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AI and GenAI adoption by local and regional administrations

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This report was written by
Susanna Fontana, Beatrice Errico, Sara Tedesco, Fabio Bisogni (Fondazione FORMIT),
Robin Renwick, Mikio Akagi, Nicole Santiago (Trilateral Research Limited).

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List of acronyms

AI	Artificial Intelligence
AI4Gov	Trusted AI for Transparent Public Governance fostering Democratic Values
AI HLEG	High-Level Expert Group on Artificial Intelligence
AIDA	Artificial Intelligent in the Digital Age
AIoD	AI-on-Demand Platform
ALTAI	Assessment List for Trustworthy AI
AMTEGA	Agency for the Technological Modernisation of Galicia
AR	Augmented Reality
ARISA	Artificial Intelligence Skills Alliance
BMA	Better Mobility Accelerator
CML	Lisbon City Council
CO2	Carbon Dioxide
CoR	European Committee of the Regions
COVID-19	Coronavirus disease of 2019
DA	Data Act
DEET	Tertiary Eco-Energy Scheme
DESI	Digital Economy and Society Index
DGA	Data Governance Act
DIAT	Demonstrators of frugal artificial intelligence at the service of the ecological transition of territories
DIGIT	European Commission's Directorate-General for Informatics
EC	European Commission
ECON	Commission for Economic Policy of the European Committee of the Regions
EIF	European Interoperability Framework
EIT	European Institution of Innovation & Technology
ELAN	French Law on changes in housing, land management and digital technology
ERDF	European Regional Development Fund
ESF+	European Social Fund Plus
EU	European Union
GAIS	Galician Artificial Intelligence Strategy
G2B	Government-to-Business
G2C	Government-to-Citizen
G2G	Government-to-Government
GDPR	General Data Protection Regulation
GenAI	Generative Artificial Intelligence
GovTech	Government Technology
GPS	Global Positioning System

HIP	Hydrological Information and forecasting system
HoWest	The Digital Arts and Entertainment programme
ICT	Information and Communication Technologies
IoT	Internet of Things
IP	Intellectual Property
IT	Information Technology
JRC	European Commission's Joint Research Centre
KL	Local Government Denmark
KPI	Key Performance Indicator
LIFE	Programme for the Environment and Climate Action
LLM	Large Learning Model
LRAs	Local and Regional Authorities
LPR	License Plate Recognition
ML	Machine Learning
NO2	Nitrogen Dioxide
OCR	Optical Character Recognition
ODPTP	On-demand Public Transportation Platform
OECD	Organisation for Economic Co-operation and Development
PA	Public Authority
PCR	Polymerase Chain Reaction
PSI Directive	Directive on the re-use of public sector information
PSTW	Public Sector Tech Watch
R&D	Research and Development
RDI	Research, Development, and Innovation
RECITAL	Immediate and Long-Term Energy Reduction
RRF	Recovery and Resilience Facility
SaaS	Software-as-a-service
SCAIS	Sustainability Criteria and Indicators for Artificial Intelligence Systems
SDA	Sofia Development Association
SDG	Sustainable Development Goal
SDS	Spanish Digital Strategy
SEDEC	Commission for Social Policy, Education, Employment, Research and Culture of the European Committee of the Regions
SMEs	Small and Medium Enterprises
Snia	French National Strategy for Artificial Intelligence
TOE	Technology-Organisation-Environment
TSI	Technical Support Instrument
UIA	Urban Innovative Action
US	United States of America
WEF	World Economic Forum

XAI	Explainable AI

Executive Summary

Artificial Intelligence (AI) is integrated in several sectors of society and its role and influence on economic and social domains are expected to increase in the years to come. The urge for a regulatory framework to support its assimilation became evident at European level. For this reason, the European Union adopted the AI Act (Regulation 1689/2024), which will be an influential reference in guiding the adoption and implementation of AI at European level and beyond due to its innovativeness and scale of application.

Background and objective of this study

The recently adopted European regulation offers a definition of AI, a term coined in the 1950s but whose boundaries are not conclusively defined. In the AI Act, the definition of AI is not limited to a single technological application but extends to all machine-based systems capable of adaptive behaviour that share the ability to generate outputs of various typologies following the processing of received inputs. The GenAI subcategory is related to systems characterised by the ability to generate new content, supporting activities ranging from text generation to predictive analysis.

In this respect, there is much potential for the fruitful exploitation of AI by the public sector. Despite to date it is noted that AI is most widely employed at national level around Europe, exploitation of AI by local and regional authorities (LRAs, also known as subnational authorities) – as the closest level to citizens - is essential to foster the spreading and public acceptance of this technology. The benefits that AI could bring to local public administrations are varied and range from improving the efficiency of internal organisation to enhancing the interaction between the government and citizenship and to supporting decision-making processes. On the opposite side, the risks involved in the use of this technology are various and derive from operational, strategic and ethical challenges.

With the aim of delving deeper into the opportunities and challenges that European subnational authorities face with respect to AI and GenAI technologies, this study draws and expands on research conducted to date on their adoption at local and regional level.

Methodology

The study is built upon a systematic review of academic research, legislation and practices related to the adoption of AI at subnational level. Further analysis has been conducted through evidence-based observations stemming from primary

data on the current state of play of AI adoption at local and regional level. Data was collected through an online survey targeting LRAs and launched in September 2024. The survey aimed at exploring the details of the concrete uptake of AI by local administrations, investigating aspects such as who promoted its adoption within the organisation, and their expectations and opinions on the future of AI use at subnational level. Additional primary data have been consolidated from interviews conducted to build eight case studies, as well as from experts who not only have expertise in AI but also have a deep understanding of its implementation in public administration settings. Lastly, in order to contribute to the academic and policy debate on the future adoption of AI with original, evidence-based insights, this study provides action-oriented recommendations based on the study findings and on a foresight analysis. This latter analysis is intended to offer an overview of possible developments of the AI in the near future.

The methodological approach used to conduct this study comprised the following steps:

- A literature review about the state of play of AI and GenAI adoption at local and regional level, with special reference to the previous recent research results achieved in this area.
- Data collection through an online survey to gather evidence on the characteristics, drivers and barriers of AI use amongst LRAs. The survey results are interpreted with a focus on the demographic size and the geographical area in which LRAs are located.
- Identification and analysis of AI-based solutions that are led by local and regional administrations to explore the critical factors that contribute to the successful adoption and implementation of the technology at subnational level.
- Foresight analysis based on the consolidation of (1) the AI trends identified by the LRAs that participated in the survey, (2) the Horizon Scanning for the relevant weak signals detection and (3) the Megatrend analysis.
- Drafting of political and operational recommendations to the European Union, as well as the Member States and the LRAs.

Report structure

The study is structured in three parts.

Part 1 is divided in two main sections. The first section offers a high-level summary of research on the use of AI in the public sector. An overview of the uses of AI in the public sector and a summary of the academic research on the topic is therefore provided. Specific emphasis is posed on topical aspects such as

the factors that enable or hinder AI adoption, citizen acceptance and the perceived risks of public sector AI. The second section has the objective of offering an overview of the current state-of-play of AI adoption by the public sector at the subnational level across the EU Member States and draws conclusions based on the analysis of the responses of the online survey submitted to LRAs in all 27 EU Member States. The survey results were divided for analysis into four areas to investigate AI adoption and implementation processes in relation to aspects of the internal organisation of local public authorities and their relationship with the ecosystem in which they are integrated.

Part 2 explores the factors for the successful AI adoption at the local and regional level. The section is based on the elaboration of primary data collected through qualitative research. In more detail, information is gathered from interviews with officials at the local and regional level and experts from academia and research centres. Interviewees contributed to enriching the analysis by sharing the theoretical knowledge and practical insights based on their professional experience into AI's role in local and regional governance. The factors that contribute to the successful adoption and implementation of AI technologies are analysed through the lens of the Technology-Organisation-Environment (TOE) framework. Elements considered to be of relevance for the successful use of AI include: the volume of investments, both from the public sector (at regional, national or European levels) and the private sector; the degree of collaboration between public administration and private companies on the ground; and the concrete support provided by policy makers to digitisation projects. In addition, the importance of digital skills and a deep understanding of technological solutions by the personnel of the administrations is emphasised. Crucial also appears to be the involvement of citizens in the implementation of digital solutions. In conclusion, the potential scalability as a criterion for evaluating the success of a project is discussed.

Part 3 of the study is composed of two sections and is aimed at providing policy recommendations addressing relevant aspects of AI implementation. The first section is dedicated to the foresight analysis, the in-depth explanation of the components that comprised it and the exposition of the related results.

The foresight analysis focuses on possible future trends and unforeseen developments in AI technology. The analysis benefitted from the responses received to the online survey, that were clustered in ‘trends’ and used to derive insights and implication of AI for public administrations. Together with trends, the analysis made use of ‘weak signals’ and ‘megatrends’.

‘Weak signals’ are considered as emerging signals of development with a likely future impact, analysed through the technique of Horizon Scanning. In particular,

the weak signals relevant to the present research, as described in the 2021 JRC report, are: Ethical AI, Green AI, Smart cities and Edge AI. Finally, the analysis considered the 'megatrends', intended as long-term driving forces that are observable now and will continue to have a global impact in the future. Furthermore, it is postulated that megatrends can produce an effect on the trends, accelerating them and enhancing their impact.

Based on the development of the foresight analysis, in the second section proposals for political actions are advanced, directed to the EU, national governments of EU Member States and LRAs. The objective of the recommendations is to support a coordinated action on AI adoption for the public sector at local and regional level in the EU. Eight recommendations were developed on the basis of the integration of the results of the analyses carried out in the study and, in order to avoid redundancies, an overview of the recommendations issued so far on the implementation of AI in the public sector is provided beforehand. The recommendations cover various thematic areas, from monitoring and evaluation to regulatory support and the relationship between the political and technical layers.

Key findings

The overall results of the study present interesting data. The results of the online survey addressed to LRAs show a good adoption rate of AI at European level. Indeed, of the 153 answers received, around 27% of respondents report to be adopting AI solutions at present. According to the survey results, across European regions, the most common use of this technology is on 'AI-based services for the public administration' and the benefit most frequently reported by LRAs is represented by the 'optimisation of internal management'.

Considering the aspects on which priority action should be taken to facilitate the dissemination of the technology, the main challenges that LRAs face in the adoption and implementation phases relate to cross-cutting issues such as the 'lack of skills and expertise', 'budget constraints' and the 'lack of awareness and knowledge on standardisation processes'. On the other hand, responding LRAs identified the most relevant driver of AI adoption in the 'Improved Administrative Efficiency'.

The analysis of success factors for the AI and GenAI adoption took advantage of the eight case studies explored through the interviews with representatives of selected LRAs. As anticipated, different transversal factors enabling successful AI implementation have been investigated and reference to these case studies provides an understanding of the concrete facets and challenges faced by the local public authorities, starting from the infrastructural point of view to that of political

and regulatory support. In addition to the case studies, two initiatives analysed stand out for their innovativeness and potential as examples on AI governance and regulation carried out by LRAs: the development of a regional AI Law by the Agency for the Technological Modernisation of Galicia (AMTEGA) and the AI governance framework led by the Québec Innovation Council, a subnational authority based in Canada.

Amongst the elements that emerge as progressively important, particular reference was made to ethical considerations, also considering divergence in ethical principles amongst EU countries and to environmental sustainability, given the possibility for AI to simultaneously increase and reduce energy consumption and CO2 emissions. In addition, the development of smart cities and the integration of Edge AI have the potential to exponentially increase the use of the technology and serve most remote areas, thus encouraging the use of AI in different sectors and potentially addressing the digital divide.

Policy recommendations

The eight recommendations resulting from these considerations are directed to policy makers at different levels and reflect the need to support the development of the use of AI by LRAs from technological, social, political and ethical perspectives. The recommendations addressed to EU institutions concern the supporting role of monitoring and evaluation frameworks, legal structures represented by regulatory sandboxes and intersectoral partnerships. Member States are encouraged to support the application of regulatory sandboxes and partnerships, as well as to invest in research and innovation that promotes openness, data interoperability, scalability and public trust, without forgetting their critical role in encouraging digitally inclusive initiatives. Moreover, greater efforts by the EU and the Member States for fostering the AI employment for sustainability is also stressed. The recommendations to LRAs point towards greater involvement of citizens in the AI design process through co-creation practices. LRAs are also recommended to prioritise inclusive practices to address the digital divide and to improve cooperation amongst various internal departments.

Finally, with a view to further validate these results, a comparison between the latest JRC report (2024) on factors that influence public managers for the AI adoption and the findings of the present study is conducted. The results of both studies suggest recommending context-sensitive strategies to support the enhancement of digital skills, AI governance, and public acceptance.

Introduction

The AI Act (Regulation 1689/2024) defines AI as

'a machine-based system that is designed to operate with varying levels of autonomy and that may exhibit adaptiveness after deployment, and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments' (Article 3(1))

In the context of AI, GenAI systems are those that generate 'content', e.g. realistic text, images, illustrations, audio (including speech) or video, typically based on a user prompt. GenAI can refer to simple chatbots, but typically refers to what the AI Act calls 'general-purpose AI models':

'general-purpose AI model' means an AI model, including where such an AI model is trained with a large amount of data using self-supervision at scale, that displays significant generality and is capable of competently performing a wide range of distinct tasks regardless of the way the model is placed on the market and that can be integrated into a variety of downstream systems or applications, except AI models that are used for research, development or prototyping activities before they are placed on the market' (Article 3(63); see also Recitals 97–100)

It is widely believed that AI technologies, including GenAI, have the potential to benefit local and regional administrations. The 2021 opinion by the European Committee of the Regions (CoR) on the AI Act highlighted that:

'AI systems can play an important role in local and regional authorities' interaction with citizens and service provision. Furthermore, AI systems have the potential, among other things, to improve public-sector efficiency and help local and regional authorities to respond to the adjustments that need to take place at local and regional level in the context of the green and digital transitions. It is therefore important that the experience gained by local and regional authorities is actively used in the ongoing revision of the Regulation' (European Committee of the Regions, 2021, Policy Recommendations, point 6)

The same year, a European Parliament briefing on 'Artificial Intelligence and public services' (Timan, van Veenstra and Bodea, 2021) articulated a variety of benefits and risks of AI adoption for the provision of public services. The main benefits include (3–6):

- Improved efficiency and optimisation of internal processes, leading to increased economic growth and the creation of jobs (see also Purdy and Daugherty, 2016; Gartner, 2017);
- More accurate predictions and optimised workflows, such as algorithms that aim to predict which citizens are at risk of debt so that case workers can target pre-emptive interventions (see also Steen, Timan and van de Poel, 2021); and
- Better service delivery through personalisation, provided through chatbots or other personalised interfaces for citizens in web portals and apps (see also Eurofound, 2020).

These benefits are echoed in a report by AI Watch (EC Joint Research Centre, 2022b), which adds that AI systems can help public sector bodies by (12–13):

- Integrating data from different domains to better understand the impacts of decisions;
- Monitoring data concerning the regular or daily uses and processes to improve efficiency (e.g., energy consumption or traffic flow); and
- Simulating scenarios to aid decision-making by modelling possible outcomes (e.g. urban sustainable planning).

The European Parliament briefing (Timan, van Veenstra and Bodea, 2021) also identified several main risks of AI adoption in the public sector, in particular for AI technologies based on machine learning (ML). These risks include (6–7):

- Lack of transparency and explainability, since ML-based systems are often 'black box' technologies that produce outputs without explicit justifications or reasoning that can be easily reconstructed (see also BEUC, 2019);
- Dehumanisation, since AI technologies can contribute to systems with opaque processes, limited accountability or opportunities for redress, and fewer exceptions to the rules based on common sense or sympathy (see also Ananny and Crawford, 2016); and
- Discrimination due to biases in data and algorithmic assumptions (see also The Markup, 2020).

AI Watch reinforced these concerns, and noted additional risks (EC Joint Research Centre, 2022, 16–17):

- Job losses, since, contrary to some suggestions, it is not clear that all efficiencies will result in higher net employment (Tolan, *et al.*, 2021) and risks can be mitigated by initiatives such as job reallocation and re-training;

- Privacy violations, since the development of AI technology incentivises surveillance and the collection of large quantities of data; and
- Environmental damage, since AI technologies such as ML are computationally demanding and consume large amounts of energy (see Dhar, 2020).

Previous studies have examined the adoption of AI and GenAI technologies by LRAs and other public sector bodies in Europe. Two of the recent efforts to catalogue use cases of AI in the European public sector are represented by the work of AI Watch and, more recently, of Public Sector Tech Watch (PSTW).

AI Watch is a knowledge service provided by the European Commission's Joint Research Centre (JRC) since 2018. PSTW is an observatory co-established by the European Commission's Directorate-General for Informatics (DIGIT) and the JRC.

Since 2023, PSTW has combined the 686 cases collected by AI Watch with cases catalogued by the Innovative Public Sector Observatory to create a repository of over 1,300 cases of AI use in the public sector (as well as use cases of other innovative technologies, such as Blockchain; EC Directorate-General for Digital Services, 2024; EC Public Sector Tech Watch, n.d.).

Some examples of use cases detailed in a 2022 report (EC Joint Research Centre, 2022a, 48) are:

- Greece's 'Eva' system (case #2): a machine learning system trialled during the 2020 COVID-19 crisis, designed to allocate scarce PCR tests at border control points based on personal characteristics of travellers.
- Amsterdam's Object Detection Kit (case #5): a computer vision system that analyses images taken from vehicles around the city to identify garbage and dispatch garbage management services.
- The Finnish Tax Administration's captioning system (case #7): a speech-to-text system for improving accessibility and searchability.
- The Spanish Tax Agency's income estimation system (case #8): an automated reasoning system designed to predict the annual income of tax subjects (such as SMEs and self-employed individuals) who elect to pay their taxes in phases and do not declare an exact income in advance.

The PSTW repository includes cases from 33 European countries (including all EU Member States). Cases in the repository are frequently updated and are categorised according to the PSTW taxonomy. This taxonomy includes:

- **Organisation** features (such as the responsible organisation and governmental sector);
- **Service description** features (such as whether a system is in development, a pilot, etc. and whether it is designed to serve citizens, private organisations or other government bodies);
- **Value-of-service** features (such as personalisation, cost-reduction, improved transparency); and
- **Artificial intelligence** features (such as whether the system involves machine learning, natural language processing, connected and automated vehicles)[1].

By cataloguing features for each use case, the PSTW repository makes it possible for inquirers to answer various fine-grained questions about European AI adoption using its freely available online case viewer (EC Public Sector Tech Watch, n.d.).

According to PSTW[2], European States with the most repository use cases are: Italy (197), Germany (195), the Netherlands (191), the United Kingdom (117), Spain (114), Belgium (86), Estonia (81), Finland (74), France (72), Portugal (72), Norway (66), Denmark (62), Sweden (44), Poland (33), and Greece (32). Other included countries have fewer than 30 documented use cases each (EC Public Sector Tech Watch, n.d.).

While these numbers may give an impression of the relative adoption rates of AI by public administrations, there are limitations to the data collection approach and AI Watch cautions against making comparisons between countries, since there may be varying degrees of underreporting (EC Joint Research Centre, 2022a, 34–5).

AI Watch and PSTW also note that a majority of use cases occurs at the national level, as opposed to local, regional or international cases. It is plausible that this is because national governments have the most resources for AI tools (EC Joint Research Centre, 2022a, 37; EC Directorate-General for Digital Services, 2024, 53).

Nevertheless, we have seen rising rates of adoption of AI by LRAs facilitated, in some cases, by private services and open-source options (EC Joint Research Centre, 2022a, 45). Both local and regional use cases have gained in their share of described cases, rising from 27% to 33% and 10% to 11%, respectively, since 2022 (EC Joint Research Centre, 2022a, 36; EC Public Sector Tech Watch, n.d.).

[1] For further details, see EC Joint Research Centre, 2022a, 30–34; EC Directorate-General for Digital Services, 2024, 36–42.
[2] Last update: December 4, 2024.

The most common governmental sector to be augmented by AI technologies is 'general public services' (about a quarter of cases, mostly chatbots on websites), followed by public order & safety, economics affairs, health, and social protection. There is also a recent increase in environmental use cases. Cases relating to national security may be under-reported due to secrecy considerations (EC Directorate-General for Digital Services, 2024a, 50–51). This ranking of sectoral uses across all levels is largely mirrored at the local and regional level (EC Public Sector Tech Watch, n.d.).

AI Watch reports that many local use cases concern initiatives such as smart cities, digital twins, and sustainability efforts (EC Joint Research Centre, 2022b, 13). Larger, wealthier cities are more likely to adopt smart city measures; 90% of European cities with populations over 500,000 have smart city initiatives of some sort, compared with 43% of cities with 100,000–200,000 residents, in 2021. However, not all smart city initiatives necessarily involve AI technologies (Pellegrin, Colnot and Delponte, 2021, 25).

AI Watch discusses the influence of various kinds of factors on selected use cases, including political, organisational, infrastructural, technical, demand-related, supply-related, financial, legal and ethical factors (EC Joint Research Centre, 2021, 16; 2022a, 47–54). In many cases, attention to these factors reveals differences between the use of AI technologies in the public sector compared to the ones used by private organisations.

By way of example, AI solutions for the public sector may require greater transparency and explainability, even at the cost of accuracy, so decisions may be justified to the public. In another example, relevant information (such as a subject's occupation) might be excluded from the inputs of an AI system because data are not collected on pre-existing instruments, or because there are questions about the legal basis for data processing according to GDPR (EC Joint Research Centre, 2022a, 51).

These differences between public sector and private sector requirements for AI technologies can become barriers to AI adoption within public administrations. Other barriers include the recognition of genuine risks of deploying AI systems (described above), as well as other factors recognised in existing reports:

- Existing datasets, algorithms and training techniques often lack a degree of transparency and explainability that is desirable in public sector activities (Timan, van Veenstra and Bodea, 2021, 7; EC Joint Research Centre, 2022a, 51; 2022b, 18).
- Many datasets and data-collection mechanisms are not tailored for governmental use, e.g., with sufficient documentation of privacy protections

or consideration of regulatory restrictions (Timan, van Veenstra and Bodea, 2021, 8; EC Joint Research Centre, 2022a, 51; 2022b, 18).
- Many public bodies lack the in-house expertise to develop and operate AI systems, as well as the sociotechnical expertise, to exercise appropriate oversight and risk management (EC Joint Research Centre, 2022a, 52; 2022b, 18; Timan, van Veenstra and Bodea, 2021, 7–8; Pellegrin, Colnot and Delponte, 2021, 28).
- In some cases, there is a lack of leadership support for innovative technologies or for deploying the labour necessary to collect high-quality data (EC Joint Research Centre, 2022a, 51–52; 2022b, 18).
- Public trust in AI technologies and algorithmic techniques is low in many areas. This lack of trust can be exacerbated by the fact that many AI systems rely on sensitive data or partnerships with private companies (EC Joint Research Centre, 2022b, 19; see also BEUC, 2020; Medaglia *et al.*, 2021).
- AI technologies can be perceived as especially risky, since they are still regarded as relatively novel in the public sector; risk management measures and impact assessment techniques are seen as requiring further empirical validation (EC Joint Research Centre, 2022a, 53–54; 2022b, 19; EC Joint Research Centre, 2020).

Drivers of AI adoption by LRAs can include the mitigation of these barriers, as well as other factors such as:

- Simplification of regulatory frameworks in order to enable data-sharing and confidence in cross-border applications of AI systems (Timan, van Veenstra and Bodea, 2021, 5; EC Joint Research Centre, 2022b, 19; European Committee of the Regions, 2024b); and
- Alignment of government values, strategies, processes, and AI development practices, so that cost savings can be achieved through efficiencies delivered by suitable AI systems, whether developed in-house or by private organisations (Timan, van Veenstra and Bodea, 2021, 5).

Significant agreement exists about these drivers and barriers amongst organisations such as AI Watch and the European Parliament. Correspondingly, there are major commonalities amongst the recommendations offered by the same bodies and by the EC for how public bodies can increase the adoption of ‘responsible AI’ technologies. Member States and public administrations are encouraged to:

- Promote awareness regarding AI, including both the positive impacts of adopting AI technologies and the complexity and risks of these technologies (EC Directorate-General for Digital Services, 2024, 68; EC Joint Research Centre, 2022a, 58–59; European Committee of the Regions, 2024b);

- Share practices and experiences, including success stories and failures, with others across Europe in order to foster cross-border solutions (Timan, van Veenstra and Bodea, 2021, 5; EC Directorate-General for Digital Services, 2024, 69; European Commission, 2019; European Committee of the Regions, 2024b);
- Build community by co-creating solutions and developing synergies across national and European initiatives (EC Directorate-General for Digital Services, 2024, 70; European Commission, 2019);
- Develop AI skills, including AI technical and sociotechnical/management expertise within public sector organisations and AI skills training programmes in national education curricula (EC Joint Research Centre, 2022a, 56; European Commission, 2019; European Committee of the Regions, 2024b); and
- Develop partnerships between national authorities or LRAs and other significant actors such as universities, start-up companies and large-cap companies (EC Joint Research Centre, 2022a, 56–57; European Commission, 2019; European Committee of the Regions, 2024b).

