas or regions.

A public authority that is resource-constrained should seek out similarly positioned authorities from among its peers to **pool funding** to make **joint procurement** of digital innovation technologies. These public authorities can also collaborate on a more long-term basis e.g., by sharing the same ICT team which would be too expensive or too complex for a single organisation to operate.

A public authority that is not funding-constrained can still choose to partner with another organisation (or organisations) in joint procurement as this can **reduce the cost of purchase**, leaving extra funds to develop other services.

In addition, public sector bodies should also explore new financing models for public procurement, for example, co-funding or co-creating digital innovation research with private sector entities under **public-private partnerships** to reduce the cost of innovation.

Action 4: Appoint a senior digitalisation leader to plan and oversee the digital transformation process

To plan for, and oversee the digital transformation process, the public authority should appoint a senior digital leader with extensive **knowledge and experience of digital transformation**. These officers are often titled *'Chief Digital Officer (CDO)', Chief Information Officer', or 'Chief Technology Officer'*.

As the delivery lead for digital transformation, this position's holder should have the capabilities to:

- Define a vision and strategic objectives for the organisation's digital transformation, in consultation from the public authority's leadership.

- Develop an implementation plan that covers key areas of the project such as costs, labour resources, delivery timelines and milestones.

- Communicate effectively with domain and technical specialists across different departments, as well as command support from the public authority's leadership at all levels.

- Understand how different digital technologies work and identify the right digital solutions to be deployed.

- Manage the implementation of the selected digitalisation projects and solutions and steer the organisation's direction on digital transformation.

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[9] Innovation Procurement Platform (innovation-procurement.org)

[10] The Digital Europe Programme | Shaping Europe's digital future (europa.eu)

[11] EU funding opportunities for PCP and PPI | Shaping Europe's digital future (europa.eu)

- Understand at a strategic level and a technical level the value of data. Identify opportunities linked to data to be exploited in support of digital transformation.

- Identify potential risks to digital transformation and put in place relevant mitigation measures.

- Understand the key steps to implement digital innovation in an organisation, including assessing the impact of the intervention.

The CDO will have to assemble and lead a multidisciplinary team of skilled experts – e.g., data scientists, ICT engineers, and human insights sociologists, and product designers – to address these points and collectively deliver digital innovation projects in the public authority.

It is also important that the CDO has the authority to work with key managerial staff across the public authority's different departments, make strategic digital-related decisions, in addition to having the support of the organisation's top leadership.

Phase 2

3.2   Changing the government structure

Action 1: Create a digital vision and strategy

To steer the direction of its digital transformation, the public authority should **develop a digital vision** that sets out what the organisation and the local area want to achieve through digital transformation in the long term.

While this vision is articulated and understood within the local context, the local public authority must also **interpret and integrate in this vision the relevant national digital policy principles and priorities** to avoid intergovernmental conflict on policy. For example, national policy on internet broadband coverage for households and online public service provision targets should be accounted for. In some cases, the public authority may leverage some of these higher government level directives to access funds for local use on digitalisation projects.

Several EU programmes, national, and non-governmental initiatives promoting digital transformation in public service offer resources on developing a public authority's digital strategy and policy guidance,[12] such as was provided to dozens of European cities under the Digital Cities Challenge.[13] Other commercial and non-commercial systems also provide digital transformation tools, including on strategy development, e.g., the Digital Transformation Learning Tool[14] which provides an extensive framework and courses on organisations can go about implementing digital translation.

To build a common vision and secure extensive buy-in from different stakeholders, the local government should bring together a **wide range of stakeholders** from across the public and private sectors to discuss common expectations and competing requests, as well as the role digitalisation can play towards achieving stakeholder goals.

Action 2: Define specific goals and objectives

When a collective digital vision is created, the public authority should define specific goals to be achieved through digital transformation. The organisation should set **staged targets that are achievable within specified timeframes**. These should be based on the significance of the local challenges, the organisation's digital maturity level, as well as the funding and resources available.