Many of these recommendations have been incorporated into the EC's new strategic investment framework in 'trustworthy AI' (European Commission, 2019). This framework includes investment in supercomputing infrastructure, startup funding, educational initiatives and other programmes. These initiatives are meant to promote the development of AI skills and the distribution of infrastructure related to AI and data, especially near 'AI Factories', where investment in supercomputing and data infrastructure will be concentrated. Additionally, the EC has a wide range of funding instruments such as Horizon Europe, Digital Europe, and the Technical Support Instrument (TSI) which contribute to fostering the AI adoption.

Importantly for LRAs, the 'trustworthy AI' framework includes the 'GenAI4EU' initiative, which aims to support collaborations between AI start-ups and deployers of AI in industry and the public sector by focusing on fostering practical applications of AI technologies in thirteen key sectors. These sectors include: robotics; healthcare; biotechnologies and chemicals; materials and batteries; manufacturing and engineering; mobility; climate change and environmental sustainability; virtual worlds and digital twins; cybersecurity; aerospace; AgriFood; sciences; and the public sector. In addition, the framework includes initiatives such as ALT-EDIC that are meant to promote the development of language models for European languages, including languages with few speakers and limited language data. The GenAI4EU initiative will provide EUR 500 million through the Horizon Europe and Digital Europe grant programmes by 2027.

The most significant effort to harmonise the regulatory framework for AI throughout the European Union is the AI Act (Regulation 1689/2024). The AI Act outlines a 'risk-based approach', classifying AI systems with respect to their risks and setting out different requirements and obligations based on risk levels. AI systems that present 'unacceptable' risks are prohibited. AI systems that are 'high-risk' may have significant impacts on health, safety or fundamental rights and are subject to demanding requirements and obligations. For AI systems that present limited risks, the AI Act outlines information and transparency requirements. There are also specific rules for 'general-purpose AI models' (i.e., 'foundation' models such as many GenAI models), and in particular for those models that could pose systemic risks and have significant impacts on the European market.

Now that the AI Act has passed into force, focus will shift from how to regulate AI to implementing the AI Act. These different emphases are reflected in the division of labour by CoR commissions.

The CoR Commission for Social Policy, Education, Employment, Research and Culture (SEDEC) is concerned with the development and regulatory framework of AI technologies (see in particular European Committee of the Regions, 2021, 2024a). The CoR Commission for Economic Policy (ECON) focuses on the implementation of AI at the local and regional level and its implication for digital policy. LRAs can benefit from guidance from the ECON Commission. In implementing the AI Act, LRAs should identify AI technologies' opportunities and challenges and prepare themselves accordingly.

In summary, this study analyses and builds on the results of previous publications, and delves deeper into the opportunities and challenges LRAs have with AI and GenAI adoption through analysis of responses from a dedicated survey and development of case studies. The information provides insights into the impact of AI on the quality of LRAs' interactions with citizens, as well as the efficiency of internal and cross-administration processes. Reflecting on these findings, the report considers how AI and GenAI could contribute to bridging digital divides and examines the role of political leaders in promoting AI and GenAI, concluding in a set of policy recommendations tailored to policymakers at the EU, national and subnational level.

Part 1: State of play of AI and GenAI adoption at local and regional level

1.1 Overview

This literature review provides a high-level summary of research on the use of AI in the public sector. The sources include academic publications and select reports from key international organisations. When possible, the sources focus on GenAI research or issues faced by LRAs and municipalities when developing and adopting AI.

Section 1.1.1 begins with a summary of research on how AI has been, and is currently, used in public sector contexts, along with research on the perceived benefits of public sector AI. Section 1.1.2 provides information about select infrastructure and initiatives available to support LRAs with the successful adoption of AI. Section 1.1.3 is an overview of the academic research on public sector AI, including discussions on analytical trends and enablers and barriers to AI adoption. Section 1.1.4 discusses research on citizen acceptance and perceived risks of public sector AI. Section 1.1.5 summarises research on regulatory and policy perspectives.

1.1.1 Local and Regional Authority (LRA) and Public Authority (PA) implementations

Research on the use of AI in the public sector reveals that, despite widespread expectations for perceived benefits, the use of AI by governments, particularly municipalities, is limited both in terms of number of initiatives and early-stage deployment (Selten & Kleivink, 2024; Mikalef *et al.*, 2019; Mikalef *et al.*, 2021; van Noordt & Misuraca, 2022). This is due, in part, to a tension between the 'flexibility and agility that are needed to explore and adopt AI and, on the other hand, the formal and rigid bureaucratic structures and mechanisms' of public institutions (Selten & Kleivink, 2024).

To date, research finds that public sector use of AI has focused primarily on automating simple and repetitive tasks, predictive analytics (e.g., in law enforcement and financial fraud detection), and facial recognition for surveillance and security (e.g., Selten & Kleivink, 2024; Qin & Zi, 2024). However, the recent wave of AI systems using machine learning allows for more complicated and sophisticated uses (e.g., Young *et al.*, 2019). Furthermore, even in the absence of clear or formal AI policies at the organisational level, civil servants are informally using GenAI tools for a range of functions (Cantens, 2023). AI for surveillance, in particular, has received attention, as it is widely used by public authorities and

raises significant privacy and ethics concerns for the general public (Ardabili *et al.,* 2024; Floridi, 2024; Salgado *et al.,* 2024).

The public sector is motivated to develop and adopt AI technologies primarily because of the perceived benefits. Those benefits include perceived financial advantage through efficiencies (in personnel and resources), enhanced decision-making and support for policy initiatives, and improved service delivery to citizens due to AI-enabled accessibility and inclusivity capabilities (Qin & Zi, 2024; Kreuels *et al.,* 2021). Referring to GenAI specifically, Cantens (2023) argues that AI can have a 'transformative impact on intellectual production of the state' due to improvements in the analytical and critical faculties of civil servants and greater equality in policy-making globally. Additionally, LRAs may be motivated to explore potential AI technologies because of perceived pressure from industry, national government, and the general public (Kreuels *et al.*, 2021). In the eyes of various stakeholders, the State should do both: innovate and use its resources to deploy technologies to gain operational efficiencies.

However, research on whether, and to what extent, these perceived benefits are actualised is limited. Selten & Kleivink (2024) suggest success may depend, in part, on how exactly AI is adopted within the public organisation. AI teams that are structurally separate from other departments may develop technically more robust AI systems, but the systems may not align with operational needs, or be compatible with existing IT infrastructure; integrating AI expertise across departments does not face the same challenges but the AI solutions rarely progress beyond initial conception or small-scale piloting (Selten & Kleivink, 2024). In either case, further research is needed to better understand which organisational conditions create better opportunities to benefit from the use of public sector AI.

GenAI has received some attention for its proposed ability to transform government functioning - raising efficiency and increasing the effectiveness of public service delivery. However, unlike general AI, there is very little evidence of GenAI adoption by LRAs, and research is scarce on adoption success factors or challenges specific to GenAI. Where it has been studied, civil servants seem to be informally using GenAI tools (Cantens, 2023). One example of a formal study in the United Kingdom found that GenAI was prevalent across government functions, with 22 percent of public sector professionals reporting they used GenAI tools (Bright *et al.,* 2024). The researchers found that due to the accessible, often browser-led, proliferation of GenAI tools (e.g., Chat GPT, Google Bard, Microsoft Copilot, etc.), government employees were beginning to integrate the functions into their daily work practice – leading to perceived (and actual) efficiency gains. The researchers noted how this type of deployment is different from formal top-down deployment approaches, where strategies and funding are decided through formal processes, policies, and projects. While the informal

uptake of GenAI is improving agency and flexibility for government employees, this bottom-up approach was not always viewed as entirely beneficial, specifically where there is a lack of clarity regarding oversight and guidance on appropriate use (Bright *et al.,* 2024).

The limited evidence of ongoing deployments of GenAI at the local or regional level could be attributed to a) a lack of acknowledgement, or awareness, of how GenAI tools are starting to become embedded through informal work practices, b) the fact that many AI projects are at an early stage of development and deployment, and there has not been sufficient time for reflection and analysis, or c) a lack of top-down formality being affected within local or regional departments.

This might be due to: trust, confidentiality, accountability concerns (Cantens, 2024); a lack of research and innovation projects that have moved past very initial prototyping or research ideation phase (Williams *et al.,* 2024); or ongoing concerns over the interaction between the EU AI Act and governmental accountability, as demonstrated by the Kortrijk use case within this study (see Case II.1).

Despite little published evidence of GenAI adoption and benefits at the local or regional level, the potential benefits of its adoption are widely discussed. For example, the Organisation for Economic Cooperation and Development (OECD) has outlined how GenAI might support efforts towards anti-corruption and governmental integrity (OECD, 2024), finding evidence within enforcement, investigative and tax audit functions of government across the EU. Though, it should be said that the vast majority of examples were at the exploratory stage, and perhaps this is why evidence of this did not appear through our surveying. The OECD also highlights the Netherlands National Strategy for the Adoption of GenAI (2024) as being a good example of how top-down approaches might be most suitable, given the rapidly evolving nature of the technology, and its well communicated risks, and potential consequential impacts, both positive and negative. National governments equipping local and regional governments with the ability to assess and adapt to these impacts might improve the overall deployment of GenAI tools into sub-national governmental regions.

1.1.2 Existing AI infrastructure to support LRAs

There are several existing European initiatives that intend to support LRAs in developing and adopting AI. These initiatives prioritise knowledge sharing, networking and tools for trustworthy AI, built on strong European ethical principles.

AI4Gov Project

The 'Trusted AI for Transparent Public Governance fostering Democratic Values' (acronym AI4GOV) project is a European project funded under the EC Horizon Europe call *Artificial intelligence, big data and democracy*. The project, which runs from 2022-2025, aims to develop evidence-based innovations, policies and policy recommendations to mitigate the negative impacts of Big Data and AI, and increase citizen trust. Outputs from the project will include a Reference Framework for Ethical and Democratic AI, AI explainability techniques, AI fairness monitoring and bias mitigation tools, and training for stakeholders.

AI4Gov Hub

AI4Gov Hub is 'a leading international ecosystem of research, training, and innovation opportunities aiming to use AI to improve public services'. Its goal is to empower public administration to use human-centric AI to transform public service delivery. AI4Gov hosts events, a Knowledge Hub for shared research and peer learning, and a Master's Programme on AI in Public Services (hosted at Universidad Politécnica de Madrid and Politecnico di Milano; co-financed by the Connecting Europe Facility of the EU).

AI4Europe

Building on the work of the AI4EU project (which ran from 2019-2021), AI4Europe project (2022-2025) is the 'enabling engine' behind the AI-on-Demand Platform (AIoD), the first European AI On-Demand Platform and Ecosystem. It is funded under the call *European coordination, awareness, standardisation and adoption of trustworthy European AI, Data and Robotics.* AIoD is intended to be a resource for knowledge sharing to facilitate experimentation and the development of solutions and technologies. AIoD 'will offer interoperable services, data and tools from several related projects and communities, and provide solutions to facilitate research productivity, reproducibility, and collaboration'. AI4Europe is establishing support mechanisms to foster engagement between academia and industry.

GovTech Network

GovTech Network is a global cross-sectoral initiative at the World Economic Forum (WEF) focused on exploring the effective and responsible use of technology for public service delivery. The network is open to members of the WEF (through an annual membership fee) representing government, industry and experts. The global network aims to connect national GovTech Centres into an

innovation ecosystem. The network publishes briefing papers on a broad range of issues related to technology and government.

GovTech4All

GovTech4All project is an EU-funded project that aims to foster a cohesive GovTech ecosystem across multiple countries. The project will develop a pan-European GovTech market and ecosystem, aimed at delivering innovative digital public services for European citizens, residents, and beyond. The project has three primary pilot projects: a Secure Cross-Border Information Sharing initiative to enhance secure communication and data sharing at borders; a Personal Regulation Assistant to help citizens apply for social benefits; and a GovTech Start-Up challenge for energy efficiency solutions at the municipality level. GovTech4All also runs a 'Boot Camp' for European start-ups to develop and scale government technology solutions. The GovTech4All community is open to all stakeholders, offering a chance for public sector representatives to connect and learn best practices from industry and other public administrations.

AI Skills Academy

AI Skills Academy is an independent resource offering online courses on AI. Their mission is 'to empower individuals and organisations with cutting-edge AI skills tailored to specific roles and industries'. The course curriculum includes foundational knowledge and hands-on experience.

ARISA AI Skills Training

The Artificial Intelligence Skills Alliance (ARISA) is a network of European organisations focused on training in AI and connected disciplines. The network is co-funded by the EU and is part of the EC Pact for Skills initiative. ARISA provides a platform for knowledge sharing and capacity building, as well as skills training in the form of an online course offering a 'comprehensive, yet accessible' overview of AI. The free, 12-week course covers core AI concepts, key players and trends in the AI ecosystem, and concerns such as transparency and data privacy. The course is marketed towards all stakeholders, including policymakers.

Digital Innovation Hubs

European Digital Innovation Hubs exist at both the EU and national level. The Hubs are designed to serve as 'one-stop shops' for companies and SMEs to receive information and support in the design and deployment of technologies, including AI for the public sector. The European Digital Innovation Hubs, part of the Digital Europe Programme, bring together and support national Hubs,

increasing their capacity and enabling knowledge building and transfer across the EU. With this wider network, the EC wants to foster networking, cooperation, and knowledge transfer activities between the private and public sectors.

1.1.3 Academic research

While the number of publications in recent years on public sector AI is indicative of increasing interest in the topic, literature on AI in the public sector is limited. The following sections provide an overview of existing literature, with a focus on analytical trends, enablers and barriers to AI adoption, research on citizen acceptance and perceived risks, and research on regulatory and policy perspectives.

Systemic reviews

There are some literature reviews (e.g., de Sousa *et al.*, 2019; Reis, Santo, and Melão, 2019; Pencheva *et al.*, 2020) and case studies of specific tools and initiatives in early stages of development and piloting (e.g., G20 DEWG, 2024; Androniceanu, 2023; Neumann *et al.*, 2024; Sun & Medaglia, 2019). These landscape analyses of AI deployment in the public sector show that few public administrations have actually ventured into AI (van Noordt and Misuraca, 2022). There is no literature or online resource offering a comprehensive summary or catalogue of public sector AI projects around the world. As such, '[t]here is still a gap in terms of identifying and characterising the main actors, governance structures, and related policies' (Criado, 2024).

Most of what is published come from a theoretical perspective (e.g., Wirtz *et al.*, 2019; Zuiderwijk *et al.*, 2021) and focus on the perceived challenges and barriers (technological, legal and regulatory, normative and societal) to AI deployment in the public sector (Wirtz *et al.*, 2019). Medaglia *et al.* (2021) found that studies grouped around seven topics: (1) AI definitions and attributes; (2) AI techniques and methodologies; (3) AI uses and applications; (4) AI results, impacts, and benefits; (5) AI challenges and determinants; (6) AI strategies, best practices, and guidelines; and (7) ethical considerations about AI.

Furthermore, articles focus on the 'macro' governance level (international, regional and national) and do not often investigate issues at the local or organisational level. While these conceptual frameworks and case studies provide valuable insights (Selten & Kleivink, 2024), there is a need for more research on how LRAs use (or plan to use) AI, and the challenges and benefits at an organisational and individual level.

Two additional considerations also characterise existing research on public sector AI. First, much of the discourse is 'fragmented and predominantly defensive' especially in regard to GenAI (Cantens, 2023). Second, most research makes clear that it considers AI to be not 'just another' IT innovation, but rather something distinct and more significant due to the pace, extent, and nature of change that AI might bring to the public sector (Selten & Kleivink, 2024).

Enablers and barriers for public sector AI adoption

Existing literature identifies conditions and characteristics that impact the effectiveness of AI uptake in the public sector. When present, these conditions and characteristics become enablers of public sector AI; when not present, they can be seen as barriers.

One condition is an AI system's compatibility with existing IT systems (or the LRA's willingness and ability to update existing IT infrastructure), identified by Kreuels *et al.* (2021) as prerequisite. Other conditions related to resources include personnel with technical AI competencies, staff capacity to manage AI projects, and financial assets to support a project to fruition (Kreuels *et al.*, 2021; Mikalef *et al.*, 2021).

Due to the perceived risk of AI and discourse around potential harms, 'AI can be expected to pose more operational and strategic challenges for public organisations' as compared to other IT tools (Selten & Kleivink, 2024). Therefore, additional conditions of successful adoption are: proposed AI initiatives are strategically aligned with organisational and/or departmental needs; staff have a shared common understanding and acceptance of AI technologies; and a certain level of 'organisational innovativeness towards AI as well as digital transformation', particularly from top-management and leadership (Kreuels *et al.*, 2021; Mikalef *et al.*, 2021; Neumann *et al.*, 2024; Sun & Medaglia, 2019; Vogl, Seidelin, Ganesh, and Bright, 2020). Misalignment within, and across, departments (e.g., data science departments and IT departments) and between data scientists and domain experts must also be avoided, or minimised, especially when IT departments are resistant to change, or subject matter experts are reluctant to use (or do not see value in) AI tools (Selten & Kleivink, 2024).

Regulatory and legal concerns are not explored in the literature, suggesting that they do not pose as significant of a challenge to public sector AI in comparison to the internal organisational barriers (Selten & Kleivink, 2024).

1.1.4 Citizen acceptance and user experience with AI in the public sector

Citizens can be both subject to the use of AI by public servants and users of AI-enabled public services. In both contexts, concerns about the use of AI in the public sector (closely connected to general concerns about AI) exist, relating to issues such as explainability, confidentiality, authorship and ownership, and machine error resulting in harm (Cantens, 2023). These general public concerns may present a significant hurdle to successful implementation and uptake of AI within LRAs (e.g., Galloway & Swiatek, 2018 on 'AI anxiety'; Kowalkiewicz & Dootson, 2019, discussing how digital sanitisation, or the removal of human interaction in service delivery, is not welcomed by citizens). Understanding citizen acceptance, and the roots of existing concerns about the use of AI in public services is important. However, it is suggested there is a knowledge gap in what is known about citizens' acceptance and user experience with AI in the public sector (Gesk & Leyer, 2022, Chen *et al.,* 2021). Whether existing (or future) deployments in the public sector can bridge this knowledge gap is somewhat unknown, especially as user feedback is not necessarily collected in a formalised manner within a notable number of public sector innovation projects.

Researchers have identified different factors that influence citizens' perception of AI within public services. Factors that positively influence citizens' perception of AI in public services include perceived usefulness, personalisation capabilities, aesthetics of the user interface, level of trust in government, whether there is a 'human-in-the-loop', and level of knowledge of AI technologies (Gesk & Leyer, 2022; Chen *et al.*, 2021; Schmager *et al.*, 2023; Willems *et al.*, 2023). Factors that negatively influence citizens' perception include fear of AI failure, lack of transparency, lack of citizen participation in decisions about AI, privacy concerns, and perceived time spent on the system (Gesk & Leyer, 2022; Chen *et al.*, 2021; Schmager *et al.*, 2023; Willems *et al.*, 2023). Furthermore, Kleizen *et al.* (2023) found that already existing attitudes and experiences (e.g., existing privacy preferences, trust in government, trust in AI) have more impact on the general public's level of trust in governmental AI projects, regardless of how the public authority communicated ethics considerations.

Research studies have solicited direct feedback from citizens on their acceptability of public sector AI to identify these factors. Gesk & Leyer (2022) investigated the general public's acceptance by asking citizens in Australia to choose between a human, or AI-based software, to perform a public service. Then, they were asked to complete a questionnaire on their acceptance of AI (e.g., usefulness, time savings, transparency). They found a higher rate of acceptance when AI is used for general services, as opposed to specific services, in the public sector and that citizens did not believe AI could handle 'exceptional concerns.'

Factors that negatively influenced on public acceptance of AI included: fear of AI failure; lack of transparency; and lack of citizen participation in the choice of design and use of AI. The researchers also found that citizens felt they do not have 'much of a choice regarding the introduction of AI'.

Chen *et al.* (2021) asked citizens about the user experience with AI-enabled self-service machines in a public service centre in China. They found that users related positively to personalisation capabilities and aesthetics, and related negatively to perceived time spent on the machines. The researchers also noted that citizens were more likely to report a pleasant experience using the AI-enabled technology if they also reported a higher level of trust in government more generally.

Schmager *et al.* (2023) surveyed Norwegian citizens on their comfort level and experience using a potential AI-enabled system in public services. The results were generally positive, with almost all participants consenting to the use of AI and expressing positive levels of comfort with the use of AI tools in the public sector. The researchers identified three contributing factors for positive acceptance: participants' self-rated high level of trust in government, the existence of a 'human-in-the-loop', and transparency about the AI tool.

Willems *et al.* (2023) looked at the acceptance of AI-driven chatbots for public services by asking Austrian citizens whether they would download such an application. To investigate privacy issues, the researchers varied the level of personal information required to download the theoretical application. Respondents were then asked to rate the usefulness of and the degree of their privacy concerns regarding the application. The researchers found that perceived usefulness was the main factor in citizens' willingness to download, and privacy concerns would reduce their willingness to download, and use, the application. However, respondents were willing to 'trade-off' general privacy concerns if the perceived usefulness was high. The research confirmed the existence of a privacy paradox (i.e., inconsistency between general concerns and actual behaviour). Supporting this theory, Wang, Chen, and Chien (2023) found that perceived transparency of an AI system increases trust, while privacy concerns about sensitive information decrease trust. The researchers also found that citizens familiar with AI are more likely to trust the recommendations made by AI platforms for decision-making purposes.

The literature consistently notes the need for future research to better understand citizen perception, and acceptability, of public sector AI. This includes calls for further research to inform recommendations for national and local governments to improve citizen perception, and acceptance of AI. For example, Osborne & Nasi (2024) suggest further research on the co-creation and co-design of AI as innovation methods for the future of public service delivery.

Perspectives of Regulation, Law and Policy

Governance frameworks relevant to AI are multi-level; they exist at the international, regional (including European), national, and local level. There are many articles, reports and websites cataloguing these legal and policy developments (e.g., Jobin *et al.*, 2019, UN Governing AI for Humanity Report 2024).

The literature points to several concerns regarding the regulation of AI globally. Predominant concerns focused on the necessity, and desirability, of regulating AI at all, with arguments against regulation generally citing the existence of sufficient non-legal governance mechanisms (e.g., self-regulation, voluntary principles, codes of conduct) and concerns about the potential stifling of innovation (e.g., Strous, 2019). However, the emergence of AI regulation over the past few years seems to have reduced the efficacy of this argument.

Looking at new, and developing, AI laws and policies, experts argue there is a distinct need to better define AI (e.g., Folberth *et al.*, 2022; Ulnicana *et al.*, 2021). Currently, there is no single accepted definition of AI used consistently across regulatory, or governance, frameworks, and not enough attention has been paid to the difference in typologies of AI systems (Robles Carrillo, 2020). Additionally, noting the many forms of regulation, researchers contend the type of regulation should, and will, vary depending on the deployment context (e.g., Folberth *et al.*, 2022).

While each AI application in the public sector will have unique legal challenges, all ‘must not only conform to legal principles in their design but also in the outcomes they produce’ (Correia *et al.*, 2024).

AI Act

The EU AI Act is the first law in the world dedicated to regulating AI. Drawing on the EC independent High-Level Expert Group on Artificial Intelligence (AI HLEG) Ethics Guidelines for Trustworthy AI (2019) and Assessment List for Trustworthy AI (ALTAI) (2020), the EU AI Act takes a risk-based approach to regulating AI, laying out legal obligations related to, for example, risk management, fundamental rights, transparency, and human oversight.

The AI Act, which came into force in August 2024, is both welcomed and critiqued by experts and researchers. Proponents argue that the AI Act positions the EU as a global leader in the development and deployment of ethical and human-centric AI (e.g., Feldstein, 2024). Critics suggest it will stifle innovation, and point to concerns such as: the conflation of ‘trustworthiness’ and

‘acceptability’ (Laux *et al.*, 2023); the consideration of the administrative burden of compliance (Finocchiaro, 2024); and whether the AI Act will do enough to protect fundamental rights and EU values (Finocchiaro, 2024).

Data protection, governance and sharing

Data governance is a key area of concern for LRAs, due to the increasing use of data-driven technologies, the exacting nature of current data protection regulation within the EU, and the emerging regulations regarding open data and data commons. In the EU, the relevant regulatory frameworks are: the General Data Protection Regulation (GDPR); the Data Act (DA); the Data Governance Act (DGA); the Open Data Directive (Directive on the re-use of public sector information or the PSI Directive); and relevant national legislation. While the GDPR’s primary purpose is the right to privacy and protection of personal data, the DA, DGA, and PSI Directive support the sharing of public sector data, including to privacy entities. The framework ‘expands and deepens’ data sharing based on the Open Data Government movement, but scholars note limited positive results due to barriers on both the demand and supply sides. These may include a lack of opportunities, motivation and ability to use public data, and a lack of appropriate incentives to share data (Buttow & Weerts, 2024).