Priority should be focussed on areas that are more amenable to change and with the potential to create the most value and result in a bigger positive impact on the system. To avoid duplicating efforts and unnecessary competing for resources, the implementation team needs to run a series of **cross-departmental consultations** to coordinate and align different departments' objectives holistically to ensure they are contributing towards the same overall digital vision. This will also unlock synergies, e.g., through elimination of role duplication.

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[12] [Digital transition in cities | European Commission (europa.eu)](europa.eu)

[13] [The Digital Cities Challenge – Designing Digital Transformation Strategies for EU Cities in the 21st Century (intelligentcitieschallenge.eu)](intelligentcitieschallenge.eu)

[14] [Course: Digital Transformation: Strategy Development (digital-transformation-tool.eu)](digital-transformation-tool.eu)

Action 3: Formulate an agile framework of actions

When the vision and specific goals are defined, the next step is to develop a **framework of actions for digital transformation**. As the COVID-19 pandemic recently highlighted, it is important to build institutional resilience to cope with unexpected shocks. The public authority should account for flexibility and adaptability when developing its action plans.

This means, for example, including in the framework a **review and feedback mechanism** so that improvement to the process can be undertaken in future as the need arises. For instance, for implementing digital solutions or organisational change, actions taken should allow for future changes such as increasing system capacity and adapting existing functions.

In addition, the framework of actions should not aim to provide a once-and-for-all type of solution, instead, it should allow for **incremental digital transformation** with built-in feedback loops informing interactive processes over time. This **agile approach** allows for reviewing, learning, and improving during project delivery.

Action 4: De-silo the organisation's structure to facilitate cross-departmental and interdisciplinary collaboration

To enable a smooth digital transformation, the public authority needs to **dismantle the siloed organisational structure** to foster collaboration within and across service areas.

First, a **representative cross-departmental and multi-disciplinary team** needs to be set up to identify opportunities to de-silo the organisation. These silos may be due to a lack of standardised processes, limited channels for communication and data sharing, as well as an overly decentralised decision-making process in the organisation.

When the silos are identified, the delivery team needs to explore how the organisation's structure should be reorganised to facilitate digital transformation, as well as how digital solutions could help de-silo the current organisational structure. For instance, the team should **streamline and standardise cumbersome processes** such as procurement that can vary across departments.

In addition, the delivery team should also create mechanisms to facilitate **data and resource sharing** across departments. The cross-departmental communication platform can be organised as a working group tasked with identifying areas for collaboration across departments and with stakeholders from outside the organisation.

Action 5: Adopt an outcomes-based approach and define Key Performance Indicators (KPIs)

Compared with traditional output-driven approaches that pay less attention to impact, adopting an outcome-based approach will allow the public authority to measure and maximise the impacts from policy intervention actions taken.

Not only does it require a change of traditional mindset from just getting things done towards efficiently getting the most out of the work completed, it also requires the public authority to **adopt KPIs to measure the success of policy interventions**.

Subject to different types of actions taken, new KPIs should be able capture the wider economic, social, and environmental impact. For instance, they could include the return on investment (ROI) in digital adoption, citizen-to-citizen social interactions enabled by government digital platforms, reliability of digital solutions, digital capacity enhancement, institutional productivity improvement, number of citizens engaged, user satisfaction, and direct or indirect carbon reduction in the local area.

3.3 Building government capacity

Action 1: Review the current status of the public authority's skills and capacity

The public authority should identify the organisation's **digital skills and capacity gaps**. To do that, conduct an in-depth survey of existing staff to understand the digital literacy level across the organisation.

Once an understanding is gained, the next step is to compare it with the digital vision and objectives to identify the current gaps in skills and capacity, and then decide what digital roles and expertise need to be brought into the organisation to support the digital transformation process.

Action 2: Bring in new roles and expertise

The public authority should bring in **new staff to fill roles missing expertise** needed to operationalise digital innovation projects. Subject to the organisation's digital maturity level and the budget available, these new roles could be recruited on a permanent or contractual basis.