1.1.5 Summary

The literature shows a growing interest in public sector AI deployment, reflecting both the transformative potential, and significant challenges, the technology brings with it. As evidenced by the literature, research suggests that AI might enhance efficiency, decision-making, and accessibility. However, there are concerns about ethics, privacy, accuracy, and trust (in both AI and government), especially from citizens. Additionally, research suggests there are resources and organisational conditions that must be in place for the successful adoption of AI. It would seem that further research is required to fill an existing knowledge gap on the AI success factors, to better improve the development and adoption of AI in the public sector, particularly on maximising the benefits of AI and addressing citizen concerns.

1.2 State of play of AI adoption across the EU LRAs

This section is aimed at offering an overview of the current state-of-play of AI adoption by the public sector at sub-national level in EU Member States. Considerations are based on the results of an online survey the authors submitted to LRAs in all 27 EU Member States and supported by desk research.

The questions at the core of the survey were structured in three sections targeted to gather evidence on the following:

- General data on the respondents;
- Drivers, barriers, opinions and best practices on the AI adoption by LRAs; and
- Views on the future of AI for public administrations to support policymaking.

To avoid selection bias, the selection of LRAs was done by random sampling within each of the 27 EU Member States. Invitations to the survey were sent by email to employees and managers of LRAs, having care to include the personnel of departments in charge of IT and digital transition operations. Where possible, personal email addresses were preferred over generic email addresses.

The invitations to the survey were initially directed at the same number of local public authorities in all Member States. The sample was then extended for countries with a lower response rate, in particular for Austria, Czech Republic, France and Italy. The consultation was launched on 2nd September 2024 and concluded on 15th October 2024. The survey received a total of 153 responses from all 27 EU Member States.

The analysis of the survey results was carried out considering the findings of recent research on the use of AI in the public sector and the implications of the AI Act. With the aim of gathering evidence on the drivers and barriers to the adoption of AI at local level, the data are elaborated primarily in relation to the demographic size and the geographical area in which LRAs are located.

1.2.1 AI adoption, application sectors and main benefits for LRAs

Figure 1 provides an overview of the adoption of AI and GenAI solutions by LRAs within the sample of respondents.

Figure 1. Proportion of LRAs adopting AI within the sample of respondents

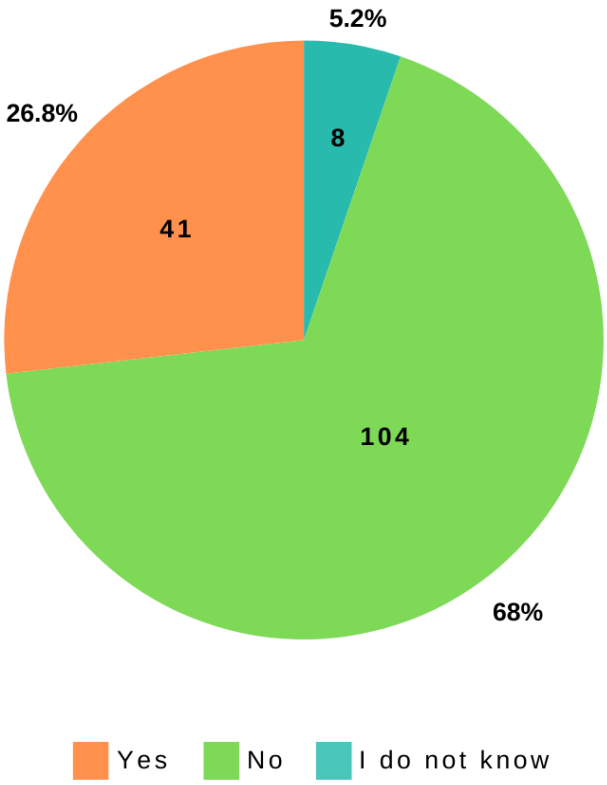
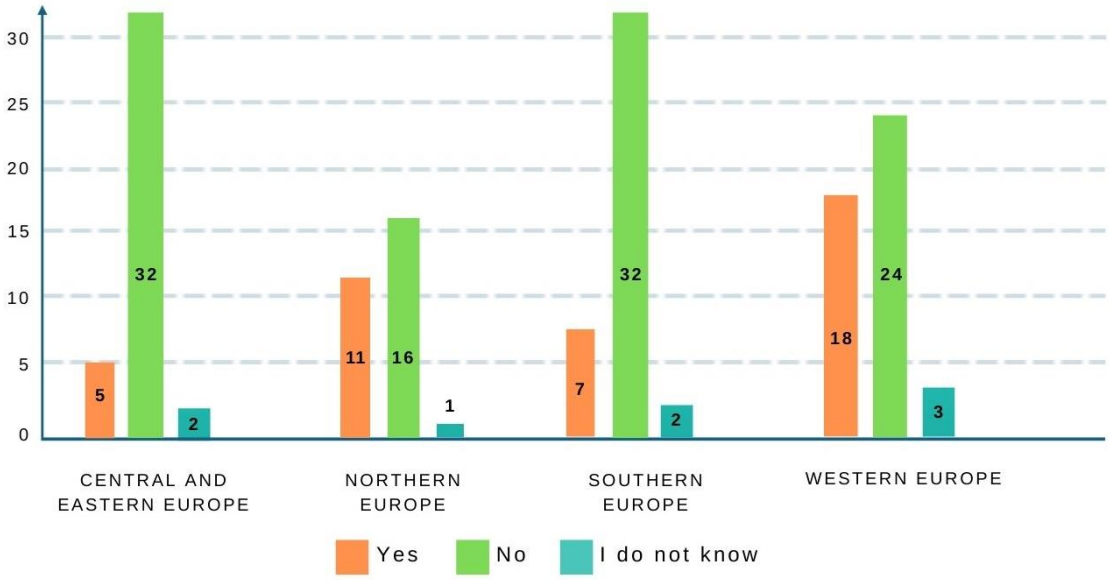


Figure 1 shows how the majority of LRAs responding to the survey are *not* adopting AI or GenAI solutions. The information on the lower rate of LRAs adopting AI is in line with the expectations and with background literature. However, it is worth noting how the percentage of those adopting this technology reaches around 27% of respondents, thus pointing to an emerging level of adoption across the EU.

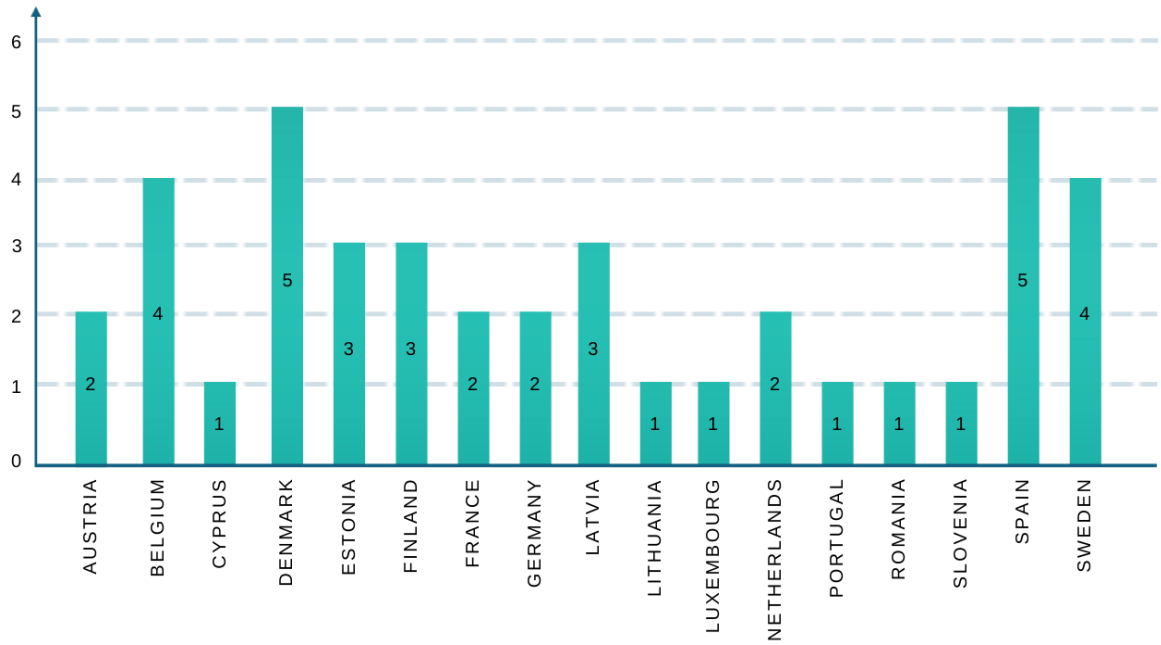
Figure 2. Number of LRAs adopting AI by European region



Looking at AI adoption cases by European region (**Figure 2**), the survey results show that the highest number of cases is recorded in Western Europe (18), followed by Northern Europe (11), Southern Europe (7) and finally Central and Eastern Europe (5). These figures are consistent with the differences in the degree of digital maturity amongst European regions. The low adoption rate of AI technologies in Central and Eastern Europe is in line with data on digitisation performance summarised by the Digital Economy and Society Index (DESI) indicators (EC, 2022) that see countries in this geographic area registering amongst the lowest levels of indicators on 'AI adoption rate' and on 'Digital public services for citizens', the latter being a proxy for policy advancements in the digital field.

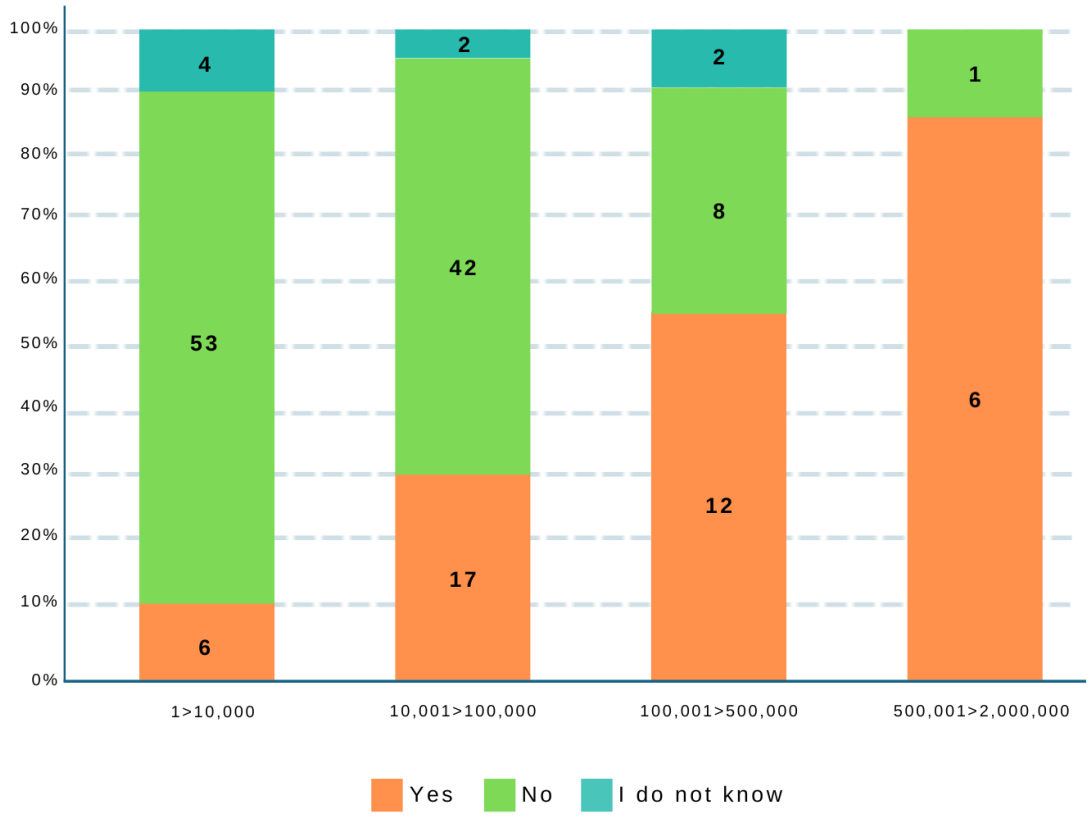
The following graphs show the data on AI use divided by Member States and demographic groups of the LRAs responding.

Figure 3. LRAs adopting AI by Member State within the sample of respondents



In line with the PSTW results, the countries with most AI use cases are Spain and Denmark, followed by Belgium and Sweden. In contrast, other countries that in PSTW were found to have the most cases of AI use in the public sector at national level, turned out to have few cases of implementation at the local level (e.g., Germany, the Netherlands and Portugal).

Figure 4. LRAs adopting AI by demographic group



Looking at adoption rates in local governments divided by demographic group, in **Figure 4** it can be seen that LRAs where AI is most widely used are the largest ones. More specifically, in the group of LRAs with a number of residents between 100,000 and 500,000, AI is adopted by about 54% of respondents. In the largest demographic group (population range between 500,000 and 2 million), AI is adopted by 6 out of 7 LRAs in the sample.

Sun & Medaglia (2019) recognise how the public sector is one of those that can benefit the most from the use of AI, and different studies investigate the implementation of AI in public authorities of different administrative levels. To date, research shows that AI technology is most widely used in administrative authorities at national level, followed by local and lastly regional authorities. Concerning the adoption of AI by local public authorities, according to Yigitcanlar *et al.* (2024), the earliest use case was in 2004. The review finds that the level of implementation of AI by local governments varied over time, with a constant increase in the number of cases registered globally since 2014, a doubling of cases was recorded in the years between 2017 and 2018, and a peak of cases was observed in 2021. On the other hand, the number of AI adoption cases seems to decrease from 2021 to 2024.

Certainly, the degree and type of AI use are not fortuitous, but many factors lead a local public authority to decide to adopt such technology. Influencing factors can stem from supra-national trends as well as from specific characteristics of local territories. As explained by Yigitcanlar *et al.* (2024), it is intuitive to understand how the use of a particular AI system depends on the specific needs and priorities of a locality. Different localities have different needs based on their intrinsic characteristics such as geographic location, population size, core economic activity and social demographics. Also, resource availability cannot be overlooked: budget, technological infrastructure and human capital are crucial in the process towards the adoption of AI technology. Moreover, as with any innovative element, the regulatory and policy frameworks have the power to influence the introduction of AI in the public sector, both at national level by setting priority objectives and resource allocation, and locally, by shaping local governance structures and directing political dynamics.

The survey data reflect the combination of these dynamics, and the analysis of the responses from the LRAs on key aspects provides a more complete picture of the factors that most induce or hinder a local authority from exploiting this groundbreaking technology.

One of the first aspects examined in the survey is the application sector of AI, where the sectors were selected based on the taxonomy proposed by PSTW (2024). In this survey question, respondents were able to select more than one application sector. Consequently, the number of options elaborated exceeds the number of LRAs responding. The fact that many municipalities indicated more than one application sector for AI also reflects an experimentation process where AI is tested for different purposes to assess benefits and obstacles.

This variety of application sectors allows for a more complete overview of all uses for which the technology is employed within local government.

The sectors in which AI is most used are in order of frequency in which they are mentioned:

1) '**AI-based services for the public administration**';
2) '**Municipal public services**';
3) '**AI-based services for citizens**' and '**Mobility and transport'**.

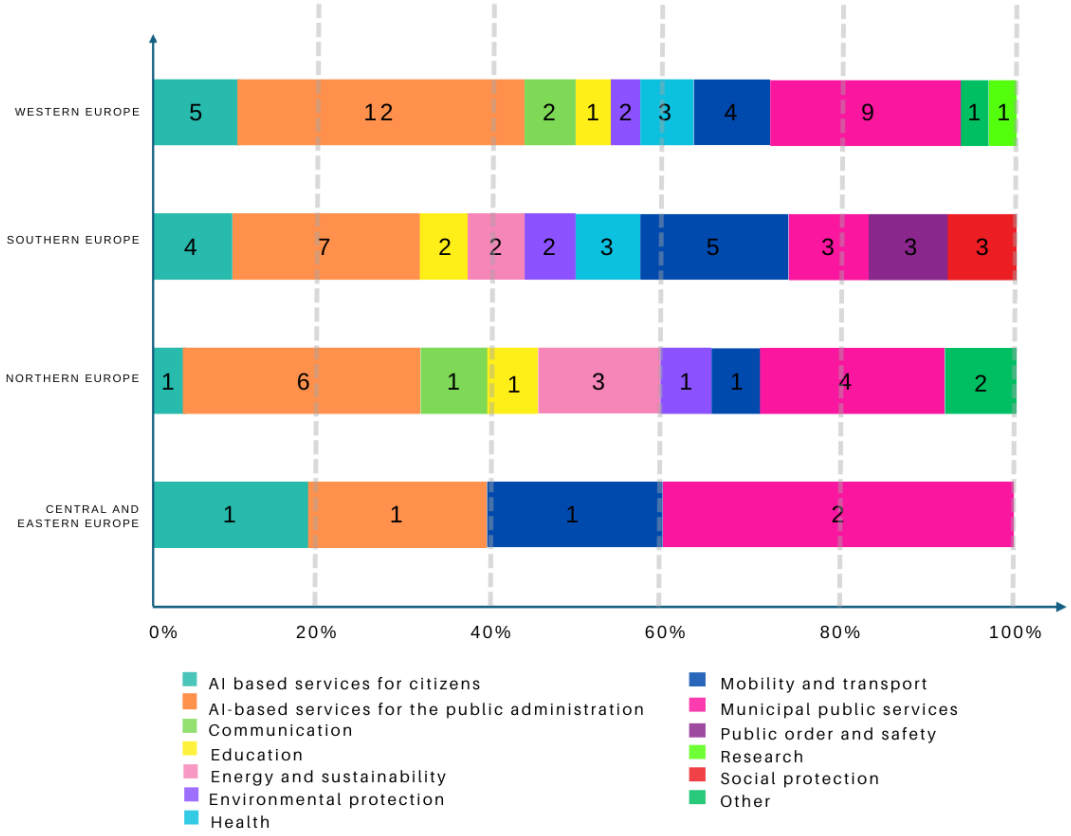
Cases in the two categories of sectors where AI is most frequently used are found in a similar proportion in all four European regions (reference was made to the classification of European regions proposed by EuroVoc[3], i.e., Western Europe,

[3] Central and Eastern Europe: BG, CZ, HR, HU, PL, RO, SI, SK; Northern Europe: EE, FI, IE, LT, LV, SE; Western Europe: AT, BE, DE, DK, FR, LU, NL; Southern Europe: CY, EL, ES, IT, MT, PT.

Central and Eastern Europe, Northern Europe, and Southern Europe). It is interesting to compare this information with the sectors in which AI is most often used by administrations at national level. According to recent data released by the European Commission (2024), also in national initiatives AI is most often used in the sectors of 'General Public Services' and 'Economic Affairs' (the latter including transport and mobility services). The difference with respect to the national data, however, is the lower percentage of AI adoption in the areas of health and education in local governments.

Figure 5 illustrates a comparison of the application sectors and benefits of AI stated by the LRAs already adopting AI, divided by European region.

Figure 5. AI application sectors by European region



Data in **Figure 5** show that in all European regions (except Central and Eastern Europe) the sector in which AI is most frequently used is '**AI-based services for the public administration**', followed by '**Municipal public services**' in Western and Northern Europe and by '**AI-based services for citizens**' and '**Mobility and transport**' in Southern Europe. While there is a preponderance of application cases in municipal public services, such as waste collection, road maintenance, this result indicates different secondary priorities in Southern Europe compared to Western and Northern regions.

Even though the response rate does not allow for statistically significant conclusions, it can be noted that data shows how in Central and Eastern Europe the application sectors are evenly distributed amongst those most frequently used in the rest of the continent.

The data on the use of AI in the '**Energy and sustainability**' sector, which is proportionally more widespread in Northern Europe, stands out, possibly as a result of a long tradition and attention to environmental protection. The least frequent application sectors are in 'Research', 'Public order and safety', 'Social protection' and 'Communication'. The results for these sectors can also be related to the other factors. For instance, 'Research' and 'Communication' would require the use of GenAI; however, as previously mentioned, its complexity has implications that are currently not governable by local authorities, and/or the use of GenAI is widely informal and unreported. On the other hand, for sectors such as 'Public order and safety' and 'Social protection', the processing of sensitive data raises concerns about possible legal consequences if not managed well.

Figure 6. AI benefits by European region

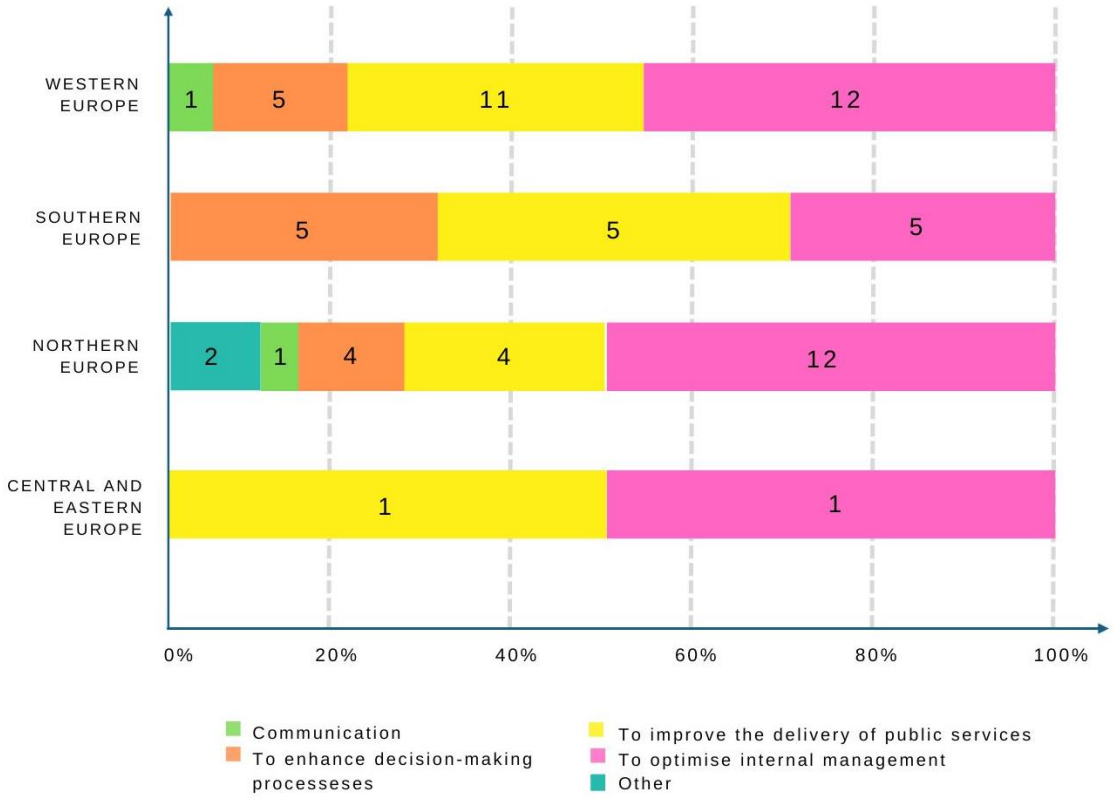


Figure 6 offers an overview of the main benefits that LRAs identify thanks to the use of AI. The options are in line with the ones considered by the European Parliament (2021), including: efficiency gains and internal process optimisation; delivery of more accessible and inclusive services; personalisation; increase of

anticipatory governance; policy through more accurate predictions; and less human error and fraud.

The three areas in which AI appears to support the most public administrations are the following, in order of frequency in which they were mentioned by respondents:

1) **To optimise internal management**;
2) **To improve the delivery of public services**;
3) **To enhance decision-making processes**.

Disaggregating these data by European regions, it can be seen that the identification of the optimisation of internal management as a main benefit is more frequent in Northern and Western European countries. In addition, most of the LRAs indicating the improvement of public service delivery as the main benefit are from Western Europe. The use of AI to enhance decision-making processes is proportionally more frequent in Southern Europe. In line with the results on AI application sectors, the least frequent benefit reported by LRAs is in 'Communication'.

The results on the main benefit of AI recognised by respondents are found to be consistent with the AI application sectors. More specifically, AI seems to be used more to improve the internal organisation of local administrations, and only in second place to improve or extend the range of services offered to the public. Moreover, AI seems to be used and benefited more in areas that are cross-cutting rather than in specific fields of intervention, such as health care or decision-making (with reference to the benefits noted by the LRAs).

While interpreting the results with caution due to the different number of responses from each region, it is possible to make considerations on results by geographical area. It is noted that in Northern Europe the application sectors and recognised benefits of AI are more numerous, signalling a greater awareness of the theme. Furthermore, there are commonalities between Northern and Western European LRAs, where the two most frequent application sectors coincide and both areas use AI mainly to optimise the internal management. These are also the only two regions that reported to use AI in the area of communication. LRAs in Southern Europe also use AI in many sectors, but unlike Northern and Western Europe the benefit they derive from is equally distributed amongst the three proposed in the survey. This is in line with a possible process of experimentation of the technology in order to understand which purposes are best pursued through AI.

1.2.2 Human resources dedicated to AI and relations with the external environment

This section is dedicated to a discussion of the role of human resources in the processes of initiating and managing AI solutions within local public authorities and its implications for relations with external stakeholders. Evidence from the survey have been elaborated and used to make considerations on the extent and qualification of human resources currently dedicated to the implementation of this technology by LRAs.

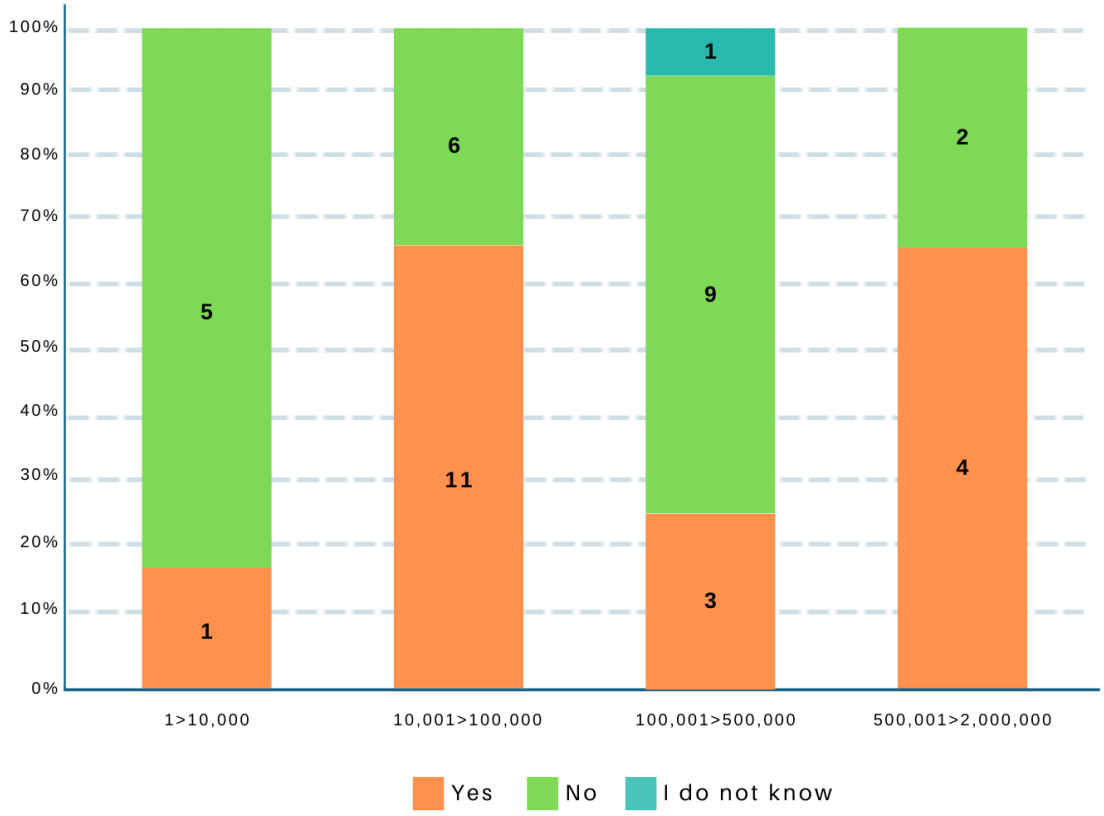
As found in the JRC study on AI for interoperability (Tangi *et al.*, 2023), a decisive determinant for the adoption of AI or GenAI solutions by a public administration is the role of the initiator, often identified in an individual or a small group of employees.

Analysing the responses provided by LRAs that are already adopting AI, the professional who most often promotes AI uptake is a **manager** (in 29% of cases), a figure internal to the public authority. The second category most often mentioned as initiator is the residual '**Other**'. In specifying this answer, many respondents stated that AI was promoted by the Digital Department, thus again professional figures internal to the public administration. Following this, the importance of the **individual** initiative of an **expert in the field** is noted. In 8 out of 41 cases, the expert was declared as initiator. On the other hand, 'partnership' and 'in-house agency' categories appear less common as initiators of AI adoption. This may be due to the fact that most municipalities are small-sized and do not have many partnerships and in-house agencies located in them, as compared to larger municipalities which have more resources.

With regard to geographical distribution, the 'manager' and the 'partnership' are the only AI promoters found in all observed European regions. The role of the 'individual expert' is also fairly transversal geographically as an initiator, being found in three of the four geographical areas of Europe. Conversely, the category of 'inhouse agency', besides being less widespread, appears more specific to the local context and, in particular, more considered in Northern Europe.

The fundamental role of internal personnel in promoting it makes the need to examine the human resources specifically dedicated to AI even more evident. The following graph in **Figure 7** shows the percentage of LRAs that are dedicating specific human resources to one or more phases of AI implementation. The information indicates the level of awareness of AI and the availability of financial and human capital within local public authorities across Europe.

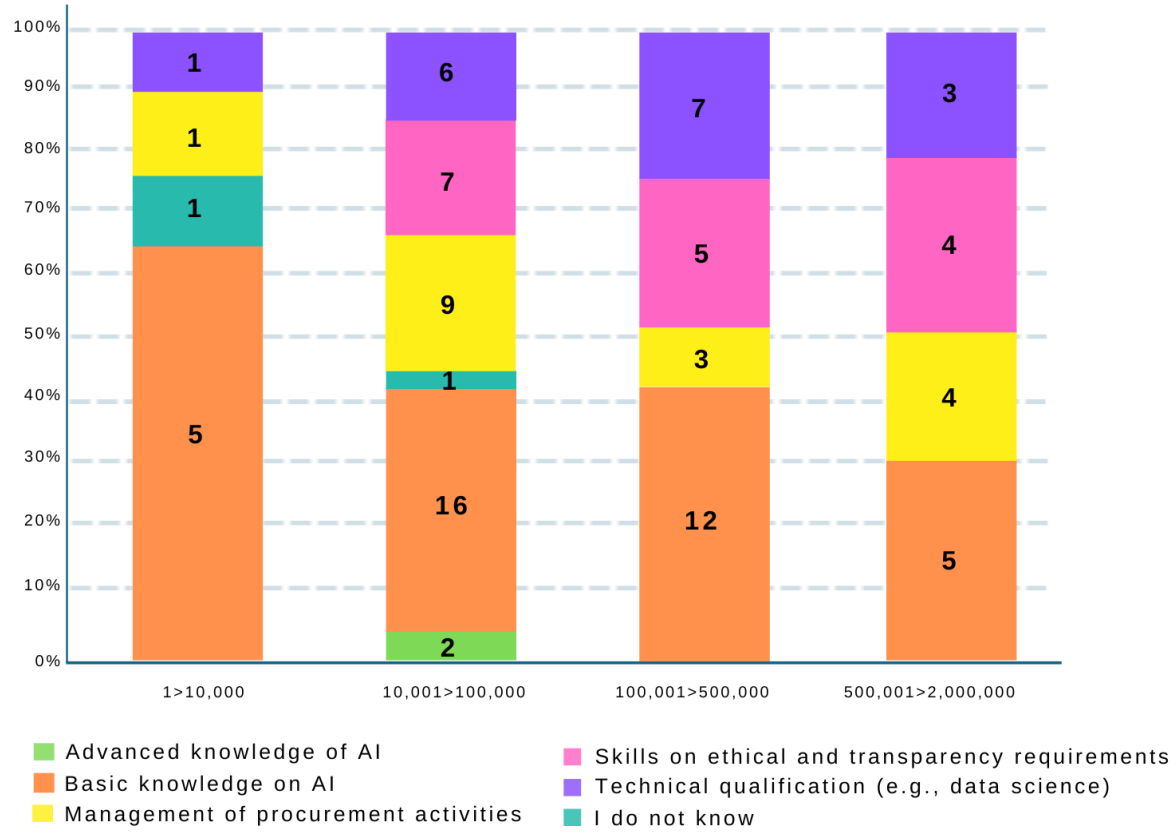
Figure 7. LRAs dedicating or not human resources to AI solutions, broken down by size



Overall, the numbers of LRAs that have a dedicated AI office or person and those that do not, are balanced in the sample (19 and 22 answers, respectively). The graph also shows the percentages of LRAs with human resources dedicated to AI and the demographic size of the municipality. Given the different number of responses in each demographic group, the data are analysed in percentages in order to appreciate the dynamics within each group. From the data in the graph, the decision to dedicate staff to AI does not appear to be correlated with the size of the local authority, unlike as postulated for the AI adoption. The demographic groups that appear to devote more staff in percentage terms are the largest and small to medium-sized LRAs. On the other hand, it cannot be overlooked that the smallest LRAs have the lowest rate of AI-dedicated personnel. Examining the responses of LRAs that have offices and roles dedicated to AI, almost all reported that they work within **IT and Digitisation Departments**.

Moreover, the detail of AI-related skills available to local administrations is considered. It is known that skills availability is one of the biggest determinant and at the same time one of the biggest challenges in implementing AI in the public domain. Data in **Figure 8** offer an insight into the availability of skills related to AI development and adoption across respondent LRAs.

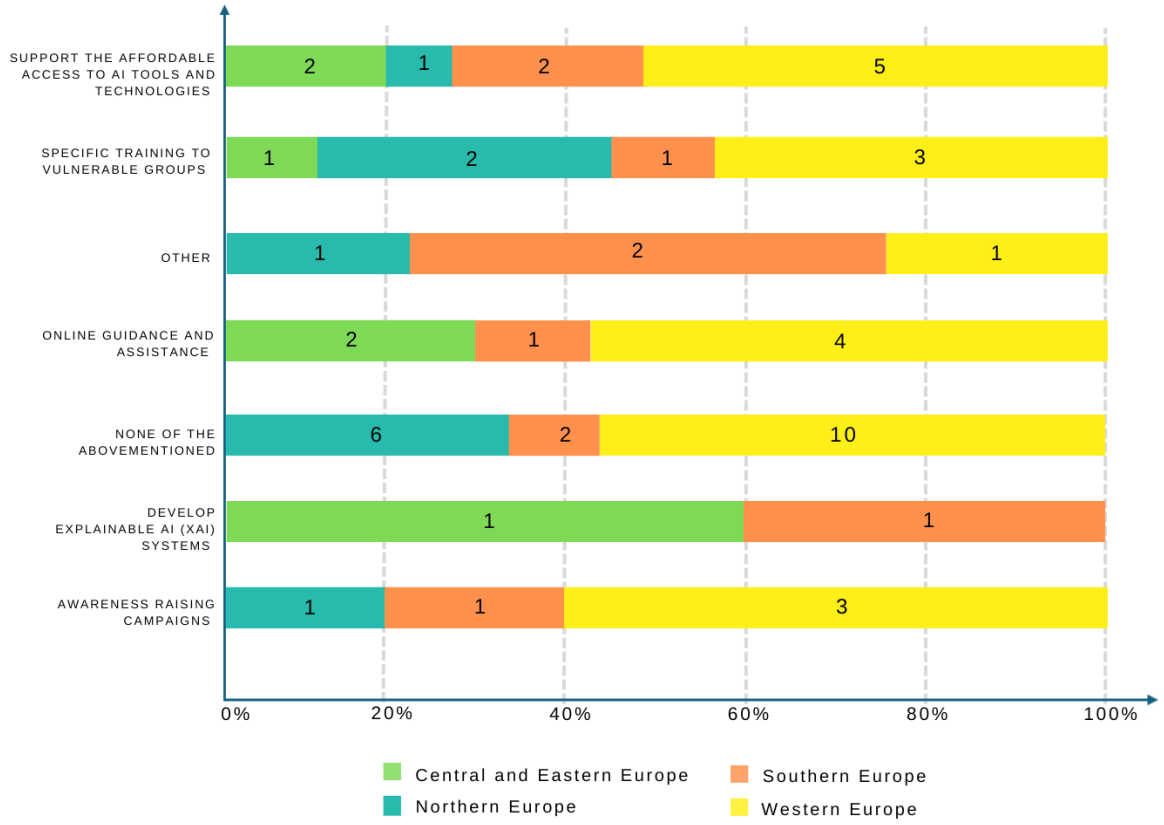
Figure 8. Presence of AI-related skills and competencies, broken down by size



Again, no clear trend can be seen with respect to the relation of AI skills and demographic size of the LRAs. The most widespread competence in LRAs of all demographic groups is the '**Basic knowledge on AI'**, which is a percentage more prevalent in the smallest LRAs. In the opposite spectrum, the least common skills are those on '**Advanced knowledge of AI'**. Consistently with the data on human resources availability, the presence of advanced knowledge of AI is in fact reported in only two LRAs within the small to medium-sized demographic group (10,000 to 100,000 residents). The second least widespread **skills** are those '**on ethical and transparency requirements'** that are completely absent in the smallest LRAs.

Considering the presence of digital skills also amongst population groups and the potential of AI to increase the digital divide, LRAs were asked to indicate the measures adopted to enable AI to include digitally disadvantaged groups. **Figure 9** below gives a perception of the most and least common actions that LRAs are currently considering addressing the digital divide.

Figure 9. Measures adopted to enable AI to include digitally disadvantaged groups, broken down by European region

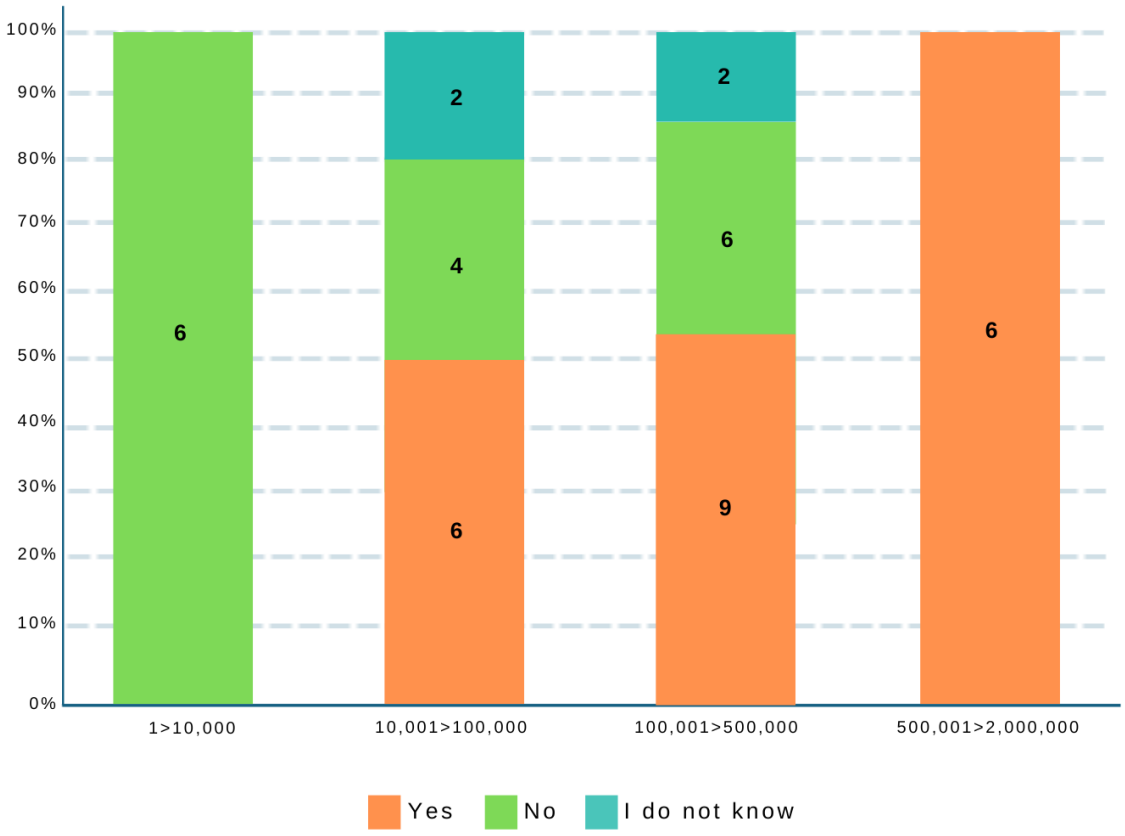


The graph above shows that most respondents are not acting to address the differences in digital competencies amongst population groups, and the percentage of those who are not implementing any of the listed actions is particularly high amongst Western European LRAs (54.5%). This result points to an area for improvement and offers space to reiterate the cruciality of social and public acceptance in adopting AI. Looking at the LRAs that are already implementing measures to enable AI to include digitally disadvantaged groups, the most common is the '**Support the affordable access to AI tools and technologies to help tackle the digital divide**', followed in equal measure by 'Online guidance and assistance' and 'Specific training to vulnerable groups'. Survey results show that the least adopted action is the development of Explainable AI (XAI) systems. **XAI** is defined as a set of processes and methods that enable human users to understand and trust the results and outputs generated by machine learning algorithms. XAI is considered fundamental in organisations to create trust and confidence when putting AI models into production. It is indicative for great potential for improvement its total absence in Central and Eastern Europe and even more so in Western Europe, where use cases are more numerous.

Related to considerations on skills availability, there is the decision of a Local Public Authority to outsource services in the AI development process. Outsourcing may be necessary due to limited internal expertise, and it has controversial aspects since it raises issues on transparency and data and IP ownership.

Figure 10 shows the percentage of LRAs that are outsourcing any AI development, divided by demographic group.

Figure 10. LRAs outsourcing or not AI development, broken down by size



Unlike the data on the availability of skills, a clear trend with respect to demographic size is evident in this case. Indeed, the data show how **the percentage of LRAs outsourcing increases with population size**, whereas none of the smallest LRAs declare to outsource. By combining this information with the one on skills availability, it can be noted how the balanced presence of AI-related skills in the largest LRAs, is combined with a total reliance on outsourcing. On the other hand, it is interesting to note how exactly half of the LRAs within the category with the broadest skills availability in the sample (those in municipalities with inhabitants ranging from 10,000 to 100,000) are outsourcing. It can be concluded that the percentage of outsourcing by LRAs seems to be more correlated with the geographic dimension rather than with its skills availability.

However, there is certainly a clear benefit in having the right in-house skills to better supervise and guide the external providers.

The involvement of expertise beyond the public administration may be facilitated through either the formal awarding of contracts to external providers or the establishment of strategic partnerships that play a crucial role in developing AI systems. Collaboration between public and private sectors is encouraged by European institutions and generally deemed as possible catalyst of innovation. In the context of AI adoption, amongst the advantages of building partnerships with academia are the attraction of young experts and the openness to technology innovation. Within the private sector, key partners are represented by start-ups, also at international level, a category that in Europe faces difficulties in exploiting its growth potential, as evidenced by the relatively minority share of total global funding for AI start-ups (6% compared to 61% to US start-ups and 17% to those in China) (Draghi, 2024).

From the analysis of the survey results by geographical area of LRAs adopting AI, it can be noted that Southern Europe is the geographic area with the highest percentage of respondents that have developed partnerships. Conversely, in Central and Eastern Europe there are no reported cases of partnerships. Western Europe is the area with the highest absolute number of LRAs adopting AI and here partnerships in local public administrations are present in about one-third of cases.

Listed below, are four examples of partnership cases reported by respondents. These good practices signal collaborations with different categories of private and public representatives and highlight territorial specificities across Europe.

- The **Municipality of Sollentuna** (**Sweden**) reports the collaboration between Swedish authorities, municipalities, regions and businesses, coordinated by the Sweden's national centre for applied AI[4]. The project has the aim to support employees in the public sector and promote national collaboration for textual-based tasks. In more detail, the project works on a prototype for a digital assistant, as a tool to promote the use of AI in the public sector. The aim is to design a prototype that is accessible to employees regardless of their technical competence and to allow them to devote attention to less automatic tasks. Another initiative by AI Sweden is '*Kraftsamling för AI i kommuner och civilsamhälle*' ('Gathering Power for AI in municipalities and civil society'). The project provided assistance and financial support to municipalities and civil society to better understand the opportunities offered by AI in welfare and to address societal challenges.

[4] AI Sweden.

- Another example of a multi-sectoral partnership is provided by the **Municipality of Tilburg** (**the Netherlands**) with the MasterMinds initiative. The project sees the participation of 15 partners from academia, knowledge institutions, the industrial and public sectors. MasterMinds consists of 5 research projects united by three main objectives: reducing the territorial gap in AI technologies, strengthening the collaboration between knowledge institutions and business partners in the field of AI technologies, and fostering innovation.

- The **City of Tallinn** (**Estonia**) reported different partnerships, including one related to the GreenTwins **project**. Within the project, the collaboration is between representatives from academia and the local public sector, more specifically between the City of Tallinn, the Tallinn University of Technology, Aalto University and the City of Helsinki. The pilot project is funded by the European Regional Development Fund and the Estonian Ministry of Education and Research. The main objective of the initiative is to deal with digital solutions for modelling blue (i.e., water-related) and green (i.e., land-related) networks in the urban environment and to develop software and models that provide information on the effects of urban planning to various stakeholders. The distinctive trait of the solution is the use of digital tools to promote urban vegetation for public well-being and to create physical and virtual spaces to allow citizens' participation.

- From **Spain**, the initiative of the **Agency for Technological Modernisation of Galicia** is worth noting. Within the Agency, the galicIA node was designed as a cooperation structure for the development of activities that allow the promotion of AI in the Galicia-North Portugal Euroregion. Public-private collaboration promotes AI in the economic, educational, labour and social fields. At its basis, there is an agreement between public institutions at local, national and international levels (e.g., Ministry of Economy, Industry and Innovation, European Grouping of Territorial Cooperation Galicia - Northern Portugal), and universities, such as the University of Santiago de Compostela and University of Vigo.

These cases are a symbol of the different modalities in which local administrations can cooperate with other sectors to promote AI for the public benefit, in particular with research institutions and private organisations. In general, entities in the public sector can be involved in three main types of relations in the implementation of AI solutions: Government-to-Government (G2G), Government-to-Citizen (G2C) and Government-to-Business (G2B). According to the EC study report 'Adopt AI' (2024), G2B solutions, i.e., interactions with private organisations and other economic activities, are the least numerous, representing 12% of the total.

From the survey results, interactions with the private sector often materialise in the development of digital platforms and clusters aimed at creating networks and promoting innovation. Cases of partnership with the private sector were reported by the **Municipality of Liepaja** (**Latvia**) with the 'Liepājas tehnoloģiju klasteris' initiative ('Liepaja technology cluster') – that sees the collaboration of IT professionals and companies with educational institutions and the city.

Other cases are from the **City of Dornbirn** (**Austria**). The Austrian Municipality indicated the projects 'Plattform für digitale Initiativen' ('Platform for Digital Initiatives') - and 'Plattform V' ('Platform V'). Both initiatives have the objective of encouraging networking and implementation of new technologies through the involvement of public and private actors. In particular, the project 'Platform V' promotes cross-company collaboration and enables the cooperation between employees of different companies for the benefit of companies, educational institutions and the population of the Lake Constance region.

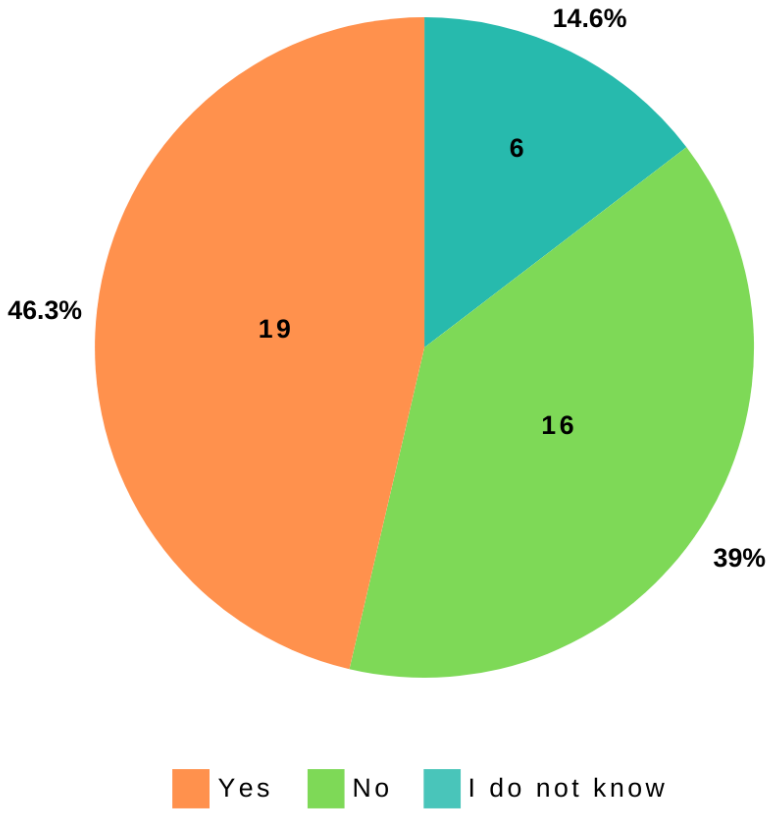
The relevance of programmes such as these, which encourage collaboration with the private sector and have a strong focus on the market, is particularly significant considering the low commercial exploitation of knowledge produced by European researchers (Draghi, 2024). Amongst the reasons for the low commercial exploitation of research, the report recognises exactly the low integration of researchers into innovation clusters in Europe.