Additionally, increasing reliance on data means that organisations now need access to data specialists such as **data engineers**, **data scientists, and digital product designers** to inform the procurement process and to process and interpret growing amounts of raw data. Indeed, some of the larger cities and regional level public authorities already have highly skilled data management and analytics teams.

To ensure that digital transformation is consistent with **user-centric design** requirements, the public authority needs to bring in roles such as human behavioural insights among service designers to improve the user experience of their digital products.

Furthermore, to ensure that the organisation keeps pace with **emerging technology** innovations, it is important to retain the services of **technology specialists** with knowledge and expertise in more advanced and fast-changing technologies, such as **5G, AI, big data, blockchain,** and **predictive analytics,** to name just a few.

Action 3: Provide digital training to upskill staff and citizens

In addition to adding new digital roles, the public authority should also provide **digital skills training to staff** to ensure that it is staffed with a digital-literate workforce competent enough to operate its digital systems, as well as to be receptive to emerging innovations.

This may include **bespoke advanced training** provided by the digital solution suppliers on how to manage and use the new systems and tools, but also more basic digital training to improve the general digital literacy across the organisation.

Instead of providing one-off training, this training should be arranged in a series of **regular training sessions** depending on need and in accordance with the staged digital transformation plans and the actual implementation progress.

In some cases, it will be necessary for the public authority to provide **training to citizens** and other stakeholders on how to use its **digital services**.

For technology to have the desired impact, the population must also have the skills to use it. The inadequacy of digital skills in society, be it among citizens using digital services or government employees providing these services, remains a barrier at the local, regional, national, and global levels.

The public authority must tackle this problem with determination by providing training to those who need it. It may have to coordinate with regional and national governments to allocate funding to local education centres to provide relevant digital training under multiple formats, e.g., evening and weekend classes for citizens in full-time employment. Skills training support is available via the EU's various funding vehicles, e.g., the DIGITAL Europe Programme[15] also supports the upskilling of the workforce by funding traineeships in key areas relevant for digital transformation – data analytics, AI, cybersecurity etc,

3.4   Changing government processes, service design and delivery

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[15] Skills in the DIGITAL Europe programme | Shaping Europe's digital future (europa.eu)

Action 1: Understand the current organisational performance and identify areas for change

Internal government operations and service delivery are ripe for digital transformation. Therefore, it is important for the public authority to fully **evaluate its current performance** on digitalisation. This will identify areas for change, improvement as well as establish baseline metrics against which to compare future performance.

The public authority should assess the status of its current digital system. For example:

- Does the organisation run a centrally managed system or is management decentralised to independent service areas?

- Is its design citizen-centric, designed to maximise internal organisation efficiency, or both?

- Is the system sustainable and designed to integrate future technologies?

- Is it an open platform that can handle common data formats and open source software or is it a closed system that only works with proprietary and access-restricted technology?

- Is it highly automated, semi-automated or does it rely on a high degree manual operation?

- Does it deliver value for money?

- Are there areas for improvement?

Answers to such questions will reveal the **extent of policy intervention** needed to for digital transformation to succeed. For example, if digital versions of services are only being accessed by a small number of citizens, there is a need to find out why and what can be done to make these services more citizen-centric, attractive, and usable by all stakeholders. This may be achieved through more citizen consultations during the design and test phases of online services.

Action 2: Streamline internal processes and promote interoperability of systems across departments

Inadequate coordination across departments leads to the establishment of parallel systems within the same organisation. Often, because these systems are not interoperable, the same functions and systems are replicated at avoidable cost to the organisation.

The public authority should **streamline its processes and remove unnecessary duplicate roles and steps** in the organisation. This action will be easier by enforcing common data and software standards designed to facilitate interoperability across systems. Where possible, processes should be automated, e.g., the regular production of reports on the performance of remotely monitored streetlights. The resulting operational efficiency gains improve resource allocation and lead to a more integrated organisation.