Data on the development of partnerships by LRAs mostly overlap with the percentages of local administrations that are working on data interoperability and security for enabling AI to work properly.

In the sense recognised within the European Interoperability Framework (EIF), interoperability is the ability of organisations to interact towards mutually beneficial goals. Enhancing interoperability implies facilitating the digitalisation of public administrations and according to Tangi *et al.* (2023), amongst its benefits for the public sector are improved service delivery, increased transparency and accountability, enhanced data quality, greater efficiency and cost savings, and facilitated cross-sectoral collaboration. When implementing interoperability, a crucial aspect to consider is security, in terms of protection of sensitive data and maintenance of robust security mechanisms.

A question from the survey was aimed at detecting the level of implementation of interoperability and security at the benefit of AI technology adoption. The data in **Figure 11** show that amongst the LRAs adopting AI, the number of those who are working on data interoperability balances out with those who are not (19 LRAs are working on interoperability and 16 are not).

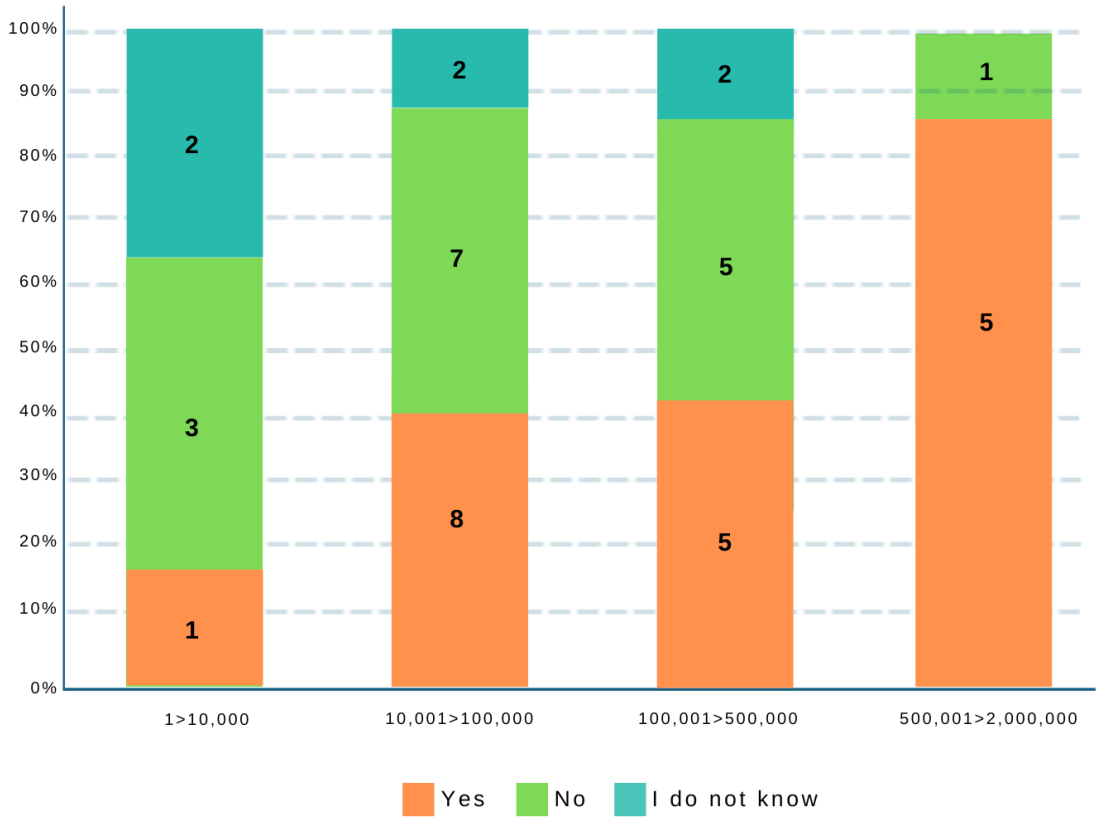
Figure 11. Proportion of LRAs working on data interoperability and security



Moreover, as anticipated, the percentage of LRAs actively addressing data interoperability is encouraging (46.3%), showing that nearly half of the surveyed LRAs are actively working on it. A considerable share of LRAs (39.0%) is not currently taking steps toward data interoperability and security. This could be related to a specific lack of technical expertise or to a perceived lack of benefits in addressing this topic. Finally, a minority of LRAs (14.6%) indicated uncertainty and it suggests that there may be a low degree of communication and alignment within the organisation.

Figure 12 below illustrates the interoperability implementation rate amongst LRAs divided by demographic group.

Figure 12. LRAs working on data interoperability and security by demographic group

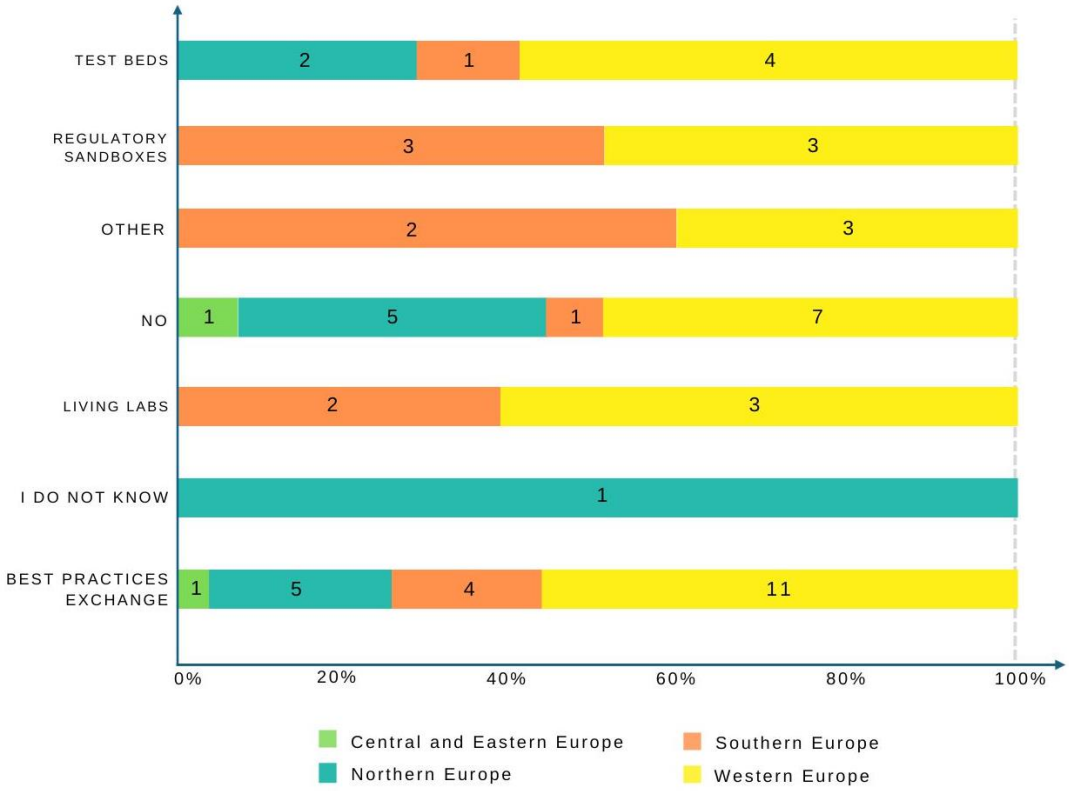


From the data in the graph, the interoperability implementation rate increases with demographic size. Approximately 83% of LRAs in the population range between 500,000 and 2 million are working on data interoperability, while the same percentage amounts to about 17% in the category of the smallest municipalities. The percentages in the middle demographic groups do not differ much and demonstrate that the rate of local administrations working on interoperability is not far below 50%.

Moving from the internal facilitating factors to the external conditions impacting LRAs' action, the use of AI, on the one hand, can strengthen trans-sectoral cooperation, while at the same time, it is the regulatory, cultural and economic environment that influences its adoption. The AI Act remarks the importance of fostering an environment that supports responsible research and innovation and includes risk mitigation measures. In particular, the recent regulation encourages

the establishment of regulatory sandboxes[5] with the aim of fostering AI innovation whilst ensuring compliance with the EU and national laws. Together with the legislative aspect, infrastructural and scientific frameworks are fundamental in supporting AI adoption. Tools such as test beds and living labs[6] have the potential to support the experimentation of new technologies and assess the feasibility and impact of real-world applications. **Figure 13** provides an overview of the level of advancement in the organisation of enabling actions in the process of AI development by LRAs.

Figure 13. Organisation of enabling actions for AI development



According to **Figure 13**, it can be seen that around one-third of the respondents adopting AI state that they do not organise any of the listed enabling actions. Looking at the LRAs that organise actions, the graph shows how, in all European regions, the most common enabling action is the '**best practices exchange**',

[5] **Regulatory sandboxes** refer to 'regulatory tools allowing businesses to test and experiment with new and innovative products, services or businesses under supervision of a regulator for a limited period of time' (Madiega and Van de Pol, EPRS 2022).

[6] **Living labs** are defined as 'open innovation ecosystems in real-life environments based on a systematic user co-creation approach that integrates research and innovation activities in communities and/or multi-stakeholder environments' (ENoLL). A **test bed** is identified in as a 'controlled experimentation platform, in which solutions can be deployed and tested in an environment that replicates real-world conditions. Its goal is to create growth opportunities for new products, services or business development' (EIT Community Testbeds).

followed by the organisation of test beds and, thirdly, by regulatory sandboxes. With respect to geographical differences, it is observed that the establishment of regulatory sandboxes is more common in Southern Europe, and no cases are reported in Northern, Central and Eastern Europe, while test beds are proportionally more prevalent in Northern and Western Europe.

Concerning the implementation of best practices exchange, from the survey two good practices emerged:

- The **Brøndby Municipality** (**Denmark**) reports a perfect example of an initiative aimed at sharing knowledge and inspiration on the use of AI amongst municipalities. The solution is offered by a Danish knowledge centre and includes various services. With the objective of providing guidance and fostering networking, the knowledge centre designed a '[Municipalities' AI Map]' that collects municipal AI solutions. The AI projects are registered directly by the municipalities and use cases can be searched all over the national territory by filtering by municipality and implementation sector. The centre also provides two '**Inspiration catalogues**', on 'How the public uses GenAI' and on 'AI solutions with potential for implementation'. The 'Inspiration catalogue: How the public uses GenAI' was created in collaboration with the Digital Agency and contains cases with solutions such as citizen-facing chatbots, minute writing and internal chatbots. The aim of the catalogue is to show how GenAI can help solve everyday tasks and make a difference for citizens and employees. For this purpose, advice from the collected cases is synthesised and shared. The 'Inspiration catalogue: AI solutions with potential for implementation' reports cases from the Municipalities' AI Map that are in operation or in pilot in one or more municipalities. The cases are selected based on their ability to inspire other municipalities to implement the technology and focus is placed on both the capacity of the AI solution to reduce the workload for employees and to improve the quality and the public satisfaction.

- The **Karlsruhe Municipality** (**Germany**) reports the [KI-Allianz Baden-Württemberg], which creates and connects AI innovation clusters in various cities and regions of the German federal state of Baden-Württemberg. The Alliance encourages connections between business, science, politics, and public administration. Its determination to promote the exchange of useful knowledge is symbolised by a newsletter that, from June 2024, provides information about events, workshops, collaborations, ideas and joint projects. An explicit objective of the newsletter is to share inspiring use cases and promote new ideas in the development and application of AI. Moreover, a sub-project in development of the Alliance focuses on the design of an AI data platform that offers stakeholders the possibility to access, create and manage data sets and AI models.

Regarding the design of regulatory sandboxes, the case of the **Agencia para la Modernización Tecnológica de Galicia** (Galician Agency for Technological Modernisation) in **Spain** is pioneering. The Agency is working on a legislative proposal to regulate the application of AI in the region of Galicia. The 'Law for the Development and Promotion of Artificial Intelligence' is soon going to be sent by the Xunta of Galicia to the Parliament for discussion, and it represents the first European regional law for the development and promotion of AI (see Section 2.2). The characteristic of the legislative proposal is to be aligned with the AI Act, and, according to representatives of the Agency, it has three main objectives:

- Establish the framework for the design, acquisition, implementation and use of AI in public administration;

- Regulate the legal regime for the use of AI by the public sector; and

- Promote the development of AI in the Galician R&D ecosystem and the business regional network.

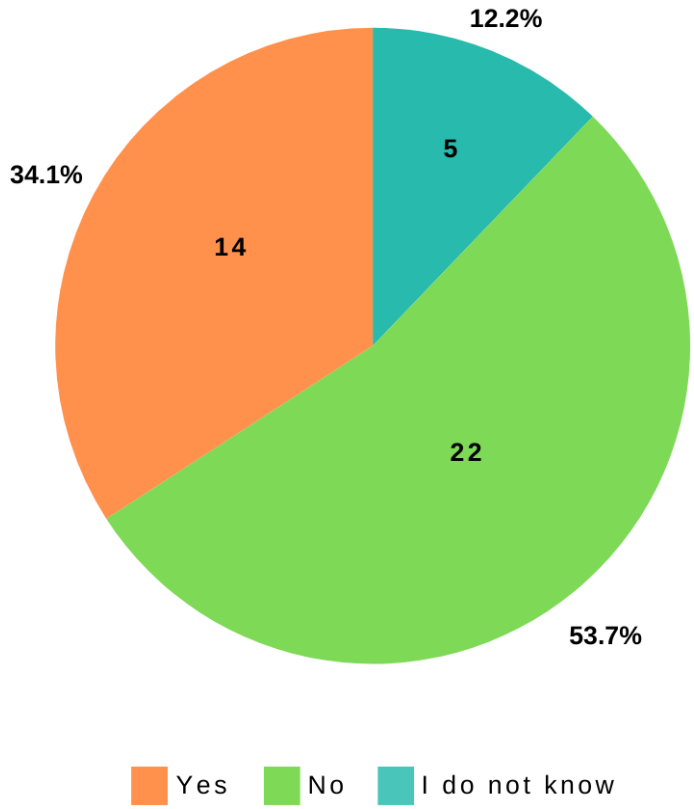
The law is a self-regulating legislation, so that it does not apply to markets. Nevertheless, in pursuing its objectives, it addresses various domains, from the fiscal incentives for enterprises, to promoting skills acquisition in the public and private sectors, to raising public awareness on the risks of AI. Further details and analysis on this case will be covered hereafter in this report.

1.2.3 AI monitoring and evaluation mechanisms

After analysing the key characteristics of AI adoption and implementation, a less investigated but crucial aspect is related to the monitoring and evaluation mechanisms to track key performance indicators (KPIs) and evaluate the success of AI-based solutions. As explained by Yigitcanlar *et al.* (2024), the introduction of regular evaluation would help address barriers to AI adoption and support public administrations in identifying areas for improvement and optimising AI systems, both in internal efficiency and in satisfying external stakeholders.

Figure 14 provides an overview of the LRAs that are currently assessing the effectiveness and efficiency of the AI and GenAI systems they are using. The pie chart shows that **the majority of respondent LRAs that are adopting AI are not currently working on assessing its impact or effectiveness**.

Figure 14. Proportion of LRAs assessing or not the effectiveness and efficiency of AI applications



To better understand the characteristics of local public authorities adopting evaluation mechanisms, **Figure 15** shows the percentages of respondents by demographic group of related territories.

Figure 15. LRAs assessing or not the effectiveness and efficiency of AI applications by demographic group

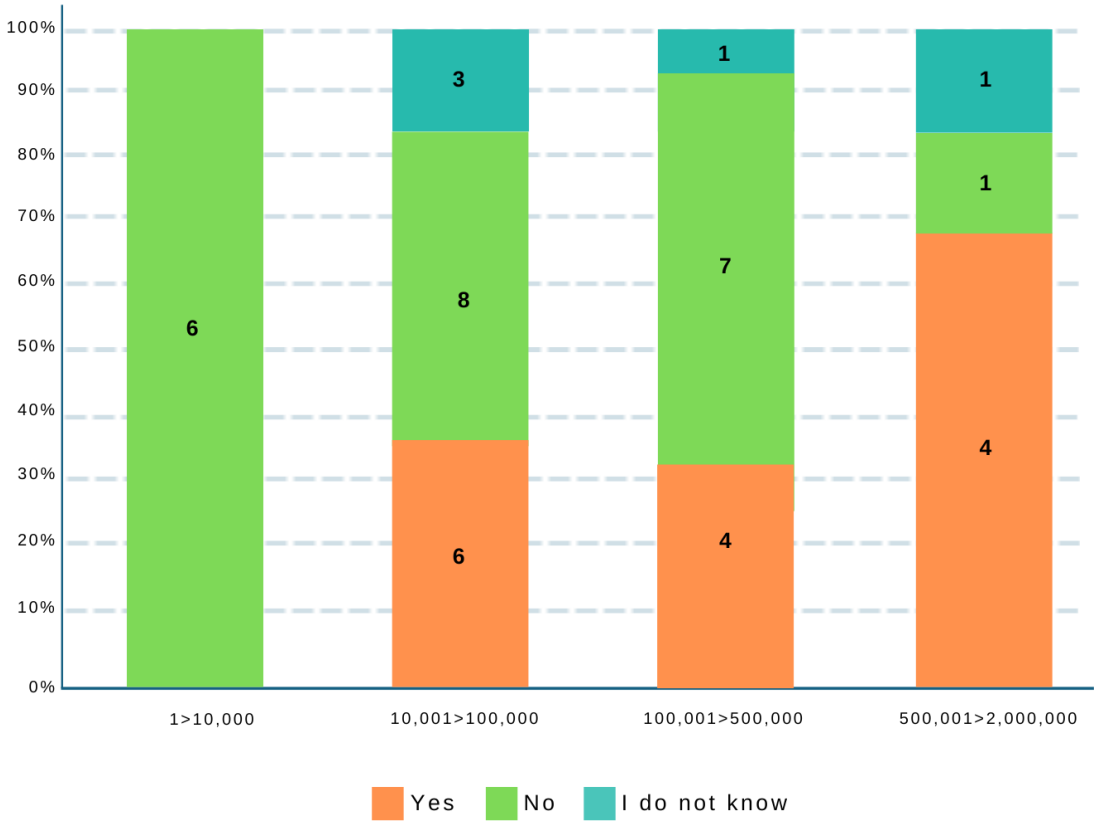
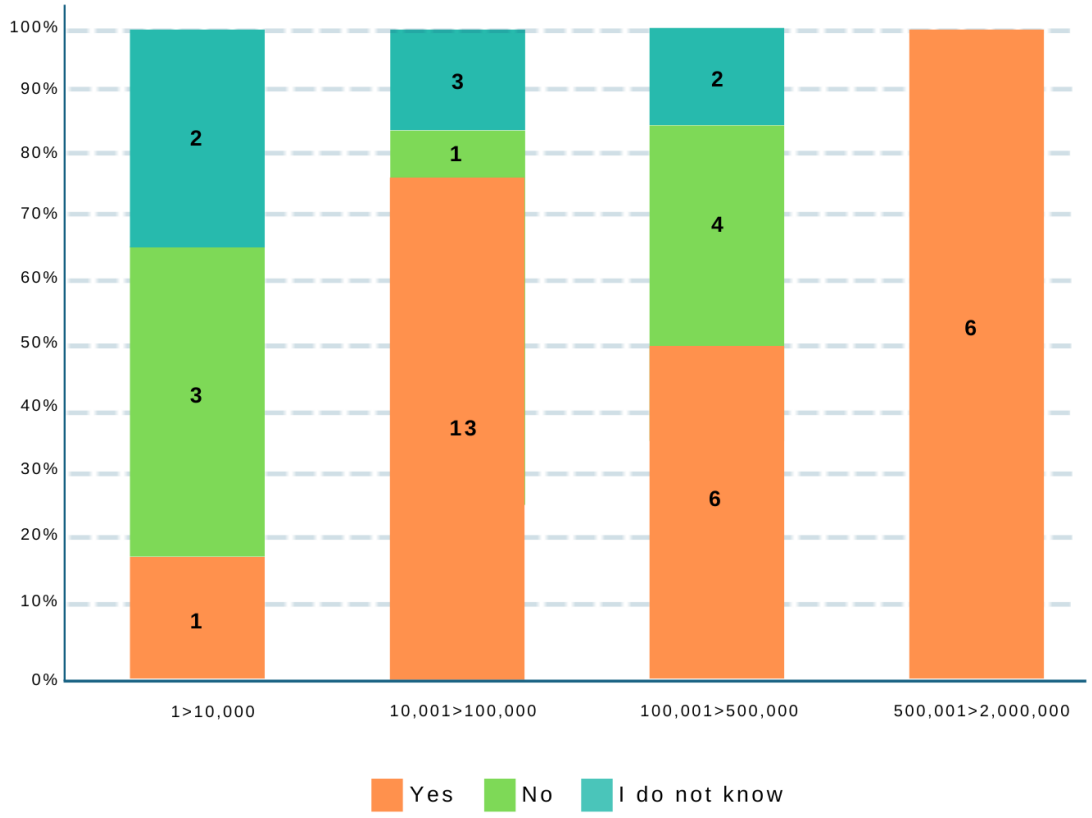


Figure 15 clearly demonstrates how the percentage of respondents that assess the effectiveness and efficiency of AI is higher in the largest local administrations while no assessment is performed in the smallest LRAs. In contrast, in the municipalities pertaining to the middle demographic groups, the percentage of adoption of evaluation mechanisms is comparable and is around 35%.

Figure 16 below goes into detail about the use of monitoring and evaluation systems and intends to examine whether within the local public administrations there are evaluation mechanisms aimed at adapting ongoing projects to innovations, in the sense of population evolving needs and technology advancements.

Figure 16. LRAs divided by demographic group that foresee or not continuous monitoring and evaluation of AI projects to adapt to evolving needs and technologies

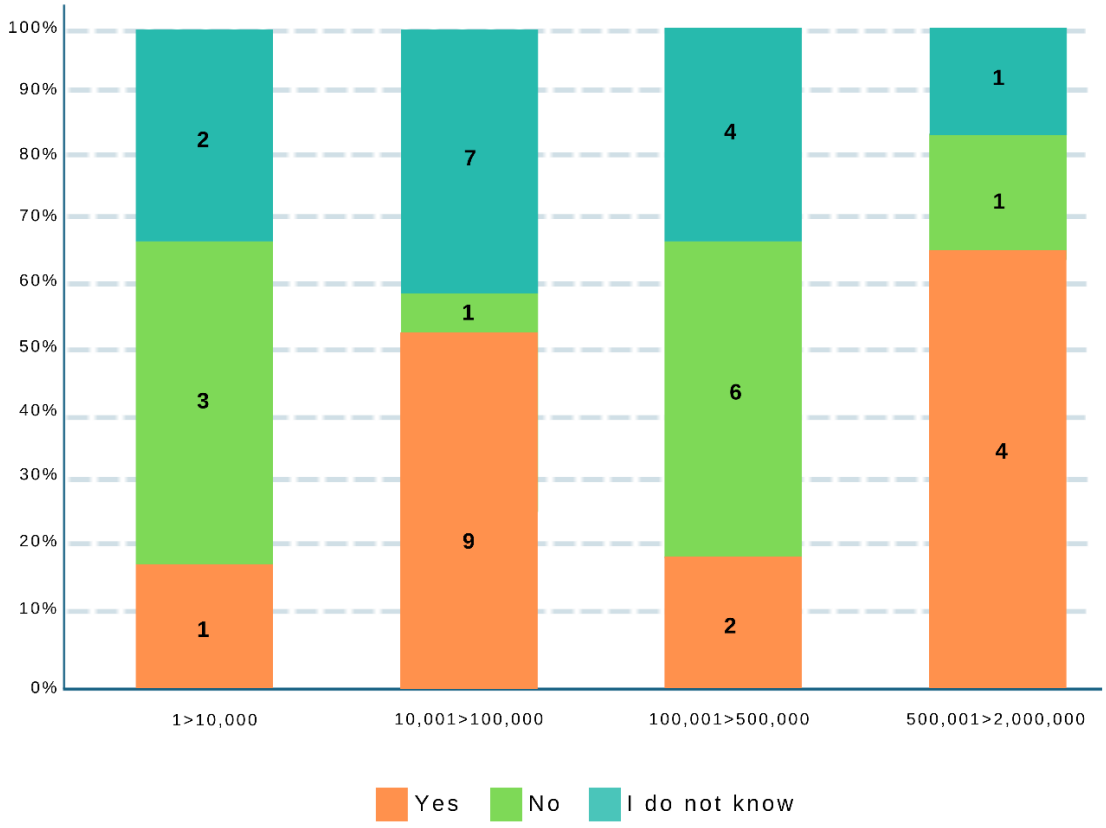


The data partly match those of the previous figure, but it can be seen that in this case, monitoring and evaluation mechanisms are also in place in the smallest municipalities, while in the largest ones, they are adopted by all LRAs. On the other hand, the gap in adoption rates widens between intermediate-sized groups of municipalities, with those with between 10,000 and 100,000 residents (small to medium-sized) showing a greater presence of evaluation systems. Disaggregating this information by geographical areas, it is noted that the highest percentages of LRAs foreseeing monitoring and evaluation systems are those in the areas of Northern and Southern Europe. No monitoring and evaluation systems are instead foreseen in LRAs located in Central and Eastern Europe.