The public authority should ensure that **interoperability of systems and applications** is a key part of its digital innovation strategy framework, and enforce this requirement internally, in external collaborations, and in contracts with third party service providers. This will minimise the risk of the organisation being 'locked-in' to specific suppliers and technology which may become obsolete in future. Digital systems installed should be interoperable with other applications and adaptable across time.

The organisation's approach towards **interoperability should be refocussed from software-driven towards data-driven**, with *open data standards* and following the Minimum Interoperability Mechanisms (MIMs)[16] approach developed by the Open & Agile Smart Cities network. MIMs are a set of practical capabilities based on open technical specifications that allow cities and communities to replicate and scale solutions globally. The public authority may have to adapt its approach to meet national level government data standards set to facilitate intergovernmental data exchange and interoperability.

Action 3: Improve data management

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[16] MIMs - Open & Agile Smart Cities (oascities.org)

Adoption of emerging technologies, open data systems, and urban data platforms will improve (automated) communication and efficiency across the public authority as well as with its external partners and its services consumers in the community.

The public authority should consolidate its data, e.g., by using cloud computing servers, so that it is accessible to both internal users and external stakeholders - other public entities, developers, universities, and businesses etc. Developing a **central data platform** for the organisation will facilitate real-time data processing and access and enable the integration of datasets from the different sources such as departments. Furthermore, access to public data will provide opportunities for innovators to create new businesses and services in smart mobility, energy management, and environment, to name just a few. Overall, **data must be well-managed** if its full value is to be unlocked through its commercialisation or simply processed and shared to inform the decision-making process in the public authority.

To instil the right habits on data management, the public authority's policies and strategies must facilitate a data management system that is flexible and as 'future-proof' as possible so that emerging innovations can be adopted easily. If necessary, the public authority should engage private sector expertise to establish these data management processes.

Action 4: Invest in innovative technologies and improve connectivity infrastructure

5G, Artificial Intelligence (AI), Smart Cities, Blockchain, Cloud Computing, Cyber Security, Robotics and Automation, Digital Twin, Internet of Things (IoT), Open Government Data, Application Programming Interface (API), and Geo-spatial Data exploitation systems are some of the emerging innovative enabling technologies. Public authorities should adopt these innovative technologies for their potential to improve system-wide efficiency and unlock value on the back of the emerging **data-driven economy**.

A capacity-constrained public authority should partner with wealthier peers, usually large metropolitan or capital city authorities, more likely to be up to date with these newer technologies.

The public authority should join co-development and sharing networks to learn about the latest technologies. In the case of **public-private partnerships**, these should be constructed to ensure that the public authority benefits from these technologies. Group purchases between public authorities and public-private partnership can reduce the technology costs. The most impactful technology such as 5G connectivity, smart city, and IoT infrastructure should be prioritised because of they can have a **multiplier effect on value creation** by unlocking many other innovations relying on real-time access to huge amounts of data.

The **digital twin innovation** is showing great potential and is an important component of smart city digital transformation processes. The combination of digital twin technology with other cutting-edge technologies – AI, IoT, the predictive power of big data, and 5G networks - has the potential to significantly improve cities' operational efficiency. These technologies are collectively important to the growth of **smart cities** for which free guidance on planning and implementation is readily accessible.[17]

Ubiquitous and stable connectivity is essential to the functioning of many digital platforms. To meet this requirement, the public authority must prioritise the deployment of systemically critical infrastructure such as for connectivity - Fibre Optics and Wi-Fi public networks - from the start of the digital transformation journey. This will enable the city and its stakeholders to deploy mature technologies for use, and test new innovations of services.

Infrastructure such as 5G connectivity is expected to unleash growth in connected technology applications, lead to improvements in mobility and remote infrastructure management, and have a substantial positive impact on productivity and economic growth. As such, it is important that the public authority supports the development and testing of these technologies as well as integrate them into their systems for their benefits.

Where a technology requires infrastructure that is outside the public authority's jurisdiction, the public authority should coordinate with the relevant authority to facilitate the technology in question. For example, a

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[17] Smart City Guidance Package | Smart Cities Marketplace (europa.eu)

small rural government may delegate to a higher regional government level decisions on fibre-optic infrastructure.