Linked to the crucial role of monitoring and evaluating processes of AI-based solutions is the aspect of gathering public feedback. The collection of feedback is instrumental to increase transparency and trust of citizens and businesses and ensure the correct and confident usage of AI by end-users. Again, adoption rates are higher in Northern and Southern Europe, and no cases are registered in Central and Eastern Europe. In addition, data in **Figure 17** make evident that the decision to gather public feedback for shaping AI and GenAI strategies is not

homogeneous across LRAs of different demographic groups. In more detail, LRAs with between 10,001 and 100,000 residents and LRAs in the largest municipalities (with between 500,000 and 2 million residents) show the highest percentage rates.

Figure 17. LRAs that foresee or not the gathering of public feedback for shaping the AI strategies, broken down by size



1.2.4 Challenges and drivers of AI adoption

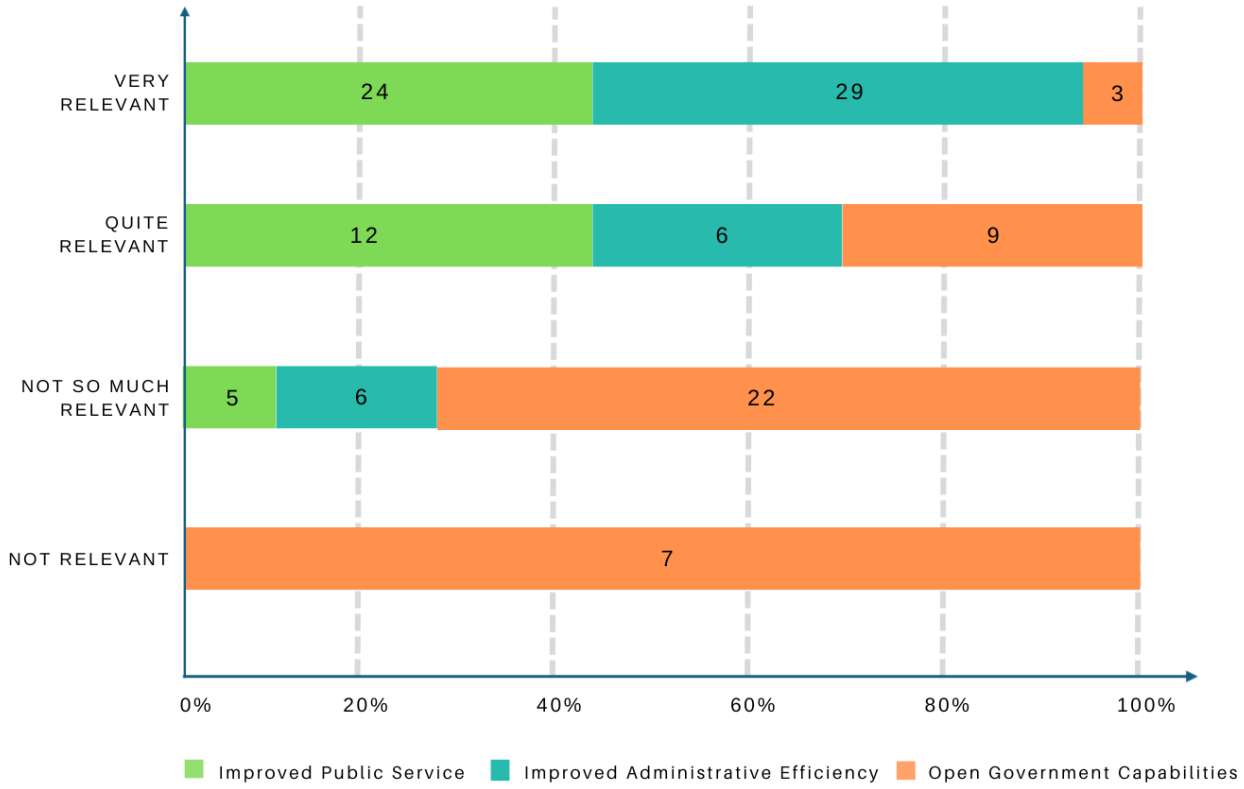
In the survey submitted to LRAs, part of the questions was devoted to gathering the opinions of the respondents to assess their perception on the current state of the AI integration process and the factors facilitating or hindering it. As a first aspect, an analysis was made of the drivers of AI adoption at subnational level.

In identifying the drivers of AI and GenAI adoption, reference was made to the 'value drivers' proposed in the AI Watch study 'European Landscape on the Use of Artificial Intelligence by the Public Sector' (Tangi *et al.*, 2022). The drivers are grouped into three categories and are intended to summarise the main aspects able to produce value in the public sector and to influence the introduction of AI within it. The 'Open government capabilities' category refers to the impact on the transparency of public operations, participation in government and public control

of government. The option 'Improved Administrative Efficiency' encloses efficiency and effectiveness purposes and aims at capturing the ability to both improve management of internal resources and deliver quality services. The option 'Improved Public Service' focuses instead on the goal of enhancing the quality of the service for the end-user, for example, by customising it or improving accessibility.

In line with previous research on AI adoption in the public sector, the data in **Figure 18** show that the driver of the AI adoption most often considered as 'Very relevant' by the LRAs is the '**Improved Administrative Efficiency**'.

Figure 18. LRAs' view on the drivers of AI adoption by public services at subnational level

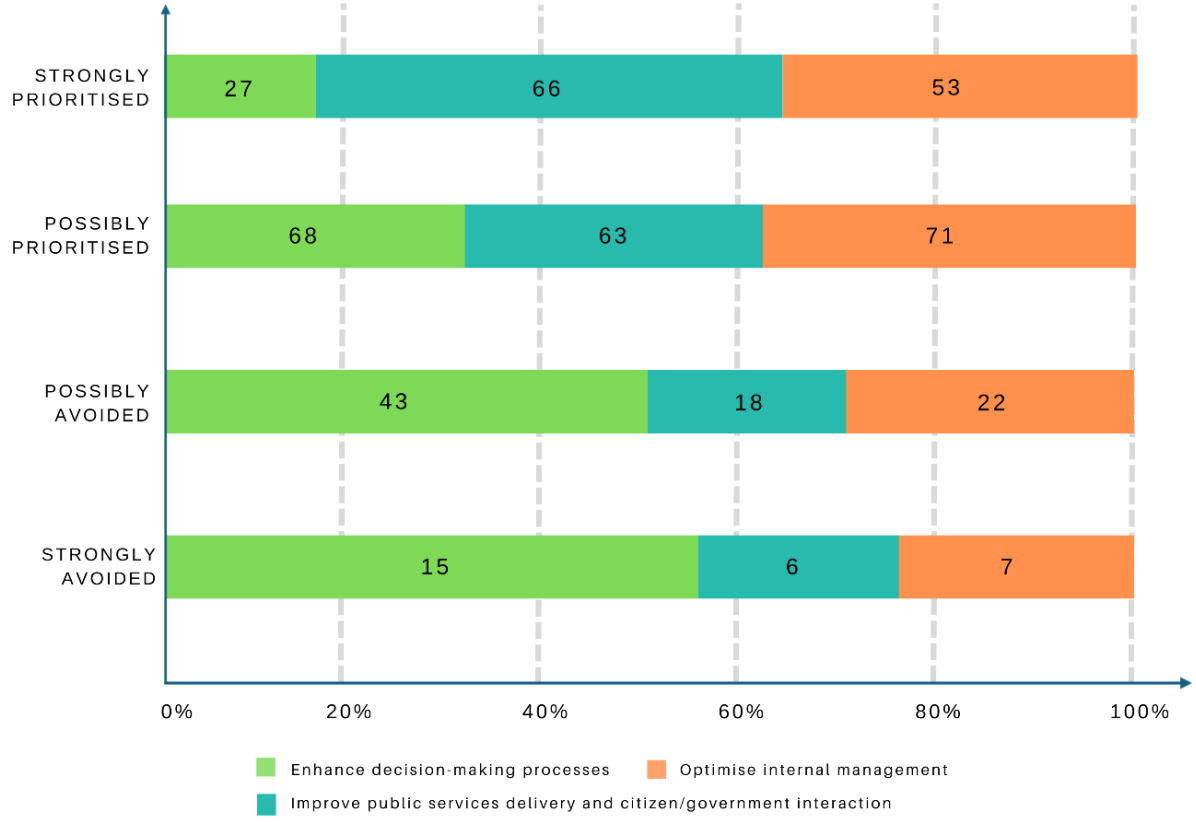


At present, the main incentive in AI adoption appears thus to be its ability to support internal efficiency, that is, reducing the amount of time and effort needed to produce and/or deliver a certain service. This may be linked to budget constraint considerations and more generally to the widespread need to improve public resources management in local governments. The driver 'Improved Public Service' is considered 'Very relevant' by a slightly smaller number of LRAs, highlighting how AI is considered more useful for improving internal efficiency rather than for enhancing the quality of the public service. It could be argued that improving internal efficiency is a less risky application (or perceived as such) than an AI in support of citizen services.

Finally, only the option 'Open government capabilities' is considered (in 7 out of 41 responses) as 'Not relevant', while most respondents deem this driver of the AI and GenAI adoption to be 'Not so much relevant'.

Compared to what drives the adoption of AI, there was a desire to understand what are the aspects that according to the LRAs should be prioritised or avoided in the future, also in the perspective of supporting policymaking. It is interesting to note that for LRAs, the aspects that should be prioritised in the use of AI and those that drive it to date differ to some extent. **Figure 19** below provides a synthesis of the results of LRAs' responses on the uses of AI and GenAI that, in their opinion, should be prioritised or avoided in the future to maximise their benefits.

Figure 19. AI uses to be prioritised or avoided according to LRAs



The data in the graph demonstrate that the use of AI and GenAI that most LRAs consider worth to be 'strongly prioritised' is to '**improve public services delivery and citizen/government interaction**'. On the other hand, the use that was most often found to be 'strongly avoided' or 'possibly avoided', is to '**enhance decision-making processes**'. This may be explained by the fact that AI-based decision-making could be perceived by LRAs as less acceptable to citizens.

These results can be commented on by combining both the responses on the uses that LRAs are currently prioritising and on the factors considered by LRAs as drivers of AI adoption. Interestingly, while 'optimisation of internal management' is seen as the main use of AI to date (see **Figure 6**), and 'improving internal efficiency' is perceived by respondents as the main current driver of AI adoption, this is not considered by LRAs to be the first aspect to be prioritised in future AI adoption. At the same time, the use that according to respondents can maximise the benefits of AI use in the future ('improve public services delivery and citizen/government interaction') was not considered to be the most relevant driver of AI adoption at present at subnational level.

Lastly, the question on the main challenges and barriers faced in adopting AI and GenAI technologies was open to all respondents in the sample so as to analyse the perspectives of the LRAs that are already implementing AI-based solutions and of those that are not. The challenges identified concern potential obstacles in the AI implementation process related to different domains such as the lack of political/community interest, the lack of resources in terms of human capital and budget availability, and technical barriers such as on data quality or interoperability.

Figure 20. Main challenges in the adoption and implementation of AI technologies

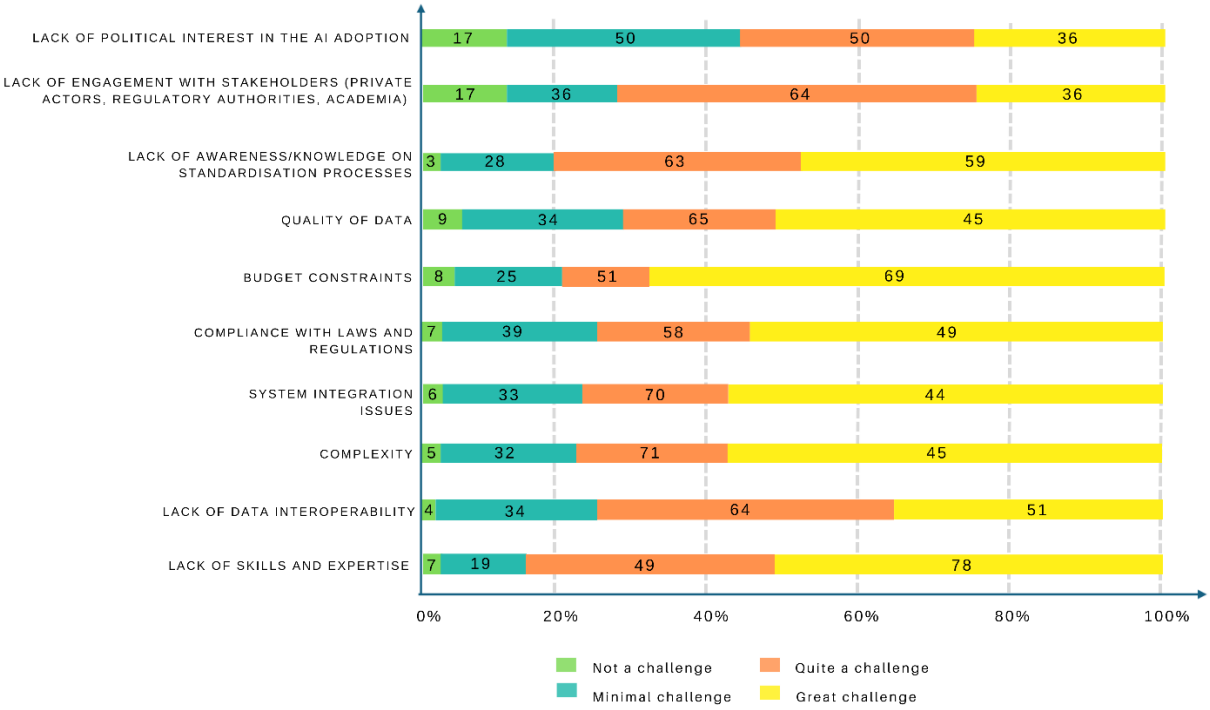


Figure 20 shows that the three barriers more often seen as 'great challenges' concern different areas and none of them is about technical infrastructure. In order of number of times mentioned, they are the '**lack of skills and expertise'**, '**budget constraints'**, and '**lack of awareness/knowledge on standardisation processes**'. On the opposite side, the aspects more often considered to be 'Not a challenge' are equally the '**Lack of political interest in the AI adoption'** and the '**Lack of engagement with stakeholders (e.g., private actors, regulatory authorities, academia)**'.

1.2.5 Conclusions

AI adoption, application sectors and main benefits for LRAs

Around 27% of LRAs that responded to the survey are currently adopting AI. Analysing AI use cases by country and comparing them with the PSTW findings, in countries such as Germany, Portugal, and the Netherlands, AI appears to be less adopted at local level compared to the national level. The degree of AI adoption increases with LRAs' territorial dimension, measured in terms of demographic size, so that in the largest LRAs the percentage of AI adoption is maximum.

At local public level, in all European regions, AI is found to be most used in 'AI-based services for the public administration'. As for initiatives at the national level, priority use is given to municipal public services, whereas fewer use cases are found in the health and education sectors. Different secondary priorities in AI use are noticed amongst European regions. In Western and Northern Europe, the second most frequent sector is 'Municipal public services', while in Southern Europe the two sectors most widespread after 'AI-based services for the public administration', are 'AI-based services for citizens' and 'Mobility and transport'. The 'Energy and sustainability' sector is proportionally more common in Northern Europe.

More generally, the main areas in which AI support the public sector according to LRAs are (1) the 'optimisation of internal management' (more frequently reported by Northern and Western LRAs), (2) the 'improvement in the delivery of public services' (more common in Western Europe) and (3) the 'enhancement of decision-making processes', a benefit more frequently reported in Southern Europe. The area that seems to benefit least from the AI implementation is 'communication'. Overall, commonalities are found in Northern and Western Europe, where the two most frequent application sectors coincide, and both regions use AI mainly to optimise internal management. Additionally, the application sectors and the recognised benefits of AI are found to be more numerous in Northern Europe.

Human resources dedicated to AI and relations with the external environment

A fundamental role in AI adoption and management is played by the human resources dedicated to it, both in terms of the number of dedicated employees and the specific qualifications. According to the survey results, the initiators of AI adoption in LRAs are most frequently identified, in order, in the figures of the 'manager', the 'digital departments' in the public authority and of an 'individual expert in the field'. 'Partnership' and 'in-house agency' categories appear less common. Comparing data by geographical areas, the roles that are recognised as initiators of AI adoption in all European regions are those of the 'manager' and of 'partnerships'. The figure of the 'individual expert' is also quite transversal across Europe, while 'in-house agencies' are more considered in Northern Europe.

Looking at the presence of internal AI dedicated staff, the decision to allocate specific human resources does not result in a correlation with the demographic size of the LRAs. In particular, the groups that show the highest percentages of AI dedicated staff are the largest and the small to medium-sized LRAs. It is to note that almost all LRAs that have offices and roles specifically dedicated to AI are employing them in IT and Digitisation Departments.

To capture the spread of AI-related skills, five main areas of expertise were investigated: technical qualification (e.g., data science), skills on ethical and transparency requirements, basic knowledge on AI, management of procurement activities, advanced knowledge of AI. According to the survey results, the presence of AI-related skills and competencies does not appear to be markedly related to demographic size either. However, it is noted that as the demographic size increases, the presence of specific skills is more balanced. In particular, the 'Basic knowledge on AI', which is the most widely spread competence in all European regions, is proportionally more prevalent amongst the smallest LRAs. The least common AI-related skill is the 'Advanced knowledge of AI' (reported in only two LRAs within the small to medium-sized demographic group), followed by the 'skills on ethical and transparency requirements', the latter being completely absent in the smallest LRAs.

Regarding the potential of AI to increase the digital divide, most respondents are not acting to address the differences in digital competencies amongst population groups. The data related to Northern Europe stands out, where the majority of LRAs are not implementing measures for the inclusion of digitally disadvantaged groups. Looking at the LRAs that are already implementing measures, the most common is the 'Support the affordable access to AI tools and technologies to help tackle the digital divide', followed in equal measure by 'Online guidance and assistance' and 'Specific training to vulnerable groups'.

In contrast with data on AI-related skills availability, a clear trend with respect to demographic size is found in the case of outsourcing. Indeed, the percentage of LRAs outsourcing increases with their demographic size. The correlation between outsourcing rates appears to be stronger with the demographic size of LRAs rather than with the availability of skills.

The survey results point to a higher percentage of LRAs developing partnerships in Southern Europe, while no cases of partnership are reported from Central and Eastern Europe. Data on partnership development overlap with those on the LRAs working on data interoperability and security. This implies that while the number of LRAs that work on data interoperability balances out with those that do not, the interoperability implementation rate increases with demographic size.

It is observed that one third of respondents that adopt AI is not organising enabling actions in the process of AI development, such as regulatory sandboxes, test beds or living labs. In all European regions the most common action organised is the 'best practices exchange'. With respect to geographical differences, it is noted that the establishment of regulatory sandboxes is more common in Southern Europe, while test beds are proportionally more prevalent in Northern and Western Europe.

AI monitoring and evaluation mechanisms

To evaluate the degree of implementation of monitoring and evaluation mechanisms of AI solutions amongst LRAs, three aspects were investigated in the survey: (1) the practice of assessing the effectiveness and efficiency of AI applications currently in use, (2) the monitoring and evaluation of AI projects to adapt to evolving needs and technologies, and (3) the gathering of public feedback for shaping the AI strategies.

The first finding shows that amongst the three actions investigated, 'monitoring and evaluation of AI projects to adapt to evolving needs and technologies' is the most widespread amongst LRAs. This indicates relatively less attention to the aspect of measuring the effectiveness and efficiency of AI applications currently in use. Indeed, only a minority of LRAs that are adopting AI solutions are working on this aspect (34%). Disaggregating data by demographic group, it is noted that the highest percentage of respondents working on effectiveness and efficiency assessment is registered by the largest LRAs, while no assessment procedures are reported by the group of the smallest ones.

The result is partly replicated in terms of differences amongst demographic groups when looking at the inclusion of 'monitoring and evaluation of AI projects to adapt to evolving needs and technologies'. In this case, as anticipated, the adoption level is overall higher and particularly both amongst the smallest and the largest LRAs. All LRAs in the largest demographic group are foreseeing the monitoring and evaluation of AI projects.

Regarding the third aspect investigated, the percentage of LRAs that are gathering public feedback for shaping the AI strategies is not homogenous amongst demographic groups. Public feedback result to be more taken into consideration by the LRAs in the small to medium-sized and the largest demographic groups.

When considering geographical differences, the adoption level of the three dimensions is consistent within each European region and no actions are reported to be implemented in the LRAs located in Central and Eastern Europe. The highest percentage of LRAs assessing the effectiveness and efficiency of AI applications is observed in Western Europe, while the monitoring and evaluation of AI projects and the gathering of public feedback are proportionally more widespread in Northern Europe.

Challenges and drivers of AI adoption

The opinions expressed by LRAs on the main challenges faced in the adoption and implementation of AI offer an overview of the aspects on which priority

action should be taken to facilitate the dissemination of the technology. The three barriers more often seen as ‘great challenges’ by the entire sample of respondents are the ‘lack of skills and expertise’, the ‘budget constraints’, and the ‘lack of awareness/knowledge on standardisation processes’. Aspects that are not considered to be limiting the adoption of AI are instead the ‘Lack of political interest in the AI adoption’ and the ‘Lack of engagement with stakeholders (e.g., private actors, regulatory authorities, academia)’.

Focusing on the LRAs that are adopting the technology, the driver of the AI adoption most often considered as ‘Very relevant’ is the ‘Improved Administrative Efficiency’, followed by the driver ‘Improved Public Service’. The aspect ‘Open Government Capabilities’, which concerns the impact on transparency of public operations, participation in government and public control on government, is considered by most respondents as ‘Not so much relevant’.

A discrepancy is noted between the opinions on the current drivers of AI adoption and the use of AI to be prioritised in the future to maximise its benefits. The use of AI that most LRAs consider worth to be ‘strongly prioritised’ is to ‘improve public services delivery and citizen/government interaction’, in contrast to the main use of AI to date (‘optimisation of internal management’) and the current main driver that is identified in the improvement of administrative efficiency. This could be interpreted as the LRAs’ view of the priority shifting from improving internal management within the local public authority to improving the perceived quality of the public service by citizenship. On the other hand, the use of AI that was most often considered to be ‘strongly avoided’ or ‘possibly avoided’ by LRAs, is to ‘enhance decision-making processes’.

Part 2: Factors for the successful AI and GenAI adoption in cities and regions

The integration of AI and GenAI technologies into the operations of LRAs has the potential to transform public sector services, improve governance, and enhance citizens' lives. However, the successful adoption of these technologies is influenced by a variety of factors that differ depending, *inter alia*, on the administrative context, the technological readiness of the LRA, and the specific use cases envisioned for AI and GenAI deployment at place-based level. This chapter explores the critical factors that contribute to the successful adoption and implementation of AI and GenAI technologies by LRAs.

In the context of this study, success factors are defined as the key elements, conditions, or practices that significantly increase the likelihood of successful AI and GenAI adoption and integration into public sector services at the local and regional level. These factors have been examined through the lens of the Technology-Organisation-Environment (TOE) framework (Tornatzky & Fleischer, 1990), a widely used theoretical model for understanding technology adoption in various settings. The TOE framework highlights three interdependent dimensions that influence an organisation's ability to adopt and successfully integrate new technologies, namely:

- Technology: The characteristics of the technology itself, including the benefit the organisation can gain from its adoption and implementation, as well as its complexity, compatibility, ease of use, and data availability and quality.
- Organisation: The internal characteristics of the adopting organisation, such as its structure, resources, culture, and readiness for change.
- Environment: The external factors that influence adoption, such as legal and regulatory environments and societal expectations (e.g., citizen acceptance and user engagement).

By applying this framework, this chapter aims to provide a structured approach to understanding the factors that contribute to the successful implementation of AI and GenAI at the local and regional level. It is grounded in primary data collected through qualitative research, specifically a set of semi-structured interviews with a diverse range of stakeholders, including officials at local and regional level and experts from academia.

The officials interviewed are representatives from selected LRAs featured in the eight case studies annexed to this study. These case studies illustrate the successful adoption and implementation of AI technologies at subnational level, providing concrete examples of how AI is being integrated into public services

and governance practices. In addition to these stakeholders, academic experts with extensive experience in AI and public administration were also consulted. The experts' selection process aimed to capture perspectives from individuals who not only possess expertise in AI but also have a deep understanding of how AI is being implemented in public administration contexts.

Four experts were consulted for the scope of this study, including authors of the EU Public Sector Watch Report (who provided an overview of the work carried out by PSTW), researchers focused on AI adoption and implementation by Italian public administrations, and a representative of an LRA that is amongst the most forward-thinking subnational governments in the EU investing in digital transformation, including AI initiatives, i.e., the Catalonia region.

By consulting these experts, the study ensures that the findings reflect both theoretical knowledge and practical insights stemming from their professional experience into AI's role in local and regional governance, particularly with regard to successful adoption strategies and challenges faced by public administrations at the local and regional level.

2.1 Fostering cooperation between the technical and political levels

The successful adoption of AI at local and regional level is contingent upon effective collaboration between two key groups: political leaders and public managers, and technical experts. On one hand, politicians may lack the technical expertise to fully understand the potential, limitations, and risks associated with AI technologies, as they are often more concerned with societal issues related to public trust, policy implications, and the democratic values underlying governance. On the other hand, technical experts may struggle to communicate the benefits and implications of AI in ways that resonate with political leaders. AI technologies are often perceived as highly technical and abstract, and their implications are not always intuitive. Without a clear understanding of what AI can and cannot do, political leaders may either reject AI innovations out of caution or fail to implement them effectively, risking missed opportunities or unintended consequences. It is therefore important that the two groups have a shared understanding of AI, for instance by translating technical jargon into plain language or by fostering the use of XAI, thus enabling a common full understanding of what AI is and how it works.
Without proper communication and understanding between these two groups, the risk of creating or exacerbating a digital divide amongst different territories across the EU becomes a significant concern. This divide can undermine the equitable distribution of AI-driven benefits, particularly for less digitally advanced regions, thus hindering the effective use of AI in public administration settings and the alignment with the broader EU goals of social and territorial equality. Through

the EU cohesion policy, the EU has been actively working to reduce disparities between regions by promoting economic, social, and territorial cohesion. Ensuring equitable access to AI technologies is a critical part of this vision, as it can drive development and innovation in less digitally advanced areas, helping to reduce the gap between high-tech urban centres and rural or peripheral regions.

The CoR has further emphasised the importance of digital cohesion (CoR, 2022), which focuses on ensuring that digital technologies and infrastructures are accessible to all regions and territories, regardless of their level of technological development. Digital cohesion is particularly important in the context of AI adoption, as technological advancements must not lead to greater inequality but promote inclusive growth and improved public services for all citizens.

According to the CoR, digital cohesion requires a multi-level governance approach, where LRAs are key players in shaping the digital transition in ways that are both inclusive and sustainable. AI technologies, when implemented with the right skills and understanding, can contribute to achieving these objectives by improving public services, increasing government transparency, and fostering economic growth across regions.

However, as already mentioned in Part 1 above, many LRAs are not internally equipped with the technical skills needed to adopt and implement AI solutions by their own means. According to this study's findings, a great number of public administrations at local and regional level tend to outsource the AI development and implementation, and/or to build external partnerships with other organisations that have the technical expertise needed.

This is the case of the **Municipality of Lisbon** (**Portugal**), which in 2022 started the 'Lisnav' project (see Case II.7). The aim of this 1-year project was to leverage on AI and AR to improve the well-being of residents with visual impairments. To achieve this, the Municipality capitalised on a technological solution designed by 3FINERY LTD, a start-up with expertise in augmented reality and inclusive technologies.

Also, the **Municipality of Vaasa** (**Finland**) implemented the 'Fix the Streets' project with support from a private sector technology provider, Crowdsorsa (formally Crowdchupa) (see Case II.3). Crowdsorsa is a company located in Tampere, Finland, which has been developing technologies for public administrations to delegate several tasks to citizens, such as providing information on the health of the streets and roads across the city, paying them for their time and effort.

The experience of the **Municipality of Jammerbugt** (**Denmark**) is another use case that is worth mentioning as driven by a multi-stakeholder partnership (see

Case II.5). Considering the growing risks of floods in the city due to climate change, in 2021 the Municipality designed the 'wet index', an AI-based tool to predict floods 48 hours in advance and contribute to decision-making in monitoring and local planning for urban and rural areas. Although the Municipality had internally the expertise to develop such a tool, a multi-stakeholder partnership with private suppliers, universities and research institutes was effective in designing the project and defining specific processes and methodologies that have contributed achieving a positive outcome upon completion of the project.

2.2 The facilitating role of political decision-makers and appropriate governance

Political leaders play a central role in driving and validating the adoption of AI at the local and regional level. While technology itself is often seen as neutral or self-implementing, its successful integration into public administrations heavily relies on the political will and capacity to lead and support digital transformation initiatives, including AI adoption and implementation. At the local and regional level, the importance of political decision-makers lies in their ability to set a strategic vision, assess the benefits and impacts of technological uptake, allocate both human and financial resources, and, crucially, foster a culture that embraces innovation.

In many LRAs, traditional models of public administration often prioritise stability, established practices, and risk aversion. AI adoption, however, presents both opportunities and challenges that require a shift in mindset. Political leaders can be pivotal in creating a culture where experimentation and innovation are encouraged, and where staff at all levels of government are trained to understand and engage with AI technologies. Without political leadership, the necessary organisational changes, investments in skills development, and adaptation of procedures will be delayed or ineffective.

This is the case of the **Municipality of Bologna** (**Italy**), which is committed to the challenge of turning itself into the most progressive Italian city by adopting a Digital Twin, i.e., a city model using data to evolve in real-time to help generate public value. As pointed out by the Mayor of Bologna, Matteo Lepore, in a recent interview (2024):
"for us, the digital twin project is […] amongst the pillars of a political strategy driven by the city's needs"[7].

[7] *"Per noi il progetto del gemello digitale è […] un pilastro di strategia politica di protagonismo della città"* (Italian original version).

Kicked off in 2024, the project is part of broader European, national and regional strategic goals aimed at fostering digital innovation, including the adoption of AI for the setup of new research infrastructure, sustainable urban development, and climate action (Comune di Bologna, 2024). Bologna is participating in the EU's Cities Mission for climate-neutral smart cities by 2030, and has incorporated the Digital Twin project within its flagship initiative towards urban regeneration and research collaboration uptake, the 'Knowledge City' (FUTURAnetwork, 2024). To achieve this, the City is benefitting from the 'Metro Plus Città Medie Sud 2021-2027', the Italian National Programme approved by the European Commission to provide funding to Italian cities for sustainable urban development projects.

Although political decision-makers at the local and regional level are crucial for driving the adoption of AI within public organisations, it is equally important that appropriate higher-level governance is in place to develop a set of terms and conditions - both regulatory and operational - enabling public authorities at subnational level to adopt and implement AI solutions. In this regard, the main benefit of clear governance is the establishment of a transparent and effective mechanism for accountability, able to demarcate the responsibilities of the municipalities from those of the regions. The most recent and wide-agreed model for AI governance is represented by the AI Act, as the first EU law regulating AI, that, when appropriately implemented at subnational level, is able to capture specific needs and governance requirements pertaining to a particular locality.

In this regard, a pioneering initiative has been recently steered by **Galicia**, a region located in the Northwest of **Spain**, on the Atlantic coast. The region includes an Agency for the Technological Modernisation of Galicia (AMTEGA, 2024). AMTEGA has four primary responsibilities: (1) oversee the digitalisation of Galician public services, (2) promote innovation and R&D in the region, (3) manage and operate ICT services for the Galician government, and (4) foster collaboration and partnerships inside the region and with national, European, and international entities.

In 2023, the Galician government tasked AMTEGA with developing a regional AI Law (Ley de IA, 2024). The Ley de IA's primary goal is to support the implementation of the AI Act within the region and to establish a set of rules, principles, and standards concerning the development and implementation of AI by the regional government itself. The law has three primary objectives: (1) to establish the framework for the design, acquisition, use, and implementation of AI technologies in public administration, (2) to regulate AI use by the public sector and its government entities, and (3) to promote the development of AI in the Galician R&D ecosystem. It should be noted that the scope of the regulation applies only to the regional public sector, the citizenship, and the region's

relations with other public administrations – not to the region's private sector AI market.

The core principles of the Ley de IA are aligned with the EU AI Act, as it contains six core tenets: (1) transparency and explainability, (2) security, privacy, and reliability, (3) human supervision, (4) accessibility and equity, (5) impact evaluation and continuous improvement, and (6) training and collaboration. The overarching goal of the Ley de IA is to promote trust and foster innovation, preparing the region for the wider enactment of the EU AI Act. It also orientates the regional authority at the forefront of the public sector, focusing on AI innovation as it continues its path towards digitalisation, as outlined in broad national strategies such as the Spanish Digital Strategy 2026 (SDS, 2026), and regional strategies such as the Galician Artificial Intelligence Strategy 2021-2030 (GAIS, 2021).

Analysing AI adoption and implementation as part of a broader framework, it is also worth taking into account an emerging need due to the fact that AI technologies are by their nature borderless. The infrastructure supporting AI can be distributed across different regions, with data centres and cloud servers located in several parts of the world. This implies that AI governance should not be limited to one jurisdiction, especially when the technology's use may violate any laws pertaining to other regions. This global reach needs to be translated into a broader cooperation amongst international counterparts, to develop consistent and enforceable frameworks for AI governance and avoid regulatory fragmentation. Regulatory divergence - where different jurisdictions adopt incompatible AI rules - can create compliance challenges and undermine the effectiveness of the laws themselves. Without harmonised frameworks, there is a risk of both over-regulation and under-regulation, each of which can have negative consequences for innovation and public trust.

In this regard, the **Canadian province of Québec** is also positioning itself as a leader in responsible AI governance. While efforts at the Canadian federal level to enact the Artificial Intelligence and Data Act (AIDA, 2022) progress slowly, Québec is developing its own AI governance framework.

The initiative is being led by the Québec Innovation Council (hereafter referred to as 'the Council'), created by the Québec Government in December 2020. Its mandate is to boost innovation in Québec companies and within Québec society. It does this in four ways: (1) advising the provincial government on innovation strategies and approaches, (2) promoting and developing a culture of innovation, (3) supporting businesses to boost performance, and (4) documenting and measuring innovation to guide decision-making. The 10-member Council is made up of experts from both the public and private sectors. One of the first tasks of the

Council was to conduct a 'non-partisan, transparent and inclusive public reflection' (Québec Innovation Council, 2024a) as a framework for AI in Québec.

The process of developing a framework began in the summer of 2023, when the Council convened expert workshops and conducted a public consultation to 'help define the issues and opportunities associated with AI in order to ensure its ethical and responsible development use' (Québec Innovation Council, 2024b). The workshops focused on six themes: (1) AI governance framework, (2) framework for investments in research and the private sector, (3) framework for the use of AI by the State, (4) impacts of AI on work and employment, (5) other societal impacts of AI, and (6) Québec's role in the international framework for AI. The public consultation, which ran from 8 June to 14 July 2023, received 422 contributions, 77% of which came from individuals responding in their own capacity. The results of both the expert workshops and public consultations were summarised in final reports and presented in a public forum in November 2023.

These consultations informed the development of the 'Ready for AI Report: Meeting the challenge of responsible development and deployment of AI in Québec' (Québec Innovation Council, 2024c), published by the Council in January 2024. The report lays out 12 priorities and 25 complementary recommendations, aimed at ensuring the responsible development, and use, of AI in Québec. The recommendations relate to ensuring agile governance, anticipating and adapting to AI-induced changes, training stakeholders and impacted groups, empowering research and development, and positioning Québec to be a leader in responsible AI. The report ends with a recommendation to continue the work by creating a transitional steering committee on AI governance.

Additionally, in June 2024, the Québec Minister of Cybersecurity and Digital Technology adopted a set of Principles for the Responsible Use of Artificial Intelligence by Public Bodies (Québec Minister of Cybersecurity and Digital Technology, 2024), which should guide the use of AI across all sectors of public administration in the province. The principles, which draw on the OECD AI principles, are: (1) respect for individual rights and the rule of law, (2) inclusion and equity, (3) reliability and robustness, (4) security, (5) efficiency and effectiveness, (6) sustainability, (7) transparency, (8) explainability, (9) responsibility, and (10) competence.

2.3 Organisational context and AI procurement

Assessing the organisational context and the internal staff skills is considered fundamental for a successful implementation of AI in public organisations.

The organisational context can largely vary from municipality to municipality. Whether there is a dedicated IT department or even an AI office can profoundly affect the AI implementation. As previously mentioned (see Section 1.2), according to the primary data gathered for the scope of this study, the outsourcing is more frequent in larger municipalities. This is probably due to the cost of charging an external provider with the AI development and maintenance. However, there is a clear correlation between outsourcing degree and in-house digital skills presence. In fact, having specific digital skills allows for a more thorough supervision of the external contractor service. Outsourcing without appropriate digital skills within the municipalities, on the other hand, can create a vendor lock-in effect, which can become an obstacle to the implementation of an AI solution that is aligned with the end-users' needs or simply to the shift to other solutions.

In this regard, Zick *et al.* (2024) postulate that it would be important to consider the establishment of an AI procurement expert within public administrations, in order to endure effective and transparent implementation.

In the case of the **Municipality of Kortrijk** (**Belgium**), the AI development as part of the 'Virtual Assistant' initiative was outsourced to a private company but the municipality retained control over certain aspects, in particular related to the integration of the AI solution with Kortrijk IT architecture and to the citizens engagement (see Case II.1). However, the private company retained the licensing rights, thus creating a dependency for future modifications.

Differently, outsourcing the AI development to a university in the context of a partnership seems to guarantee greater flexibility and transparency. The INNOAIR project carried out by the **Municipality of Sofia** (**Bulgaria**) reported to have benefitted from a collaborative effort of universities and research organisations, which ensured the alignment with the municipality's needs (see Case II.2). A similar approach and results are found in the case of the SWIFTT project involving **SIA Rīgas meži**, (i.e., the municipal forestry and park management agency in Riga, **Latvia**), which being an EC Horizon Europe funded project, saw the collaboration of public, private and academic institutions.

Although the case studies considered include two European capitals (i.e., Riga and Sofia), there is no evidence of the AI development through internal resources or in-house agencies.
Nevertheless, some European public administrations adopted hybrid approaches to deal with the AI development.

By way of example, the **Catalonia Region** (**Spain**) adopts a hybrid approach combining outsourcing and internal development. In particular, the region made

a strategic assessment which found low feasibility in approaching the AI development with internal resources, mainly due to the low volume of use cases for AI application. Therefore, the region decided to exploit the advantages of AI development outsourcing but with a strong in-house oversight. In this way, the region is able to retain internal expertise for effectively managing and guiding external contractors, also suggesting that internal development is not necessarily the optimal approach.

Another example is represented by the AI4PublicPolicy project of the **Municipality of Nicosia** (**Cyprus**) (see Case II.6). The initiative, funded under the EC Horizon 2020 programme, significantly relied on external technical skills on AI and data analytics, which was not present in the municipality. Such external expertise was provided by the CYENS Centre of Excellence, a public-private-academic partnership including the Cyprus government, local universities (i.e., University of Cyprus, Cyprus University of Technology, and Open University of Cyprus) and private companies participating in the project. This 'inclusive' outsourcing approach was considered to ensure balance and community needs alignment.

In this regard, it is useful to recall the effort made by the EC in 2023 to propose a contractual model for AI procurement that has been developed by a community of buyers. Moreover, such contractual model is drawn in two versions, one for high-risk AI systems and another for non-high-risk systems.

The research conducted indicate that the AI procurement process is still in an experimental phase, where gains and challenges of internal versus external AI development are yet to be fully assessed.

2.4 Enhancing citizen acceptance and engagement

Since the early adoption of AI technologies in the 2010s, citizens acceptance has been a central topic in the broader context of digital transformation. Mentioned as a key aspect in almost all the main European policies and strategies, citizen acceptance is often associated with the idea of trust on aspects such as risks, transparency and accountability.

The lack of citizen acceptance when implementing AI solutions can indeed contribute to a digital divide, particularly at the local and regional levels. When citizens are not on board with AI technologies, it can hinder the effectiveness and equity of their implementation. This lack of acceptance often stems from a combination of factors, including a lack of transparency in how AI systems work, insufficient infrastructure to support the necessary technologies, and a general lack of digital skills to understand AI's practical applications and benefits.

Citizens who do not fully understand how AI operates or how it can benefit them are less likely to engage with or trust AI solutions. In this context, the research carried out by Carter, Liu, and Cantrell (2020) is particularly relevant. When framing the digital divide's implications in relation to AI through a literature review analysis, they highlighted that, beyond the traditional digital divide, a new component emerges in the AI landscape, i.e., subjects' perceptions and beliefs about AI. These perceptions, influenced by factors such as transparency, accessibility, and public trust, play a critical role in the uptake of AI technologies. This reinforces the need for LRAs to prioritise both transparency in AI operations and targeted efforts to increase digital literacy through training, education and information campaigns (Vassilakopoulou & Hustad, 2021), ensuring that AI solutions are not only technically viable but also socially accepted by citizens.

According to Horvath *et al.* (2023), the most effective approaches to fostering social acceptance are based on human supervision and digital skills.

Specifically, it is noted that the greater is the involvement of humans in the functioning and supervision of AI, the higher is the perception of fairness and accuracy, even if there is little scientific evidence that the humans' contribution is actually able to mitigate AI errors.

Moreover, according to scholars, being more fluent and savvy with technologies in general, and AI in particular, can significantly improve acceptance. In fact, it is found that people that are used to interact with technologies are less sensitive to human involvement in the AI process.

On this latter point, not all the scientific literature agrees on the fact that digital skills are a major enabler for the AI acceptance. It can be argued that, at this stage of technological evolution, the interaction with most of the general AI solutions at disposal of the public, also considering the ones offered by the private sector, is very intuitive and user-friendly. This is even more true when considering the AIs based on a Large Learning Model (LLM).

However, this is true for end-users acceptance of AI, while it becomes a decisive factor for potential implementers. In this regard, in the process of deciding whether to adopt and develop AI solutions, AI and technological knowledge of the decision maker deeply influence the outcome. Having less familiarity with AI makes it more difficult to understand its benefit and possible applications.
Risk and trust are identified as more crucial themes, possibly being the reasons for both accepting or not an AI solution, in particular when dealing with specific tasks over general ones (Gesk & Leyer, 2022; Robles & Mallinson, 2022).

On this matter, collaborative decision-making and co-creation processes substantially increase trust and the risk mitigation perception, whilst fostering a sense of ownership and ensuring that the AI actually responds to the citizens' needs (He Yue *et al.*, 2024). An effective example is found in the Virtual Assistant of the **Municipality of Kortrijk** (**Belgium**), where the development of the AI solution has been preceded by users panels and inclusion advisory groups (see Case II.1). This consultation allowed the project implementers to integrate transparency features that aligned with user needs. A focus on inclusion and accessibility has also been placed by the INNOAIR project carried out by the **Municipality of Sofia** (**Bulgaria**), aiming at improving urban mobility through a sustainable, on-demand public transportation service (see Case II.2). During the citizens and end-user consultation phase, which took place before the development stage, elderly and digitally inexperienced people were included through accessible request centres and hybrid service options. Moreover, the project also included iterative feedback collection mechanisms, which were integrated throughout the development process.

Similarly, fostering acceptance of AI solutions by municipal employees requires the implementation of engagement techniques. For instance, the SWIFFT project in **Riga** (**Latvia**), aiming at monitoring forest risks, included sessions for the field staff to gain confidence and explore the technology (see Case II.4).

Feedback collection is also an approach used to engage end-users. However, as shown by our primary data (see Section 1.3), feedback gathering is not widely used, even if there is evidence that it raises the technological acceptance of end-users (Palmas *et al.*, 2021). This is the case of the 'Fix the Streets' project of the **Municipality of Vaasa** (**Finland**) (see Case II.3). The initiative was based on a gamification approach encouraging citizens to contribute with feedback both to the aim of the project (i.e., improving street maintenance) and to improve the AI solution. Moreover, the project also foresaw the inclusion of less digitally fluent users through the provision of both email and phone channels to give feedback.

Testing sessions with end-users have also been investigated in relation to technological acceptance, in particular when end-users are sceptical about the benefits of AI employment (Lin, 2013). This is also the case of the 'wet index' project of the **Municipality of Jammerbugt** (**Denmark**), aimed at forecasting flooding in the area (see Case II.5). The project organised a testing session with citizens to boost trust and validate the AI technology functionality. Similarly, it is also reported in scientific literature that usability tests and user experience can affect citizens' acceptance (Mlekus *et al.*, 2020).

Moreover, the employment of narrative and storytelling to facilitate concepts on AI technologies has been positively valued by the scientific community

(Macnaghten & Guivant, 2020; Prior & Leston-Bandeira, 2020). Indeed, evidence points out that narratives are particularly effective in conveying messages and allowing the public to understand and retain information (Lehne *et al.*, 2015; Mar, 2018; Marmolejo-Ramos *et al.*, 2022).

Finally, primary data collected in the survey show that the adoption of XAI is not widely spread amongst European municipalities (see Section 1.2), but there is agreement in the scientific community that it has the potential to promote trust (Shin, 2021; Jangoan *et al.*, 2024).

2.5 Data availability and governance

When establishing the framework for the design, adoption and implementation of AI, LRAs are asked to address ethical tensions associated with such a use, such as fairness, transparency, privacy and human rights (Madan & Ashok, 2023). In this context, data are the raw material from which AI systems learn and make decisions. Ensuring that data are available, secure, and compliant with legal and ethical standards is crucial to leveraging AI in a way that is transparent, fair, and respects citizens' rights.

In this regard, it is not only important to rely on accessible large amounts of qualitative data, but also to have the adequate expertise to produce, collect and manage data in an ethical and transparent way whilst adopting a security-by design approach at the time of developing the AI solution.

This is the case of the **Municipality of Nicosia** (**Cyprus**), which carried out a piloting activity on ‘Policies for Holistic Mobility and Accessibility’ within the EC Horizon 2020 AI4PublicPolicy project (see Case II.6). In a three-year period ranging from March 2021 to April 2024, the pilot aimed to unlock the potential of AI for the development of public policies by implementing a citizen-centric evidence-based open cloud platform to improve mobility and public transport, as well as to optimise parking accessibility for disabled people. Given the central role of disabled people participating in the activities, the municipality, in cooperation with the other partners involved in the pilot, was forced to delay the kick-off of the activities, as it found itself unprepared to collect smart city data in a proper way. To address the issue, the municipality worked in close collaboration with ethics and GDPR experts, who checked that the data were secured and cleaned, not including personal data, prior to their use.
The complex, tension-ridden relationship between data privacy compliance and the potential benefits of adopting AI at the local and regional level has been further confirmed by a use case involving the **Municipality of Turin** (**Italy**). In 2020, the municipality was expected to deploy over 200 surveillance cameras across the city as part of the ARGO project, aiming to provide an innovative video

surveillance solution to enhance urban and integrated security (Città di Torino, 2020). These cameras were envisioned to be 'smart', using AI-powered image analysis algorithms to improve the monitoring of traffic and crime across the city. However, the project encountered significant privacy concerns that ultimately led to a shift in its implementation. In response to the proposed AI-enhanced surveillance, privacy advocacy groups claimed a report to the Italian Privacy Guarantor, raising alarm over the system's potential capability to identify and track individuals in real-time. Although the AI-powered solutions were promising in their design and application, their use was modified, as the Italian Privacy Guarantor considered the collection and use of personal metadata to be ambiguous. Therefore, in 2022 a reassessment of the ARGO project was made, implying that the cameras and the broader video surveillance network were no longer equipped with AI for image analysis as it was originally planned (D'Albergo, Fasciani, and Giovanelli, 2023).

In order to ensure the ethical and responsible use of AI in the public services managed by the regional government, in April 2024, the Digital Transformation Department of the **Catalonia Region** (**Spain**) announced the establishment of an Artificial Intelligence Commission. This body is responsible for ensuring compliance with emerging laws regulating AI, safeguarding personal data, and promoting the ethical application of AI. Managed by the Vice Presidency Department of the region, it also involves senior officials from all Government departments and key representatives from public sector bodies with expertise in telecommunications, information technologies and cybersecurity operating within the region, such as the Centre de Telecomunicació i Tecnologies de la Informació, the Consorci d'Administració Oberta de Catalunya, and the Agència de Ciberseguretat de Catalunya. The task force falls within the scope of the work initiated by the regional government in February 2020 with the implementation of the 'Catalonia's Artificial Intelligence Strategy' (Government of Catalonia, 2020), to turn the public administration into '*a benchmark in the reliable use of AI, following the principles of transparency, responsibility, equity, security, sustainability and rootedness in the country*'[8].