Action 5: Adopt advanced methods and principles

Technology allows users to do more with less but increasing complexity and the ever-growing amounts of data handled can also overwhelm users. **Adopting advanced methods** and principles offers a way to efficiently manage increasingly complex systems.

The public authority should adopt advanced methods such as the once-only principle, open data platform, interoperable digital systems, open source software, solutions sharing, and common standards on code and data formats. An example of the Once-Only principle is where a government implements a central portal with a single point to access multiple public services — systems in Estonia (Eesti.ee), Finland (Suomi.fi), and the UK (gov.uk), among others, exemplify this principle. If widely adopted by many organisations, some of these methods have the potential to strengthen the networks through which public authorities interact to optimise resource allocation, learn from each other, and solve common problems.

The public authority should also build within its systems a mechanism to allow feedback to be exchanged across stakeholder relationships. This should allow peers, civic participants, and business partners to communicate with the organisation in a way that allows it to adopt useful technology and for citizens to influence the digital transformation process.

This knowledge sharing and dynamic flow of automatic feedback should mitigate the risk that the public authority's strategists and technicians become overwhelmed by huge amounts of data and the system's complexity. Technology should serve the people, not the other way around.

Action 6: Use digital technologies to improve societal engagement and engage end-users in the design of digital systems and services

Societal engagement spans the breadth of government-stakeholder interactions through consultations, co-creation of digital services, e-participation by citizens, and communication through digital channels such as social media. The public authority should adopt and staff these technologies. Efficient social engagement can facilitate a quick turnaround from reviewing a service to improving it. For example, using social media for real-time services updates and chatbots for instant feedback reduces the time (and likely the cost) it takes to inform citizens of the status of services. This can improve citizen satisfaction as well as transparency and trust in government institutions.

As part of the strategy to ensure a citizen-centric approach to digital transformation, the public authority should set up digital platforms to engage end-users, citizens, promote e-participation and improve communication channels. Engagement channels such as surveys on user satisfaction enable a feedback-loop for the government to examine and improve operations and services over time.

The public authority should **co-develop with citizens and other end-users** roadmaps and solutions to address current and future needs of citizens, its workers, and others with a stake in its area. Some of the emerging digital technologies allow interactive government-citizen participation with automated response, for example, when a citizen informs authorities about a road traffic incident that automatically triggers a response from the emergency services.

The public authority should **ensure accessibility of digital services** to all to avoid a "digital divide" that often neglects the digital service needs of vulnerable population groups - the elderly, people with disabilities, or those with limited financial means. Additionally, the public authority should organise regular events such as the increasingly popular *Digital Week* to engage society on key themes such as acquiring skills for the digital age. The Week consists of a series of events to promote digital inclusion, digital culture, and sustainability.

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

Scaling governments and markets looks at government activity and market forces which, due to their size, have a scaled-up impact on digital transformation.

For example, multi-level integration of digital systems and strong collaboration networks of public authorities operating in an environment of inclusive markets can facilitate the diffusion of innovative solutions through the public sector, including to local governments.

> **Action 1:** Map the digital innovation ecosystem. Identify peer public authorities sharing similar challenges. What are the criteria based on which peers can work together to improve their digital innovation offering?

Having limited capacity means that a public authority is unlikely to achieve digital transformation without outside assistance such as working with partners. Therefore, the organisation must identify partners and map their roles in the innovation ecosystem.

The goal is to support the establishment of a sustainable innovation ecosystem that generates solutions to the public authority's needs. This ecosystem's stakeholders include, but are not limited to, citizens, businesses, and educational institutions.

The public authority should develop a strategy on how to best leverage markets and its relationships with other organisations to achieve its digital innovation goals. This strategy should clarify the criteria for partnering with other organisations - for example, does the partnership have a net-positive impact on the authority's digital transformation? Does the partnership benefit the local economy?

Public authorities often play similar roles in society, especially if they operate at the same administrative level - local, regional, or national. As such, many face common challenges which can be addressed collaboratively.

A public authority that has identified its challenges should shortlist candidates for partnering on projects from its networks of associations and memberships.

In most cases public authorities work best together if they are not too different in profile and needs. For example, a city of 50 thousand residents would likely struggle in a partnership with a peer city of 4 million people.

To this end, the public authority should establish partnerships with others in its area and beyond that are best suited to addressing its challenges. These partnerships should have a clear structure organised around its objectives.

For small towns with small-scale operations, vertical partnerships should also be considered, e.g., between a town and a region or province, if this enables the much smaller town access to resources.

> **Action 2:** Participate in pilot projects and testbeds to influence the potential solutions at the design and test stages before they are adopted at scale

The public authority should participate in the innovation ecosystem to influence potential solutions as they are being developed as opposed to just modifying off-the-shelf products. For example, hackathons with internal and external participants offer a viable platform.

Before embarking on a major digitalisation project, the public authority should run a small-scale **pilot project** to test different strategies until a refined strategy is developed to guide implementation of the real large-scale project. Testbed programmes should be established across the organisation's different thematic areas, smart mobility, learning, health, well-being, circular economy, and energy efficiency, with the objective to use technology to address current and emerging challenges.

Even the smaller public authorities should seek to participate in innovation programmes addressing public services challenges they face. Such programmes may be coordinated by larger city-scale governments, or

at the regional, national, or international levels. Notably, the numerous EU funding streams such as Horizon 2020 and Horizon Europe provide many collaboration opportunities.

Action 3:   Create or join sharing platforms and leverage the power of network effects

The DIGISER project has found a link between the digital maturity level of public authority and whether it belongs to a network of organisations. Clearly, public authorities benefit from interacting with and learning from other organisations. The public authority should form or join platforms and networks with other organisations to exchange best practice ideas and solutions to common challenges and adapt them to its own local circumstances instead of simply copying.

Participation in such networks is also a potential source of partners of public authorities with whom to pool funding for common projects, rather than competing for scarce resources. A well-structured governance framework for a co-developed project can provide a viable basis for establishing interoperability and common standards across the systems of the public authorities involved. In addition, the economies of scale from cooperating on innovation procurement can be amplified resulting in an even bigger positive impact on the public authorities' economies.[18]

Beyond associations with peers, the public authority should also join the networks of non-governmental organisations specialising in addressing public sector issues such as on digitalisation. For example, the Open & Agile Smart Cities (OASC) as well as numerous other programmes contribute towards advancing city digital transformation. Digital bridges with advanced digital-mature cities and excellent global stakeholders encourage the sharing of best practices and peer-to-peer learning processes.[19]

The living-in.eu[20] movement, a joint initiative of European networks of organisations and institutions provides a broad range of digital solutions to cities and communities. Examples of solutions on offer include assistance with setting up urban data platforms[21] operating on open standards to facilitate interoperability with other systems. The cities of Milan in Italy, Valencia in Spain, and Lyon in France are already either using or implementing this solution. Other examples include assistance with contract clauses for the procurement of ethical AI based on the good practices of the City of Amsterdam, and networks of cities working on local digital twins[22] which have the potential to bring cost and operational efficiencies.

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[18] Policy Brief - Digital Innovation in Urban Environments

[19] https://www2.itif.org/2018-gtipa-summit-roberta-cocco.pdf

[20] Join us in building the European way of Digital Transformation for 300 million Europeans | Living in EU (living-in.eu)

[21] Urban Data Platform | Living in EU (living-in.eu)

[22] Local Digital Twin | Living in EU (living-in.eu)

Phase 3

3.6   Evaluation and impact assessment

Action 1: Adopt an iterative methodology throughout the whole digital transformation process

Policy making yields better outcomes when it is evidence-based and built around a clear mission with measurable results at various stages of implementation.

Digital transformation is a process that takes several stages and may happen over many years; therefore, the public authority should break down this process into manageable projects.

These projects should be undertaken either sequentially or concurrently, depending on project type, the needs, and constraints faced by the public authority.

The project must have pre-set objectives to be achieved by predetermined points in future. **Review of project progress** should be planned into the implementation stages to allow for quality assurance checks.

Applying the **iterative approach** to delivering digital transformation will allow the public authority to learn from experience, make incremental improvements, as well as to integrate into its systems innovations as they emerge on the market.

Action 2: Monitor key performance indicators (KPIs) and the evaluation of social, environmental, and economic impacts

The public authority should **shortlist key performance indicators** to monitor and create an objective view of progress towards its objectives.

Regular reviews of project progress and insights from KPIs should feed back into updates of the project's design and implementation of the strategy, with the process iterated until the project achieves its objectives.

The public authority should undertake an **impact assessment** of the project to determine whether the intervention has achieved its goals. It should be designed to benefit the public authority, citizens, and other stakeholders such as investors and SMEs.

Secondly, the impact assessment should also evaluate the broader effects of the intervention at social, environmental, and economic levels.

Social impacts could consider health, well-being, relationships, education and skills, citizen engagement, and crime and safety. **Environmental impacts** may include greenhouse gas emissions, air quality, water quality, waste, noise, green space, biodiversity, and resource depletion. **Economic impacts** may cover employment, tax revenue, productivity, travel time savings, property values, and economic growth. Figure 2 is a logic model for an impact assessment framework which should be customised to the public authority's profile.
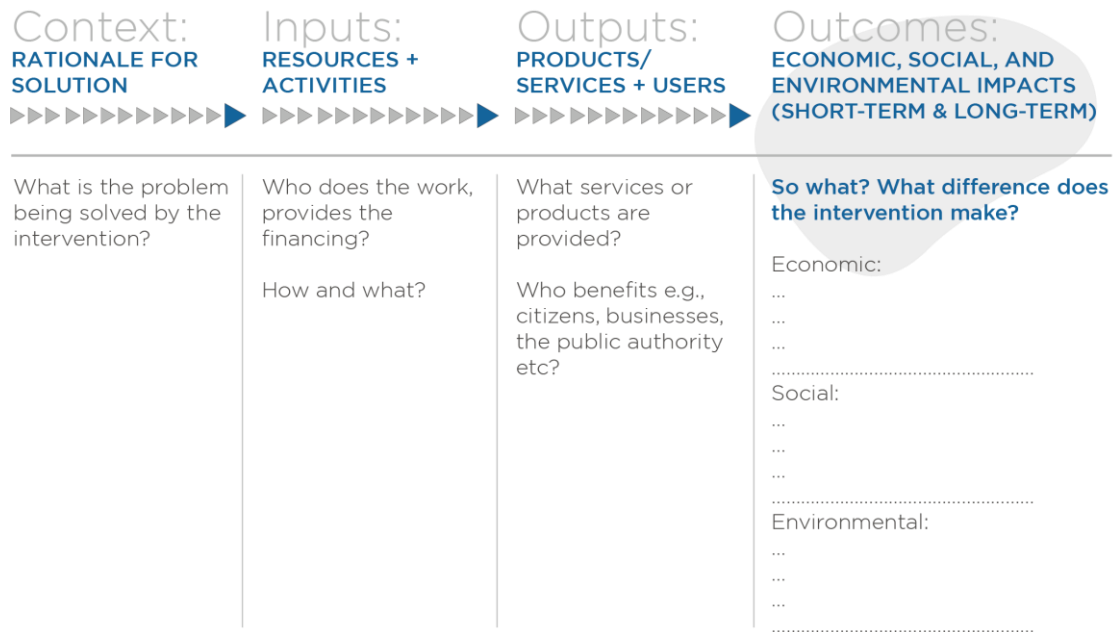
Context: RATIONALE FOR SOLUTION ▶▶▶ ▶▶▶▶▶▶▶▶▶▶	Inputs: RESOURCES + ACTIVITIES ▶▶▶ ▶▶▶▶▶▶▶▶▶▶	Outputs: PRODUCTS/ SERVICES + USERS ▶▶▶ ▶▶▶▶▶▶▶▶▶▶	Outcomes: ECONOMIC, SOCIAL, AND ENVIRONMENTAL IMPACTS (SHORT-TERM & LONG-TERM)
What is the problem being solved by the intervention?	Who does the work, provides the financing? How and what?	What services or products are provided? Who benefits e.g., citizens, businesses, the public authority etc?	So what? What difference does the intervention make? Economic: ... ... Social: ... ... Environmental: ... ...

Figure 2: Logic model for an impact assessment framework

4 Conclusion

On-going technological advances in computing and data analytics present opportunities to transform society on several fronts. In the public service sector, this technological revolution has the potential to underpin fundamental progress in how government works, how and what services are provided to citizens, and increase the contribution of government to broader social, economic, and environmental outcomes. For these benefits to be realised, governments need to overcome challenges linked to digital transformation. This handbook provides guidance on implementing a set of policy recommendations that address challenges faced by local authorities in the course of implementing digital transformation.

In the handbook, four areas were presented in which local public authorities face major challenges related to the digitalisation transformation process: changing the government structure, institutional capacity and skills, government processes; service design and delivery, and the need to scale governments and markets to realise the full benefits of the digital revolution.

The handbook also recommends step-by-step actionable guidance to the policy makers on how to address specific these barriers linked to each four challenges.

The guidance provided aims to be practical, and thus can be thought of as three phases of implementing a digital innovation project (or projects) as part of the digital transformation process.

In phase 1, the public authority carries out the preparatory work of developing its vision and overall digital strategy, as well as appointing key staff such as the Chief Digital Officer to oversee the digital transformation process.

Phase 2 is where the actual barriers are addressed. As part of the DIGISER project, four key areas were identified as posing the greatest challenges to digitalising local governments such as towns, cities, and regions. These areas are about:

- Changing government structures and policies towards enabling digitalisation,

- Building government capacity and skills,

- Changing government processes, service design and delivery as digital innovation adopters, and

- Leveraging the governments and markets to scale up digital transformation.

Actions to address related challenges may not be implemented in the order they are presented rather, they should be implemented according to the challenges, digital maturity, and capacity of the public authority in question.

Phase 3 is a review phase to assess the impact of the intervention steps taken and identify where further action is needed.

Digital transformation is a process that can take several stages and depending on the digital maturity of a public authority it may take years. Therefore, the public authority should break down this process into manageable projects. Some of the key actions that the public authority should undertake include:

- As a first step in this journey, developing a comprehensive understanding of local challenges and articulating a high-level vision of how they can be addressed through digitalisation. The public authority should develop an evaluation framework to assess both its overall and domain-specific current digital maturity levels currently.

- Access to funding is among the common reasons given for why local authorities are not adopting digital innovations. A resource-constrained public authority should seek out similarly positioned authorities from among its peers to pool funding.

- To plan and oversee the digital transformation, the public authority should appoint a senior digital leader with extensive knowledge and experience across the digital transformation cycle.

- In addition, to enable a smooth digital transformation, the public authority needs to dismantle the siloed organisational structure to facilitate collaboration within and across departments and service areas.

- The public authority should identify the organisation's digital skills and capacity gaps and in addition to adding new digital roles, the public authority should also provide digital training for existing staff to equip the organisation with the digital skills needed for the daily operation of new systems and services.

- Adoption of emerging technologies, open data systems, and urban data platforms will improve communication across the public authority as well as with its external partners and its services consumers in the community. The public authority should co-develop with citizens and other end-users' roadmaps and solutions to address current and future needs of citizens, its workers, and others with a stake in its area.

- And finally, the public authority should identify key performance indicators to be monitored to characterise the project's progress towards its objectives.

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: • 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 crowd-funding
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/e/espon

FIWARE Foundation	The FIWARE Foundation brings a curated framework of open-source platform components which can be assembled together, 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 a number of 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 and 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.