Despite the fact that data availability and governance are likely to be significant barriers to the adoption and implementation of AI at local and regional level, there are nevertheless sectors in which the use of data is more straightforward and beneficial, such as environmental protection. AI-powered systems used to predict natural hazards (e.g., floods, wildfires) are increasingly being developed and trained with publicly available large amounts of environmental data, which can be collected and used without violating personal privacy. This presents an opportunity for LRAs to adopt and implement AI solutions with fewer data

[8] https://www.aoc.cat/en/blog/2024/la-generalitat-de-catalunya-constitueix-la-comissio-de-la-intelligencia-artificial/.

governance obstacles, as confirmed by the **Municipality of Jammerbugt** (**Denmark**) (see Case II.5). As outlined by a representative of the municipality during the interview that was conducted within the scope of this study, one of the strengths of the project was the availability and quality of the data used to develop the 'wet index', which was designed to address one of the city's priorities, i.e., environment and climate change. Under such circumstances, the technical and ethical challenges associated with AI adoption are mitigated by relying on non-personal, open data sources, thus enabling smoother AI uptake and increasing the potential for scaling the solutions to other regions.

2.6 Making AI-based solutions scalable and applicable to other contexts

When used to improve the delivery of public services and/or to enhance decision-making processes, it is crucial that AI solutions are designed according to users' needs and tested prior to shifting to large-scale experimentations, which may risk eroding citizen trust (Madan & Ashok, 2023). However, once validated in their concept and application, it is crucial to ensure that these solutions are scalable and fit for various settings, in order to enhance their use, impact and cost-effectiveness.

The 'Virtual Assistant' initiative developed by the **Municipality of Kortrijk** in the Flanders Region (**Belgium**) was designed with the ambition to make the tool scalable and fit for purpose for other LRAs (see Case II.1). The Virtual Assistant was designed to easily integrate with content management systems such as Drupal and WordPress, which are commonly used across municipalities in the region. This flexibility ensures that the tool can be rolled out across other regions in Flanders and even nationally without requiring significant customisation.

The successful integration of AI into urban mobility solutions to enhance public transport and improve environmental conditions in **Sofia** (**Bulgaria**) led the Municipality to decide to make the AI solution scalable to other settings (see Case II.2). Upon completion of the piloting activities in the neighbourhoods of '*Manastirski Livadi*' and '*Baxton*', which confirmed the capability of the AI-powered solution to provide citizens with an alternative to car travel thanks to on-demand electric buses, the municipality has decided to scale up the service into three other suburbs (i.e., '*Malinova dolina*', '*Vitosha*' and '*Gorna Banya*').

The EC Horizon Europe project SWIFTT involving **SIA Rīgas meži**, (i.e., the municipal forestry and park management agency in Riga, **Latvia**), is another successful use case related to a promising go-to-market AI-powered solution (see Case II.4). Aiming to enhance forest management and biodiversity conservation,

the AI system is being developed in order to be interoperable with the Copernicus satellite imagery to detect and map the various risks to which forests are exposed.

Finally, mention should be made specifically to GenAI solutions. From the findings that emerged within the present study, GenAI solutions are not currently adopted at local level. In the cases where solutions based on OpenAI models are adopted, this is mainly for the implementation of chatbots that have been strongly limited in their generative capabilities.

In fact, it is found that without specific regulatory guidance, municipalities do not believe they can properly assess risks and implications of GenAI use. The lack of specific skills is also a factor contributing to the perception that GenAI may raise additional legal and ethical concerns regarding possible errors and hallucinations generated by the AI (Minguez Orozco & Welin, 2024). Other barriers to GenAI uptake may be represented by emotional and psychological factors that are still to be further investigated.

2.7 Investment and funding

One of the most significant factors for the successful adoption of AI at the local and regional level is the availability of investment and funding. Despite the potential of AI to transform public services, enhance operational efficiency, and drive innovation, one of the most common and persistent challenges faced by LRAs is limited financial resources. Budget constraints often create significant barriers to the effective implementation of AI initiatives at subnational level, as pointed out by most LRAs who participated in the survey that has been implemented within the framework of this study (see Section 1.2.4). The lack of adequate funding can hinder the procurement of necessary technology, the development of digital infrastructure, and the recruitment of a skilled workforce, all of which are essential to drive AI projects forward.

LRAs are often at a disadvantage when it comes to accessing large-scale funding compared to national governments or private sector companies. Many AI adoption projects at subnational level require significant upfront investment, which can be difficult to justify when budgets are already stretched thin. In addition, LRAs frequently face challenges in maintaining long-term funding for AI projects, especially given the rapid pace of technological change and the evolving nature of AI applications. Without a sustainable funding strategy, AI initiatives risk becoming unsustainable from being diffused or failing to achieve their full potential.

As a result, the long-term nature of AI projects requires a more strategic approach to financing, one that can align with local and/or regional development goals, sectoral policies, and broader national and European funding opportunities.

This is the case of the **Municipality of Noisy-Le Grand** (**France**), which in 2023 launched the 'Immediate and Long-Term Energy Reduction' (RECITAL) project, aiming to use AI to reduce the energy consumption and carbon impact of the city's 200 public buildings (see Case II.8). The project has been primarily funded through a combination of local budget allocations and national government support for energy transition initiatives. In fact, the municipality has obtained financial assistance from the French Ministry of Ecological Transition and Territorial Cohesion, which launched the DIAT call for projects on 'Demonstrators of frugal Artificial Intelligence at the service of the ecological transition of territories' that covered 50% of the costs allocated to the project (i.e., EUR 1.1 million).

Another successful case study is related to the **Municipality of Vaasa** (**Finland**), that, between 2020 and 2022, implemented the 'Fix the Streets' project, to improve the conditions and safety of the city's streets and roads through targeted, data-driven solutions (see Case II.3). Vaasa greatly benefitted from a formal research and innovation budget, granted annually by their national government. This budget promotes (and mandates) experimentation and innovation in the provision of public services, with a specific focus on technologically leveraged improvements that can be scaled to other regions and municipalities.

The **Municipality of Kortrijk** (**Belgium**) is a key player in the digital transformation of local governance. In line with the region's broader digitalisation strategy, Kortrijk has implemented a pioneering 'Virtual Assistant' project aimed at improving the accessibility, efficiency, and quality of public services (see Case II.1). Funded by a regional budget attached to a formal policy initiative, 'Municipality without a Town Hall', this initiative is part of the region's commitment to advancing smart city technologies, digital government, and e-governance through the adoption of AI solutions, *inter alia*, to better serve citizens and businesses alike. Such a commitment has been formally incorporated by the region in the Flanders' AI Policy Plan, launched in 2019 and renewed in 2024, aiming to enhance the existing AI knowledge base and its uptake in the region, in close cooperation with the Flemish industry.

Part 3: Foresight analysis, conclusion and policy recommendations

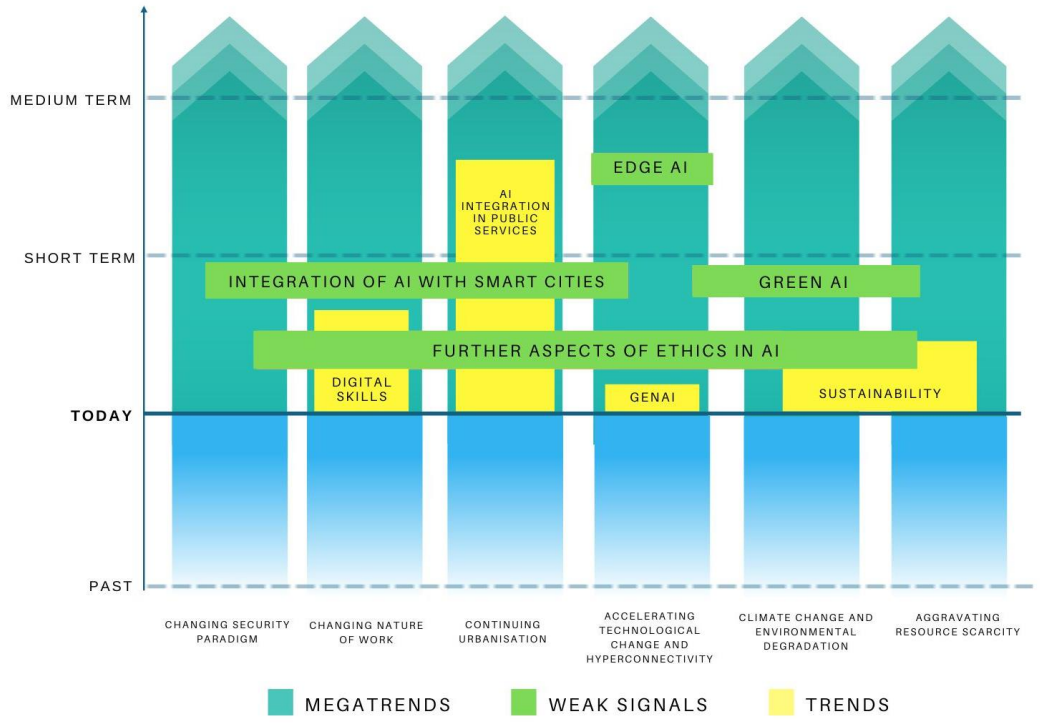
The following sections are structured to provide clear progression from foresight analysis to policy recommendations. Based on an exploration of trends in AI adoption, weak signals and megatrends, along with the main findings of the study, action-oriented recommendations are provided to support successful adoption of AI within LRAs.

The recommendations address the relevant aspects of AI implementation and offer practical and scientifically grounded guidance to EU institutions, Member States, and LRAs for an effective and coordinated action on AI adoption for the public sector at local level.

3.1 Foresight analysis

The foresight analysis approach in this study can be defined as an exploratory, empirical-analytical approach (Kreibich, 2006). It focuses on possible future trends concerning AI in public administrations, megatrends that are affecting the society globally and underexplored developments in AI technology. In this sense, the foresight technique is intended as a tool for increasing awareness and knowledge of potential future implications focused on a specific topic.

Figure 21 - Relationship and reciprocal influence between trends, megatrends and weak signals



As shown in **Figure 21**, the foresight analysis and its results are based on the consolidation of three elements:

- AI trends identified by the LRAs that participated in the survey;
- Horizon Scanning for the relevant weak signals detection; and
- Megatrend analysis.

For the purpose of this study, it is important to understand the three different timespans put in relation by these three elements. While megatrends are societal changes that are already ongoing and trends are topics that are emerging today, weak signals are considered as technological innovations that can acquire importance in the future. Therefore, it is important to examine the impact these elements taken all together may produce.

Figure 21 represents how these elements interact with each other and the dynamics such interactions create. AI trends are depicted as emerging themes in the present moment, since they were identified by the LRAs responding to the survey as topics which will acquire growing importance in the future. The different heights of the columns representing the trends are related to the frequency of selected keywords' occurrence in the survey results. Megatrends, which are represented as arrows, have trajectories that start in the past and point towards the future. In this analysis, AI trends are correlated with megatrends with a certain degree of semantic and logical proximity, which could accelerate the AI trends' development in the future. According to the qualitative feedback received on AI trends by the survey respondents, the authors performed a clustering exercise to identify a list of trends (see **Figure 22**). Lastly, weak signals of new technologies that may affect the AI uptake by public administrations are represented as horizontal bars intersecting both trends and megatrends. The weak signals width depends on their degree of logical connection and relevance to trends and megatrends. Finally, the positioning of the weak signals on the time axis describes the point in the future where weak signals might materialise.

In the following sections, each element of the foresight analysis is described individually, leading to their consolidation in meaningful key insights.

3.1.1 The AI trends identified by survey respondents

As technology advances at an exponential pace, continuous monitoring of emerging trends is essential to facilitate its adoption and, more broadly, to adapt digital transition processes within public administrations effectively.

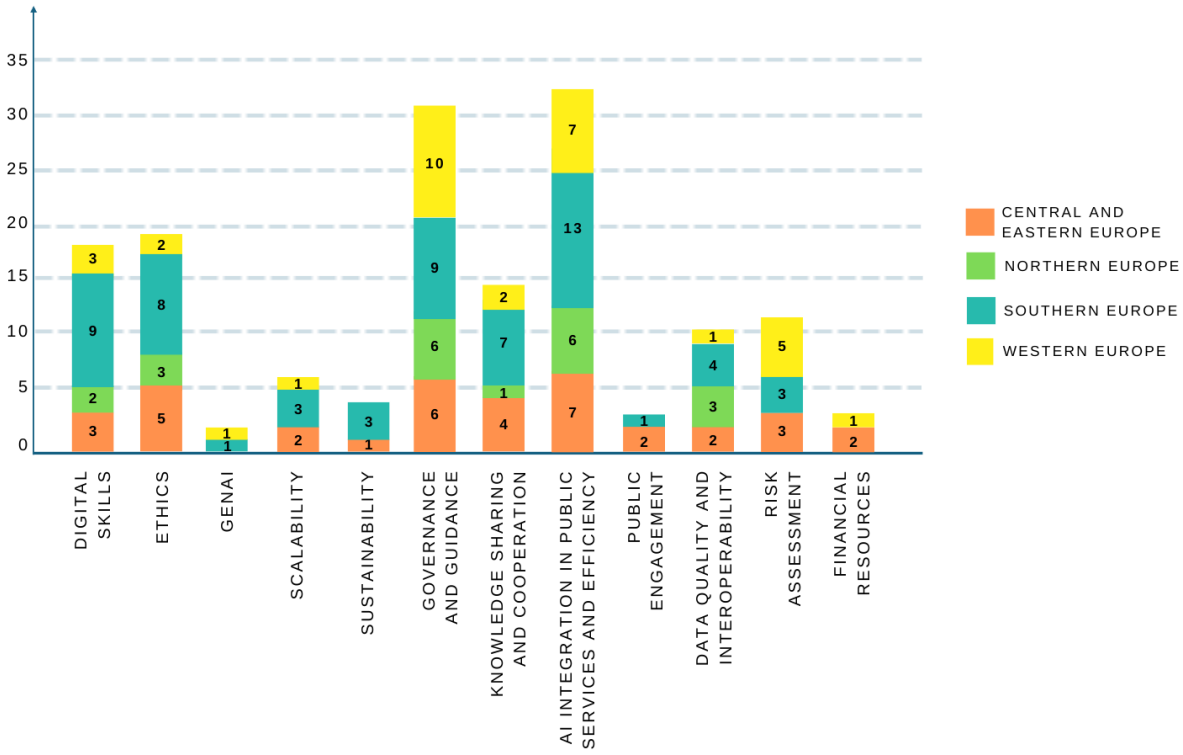
For this purpose, the survey included a specific question on relevant trends and future developments for the AI implementation in public administrations[9].

To analyse the survey responses, the authors took the following steps:

1. Replies were clustered according to meaningful keywords and coded accordingly.
2. Keywords' occurrences were counted to show the frequency and relevance of certain topics.
3. The survey data were correlated with information on the geographical area of the respondents.

Twelve keywords were identified in the responses with various degrees of frequency (**Figure 22**). Moreover, **Figure 22** allows for an analysis of how the most recurring topics are divided amongst European regions. The graph shows the frequency of the occurrence of each keyword, considering that for each response more than one keyword could have been attributed based on semantic criteria. As a criterion for the geographical subdivisions, it was used the one proposed by EuroVoc, as described in Section 1.

Figure 22 – Trends' relevance according to the survey results



[9] i.e., Q1.33 - Concerning the future of AI and GenAI, do you see any trend for this technology or lessons learnt that can be used to improve the use and adoption of AI and GenAI at regional and local levels? (see Annex I)

Figure 22 shows the most recurring themes are the ones concerning 'AI integration in public services and efficiency', 'governance and guidance', 'ethics' and 'digital skills' across European regions. It is important to note that there are more trends connected with the streamlining of internal processes than toward improving the delivery of services for the population.

AI integration in public services and efficiency. It appears clear how, from the public sector's perspective, the primary focus is the life and well-being of their citizens (Androniceanu, 2023). Therefore, AI and GenAI are considered useful tools to improve the number and quality of services offered by the administration to the citizens (van Noordt & Misuraca, 2022). The use of advanced digital solutions is, for most of the respondents, the key to enhance customer experience and optimise bureaucratic processes.

Governance and guidance; ethics. The analysed data also indicates a clear expectation from LRAs concerning the growing need for research and guidance for ethical considerations in AI use. Transparency, respect of privacy and traceability of processes have been addressed, but many aspects related to other ethical implications of AI remain underexplored. Furthermore, standardised frameworks and monitoring mechanisms are yet to be established. Consequently, ethics is still emerging as a central and increasingly prominent area of focus for the coming years (Siau & Wang, 2020).

Digital skills. The impact of digitalisation remains limited if those engaging with it – both civil servants and citizens – lack adequate training and understanding of AI-driven solutions. Providing universal opportunities to develop a comprehensive range of digital skills is essential to ensure effective utilisation and to mitigate the risk of misuse (van Noordt & Tangi, 2023). This is a topic that is perceived as pivotal to correctly manage the AI uptake and application.

Knowledge sharing and cooperation between administrations and regional/national governments, also through a standardised set of 'best practices', is considered to be of increasing relevance. This activity, often used for better exploring use cases and solutions for possible obstacles, is considered crucial to avoid duplicating efforts and to exchange significant experiences, including building networks of LRAs using AI. In light of this, the knowledge sharing will become more and more necessary for LRAs.

Risk assessment. The risks associated with AI usage, introduced and adopted as a guiding criterion by the AI Act, represent one of the foremost concerns within the public sector. Many respondents expressed the need for clear frameworks for risks assessment connected to the possible development of advanced digital solutions (Chiariello, 2021). Therefore, it is necessary to develop a comprehensive

set of guidelines that can help public administrations to adopt AI-driven solutions minimising the threat for the citizens, and such frameworks need to be easily updated to incorporate new risks identified as the technology evolves.

Data quality and interoperability. It extends beyond the provision of ensuring security and protection in case of data collection and storage from external access and manipulation. Significant emphasis is placed on establishing seamless communication and interoperability between diverse databases across municipalities throughout Europe, following the principle described by the European Parliament as the *'[…] essential link between the availability of high-quality data and the development of AI*' (European Parliament, 2021). Facilitating the sharing of non-sensitive data to support neighbouring LRAs is critical for enhancing the efficiency of AI-driven solutions, particularly those reliant on data exchanges that transcend national borders. The focus is also on the practical aspects regarding data interoperability. According to the INSPIRE Directive (2007), EU Member States should implement *'[…] rules laying down technical arrangements for the interoperability and, where practicable, harmonisation of spatial data sets and services […]'*.

The concept of data sharing is also in line with the 'Once Only Principle', according to which citizens do not have to present the same data to the public administration more than once, ensuring that '*data that is already known to public administrations is pre-filled in forms presented to the user'* (EC, 2022).

Scalability. Risk management and data interoperability are also crucial for enhancing the scalability of projects, which has been highlighted especially by municipalities in Central and Southern Europe, and which is of paramount importance to optimise the reuse of technologies and methodologies that have proven effective in other contexts. A clear model for the scalability of AI projects can also support smaller municipalities, with less financial and human resources, to adopt AI solutions more easily.

Sustainability. Much less discussed is the topic of sustainability. By way of example, AI could be used to reduce CO_2 consumption and emissions (Rakha, 2023) and support achievement of the European Green Deal. Nonetheless, the specific ways AI can support LRAs in this regard is still largely unexplored. Additionally, the energy usage – and relative CO_2 emissions – directly related to AI tools themselves is generally known but not yet comprehensively measured or addressed. As shown in **Figure 22**, countries in Northern and Western Europe do not see AI sustainability as a trend, and this could indicate that their pluriannual tradition in integrating digital solutions and territorial planning with a strong view on environmental protection is already part of their usual planning process.

Therefore, sustainability should not be considered for them as ‘emerging’ but as an ‘established’ practice (Akande *et al.*, 2019).

Public engagement. The low incidence of responses pointing out the relevance of public engagement as a future trend could be related to the modest attention that is still given to co-creation and its benefits. If public administrations were more aware of the importance of mutual feedback exchange and reciprocal advice in a context which is still only superficially studied, the direct involvement of the population would be a more widespread practice. Moreover, this is particularly relevant for the AI divide, as the level of public engagement (or lack thereof) is connected to scepticism towards the technology itself or to the perception of scarce positive impact concerning the AI applications. As AI will evolve towards increasingly complex tasks, it will be crucial to engage with the end-users to explain the AI mechanisms and to address potential concerns.

Finally, two trends received less attention as expected, namely ***financial resources*** and ***GenAI.*** The first does not seem to be considered as becoming more relevant in the near future, even if the importance of the economical dimension is acknowledged by municipalities in Central and Eastern Europe. This could be also due to the increasing presence of financing instruments that at present are available for AI implementation (e.g., Digital Europe, Horizon Europe, European Digital Innovation Hubs, Testing and Experimentation Facilities, along with national funding foreseen through the structural funds). Concerning GenAI, the low interest received is actually in line with the general sentiment towards GenAI observed in the interviews conducted for the scope of this study and in the survey results. The technology is probably not mature enough to allow public administrations to fully understand its risks, benefits and applications.

Some respondents did not identify any trends. There are different possible explanations to justify this. This may be because many public administrations are simply too small, in numbers and dimensions, to have enough experience in such a field to be able to elaborate a future vision for AI. Finally, some respondents highlighted the hype surrounding AI, suggesting that the current enthusiasm is largely driven by curiosity and prevailing fads, which are likely to be diminished in the coming years (Marx, 2024).

3.1.2 The Horizon Scanning for relevant weak signals detection

Weak signals are defined as *‘information about an emerging development with a likely future impact’* (van Veen & Ortt, 2021). Since foresight has an anticipatory aim, the detection and analysis of weak signals is crucial for exploring possible future developments within a given sector.

Starting from the JRC report on weak signals (JRC, 2021) and from the JRC Weak signals 2020 Dashboard, which is continuously updated, relevant weak signals for AI development were selected. The process of exploration, filtration and assessment of weak signals is a technique called Horizon Scanning. According to the Better Regulation Toolbox of the EC, this approach needs to be integrated as part of a wider foresight exercise, '*whenever there is a high degree of uncertainty surrounding changes to the relevant future context and to ensure that short term actions are grounded in the long-term objectives'* (EC, 2021a).

For the purpose of this study, the AI trends identified by the LRAs have been cross-referenced with selected weak signals, retrieved by 'Weak Signals in technology' (Eulaerts *et al.*, 2021). The main areas of potential development in the field of AI were identified and explored, specifically regarding their application within local public administrations in Europe.

The analysed weak signals, chosen for their particular relevance with the topic addressed in these pages, are the following:

Ethical AI. As previously highlighted, ethical considerations are crucial when implementing AI-based solutions. The importance of an ethical framework is recurrently mentioned in scientific literature, as well as within the AI Act, and its background policies and strategies. The risk-based approach adopted in the AI Act reflects the choice of the EU to approach potential problems proactively. The aim is to address the complexities of AI development, providing a structured regulatory framework to shape its future (da Costa Alexandre & Pereira, 2023). In the 'Draft Report on Artificial Intelligence in a Digital Age', published in November 2021 by the Special Committee on Artificial Intelligence in a Digital Age (European Parliament, 2021), it is clearly stated that,

> *[…] central to the EU regulatory approach is a strong attention to ethical considerations in line with core human rights values and democratic principles.*

Considering the exponential growth that AI will likely undergo in the years to come, an early attempt to foresee every single possible evolvement, field of application or possible threat derived by a misuse of the technology is a complex exercise. Excluding some implementation of AI as considered harmful for citizens is the solution adopted by the EU legislator, who acknowledges the issue of ethics as being of paramount relevance. The focus on this aspect acquires additional importance if brought into the field of public administrations, which is necessarily bound to respect the citizen, safeguarding their privacy and safety.

Starting from the provisions of the AI Act and national regulations, as well as building on the results of the present research, it is possible to identify aspects concerning the ethics for AI that are worthy of attention, as they may acquire relevance in the immediate future.

Ethical principles and values may diverge across national and regional contexts, as well as between individuals, reflecting the nuanced ethical landscape across and within the EU Member States. The data obtained from the survey underscore this variation, revealing significant differences even within the EU countries. While it is crucial for international and European legislation to provide a foundational ethical structure to ensure compliance with universal legal standards and shared values, it is important to guarantee a certain degree of freedom of action to national and regional legislators. This approach allows for the tailoring of AI regulatory measures to better align with the specific needs, cultural values, and political sensitivities of individual populations, fostering ethical practices more suitable for different social contexts. Furthermore, it is also important to consider the need for an approach to ethics in AI that is able to monitor and address new ethics concerns as they emerge with the further development of the technology and with the evolving perception of the end-users.

Moreover, another important ethical aspect in the context of the AI uptake by European public administrations, is the emergence of an **AI divide**. In order to better frame the challenge, it is possible to make a distinction between AI divide amongst citizens and AI divide between public administrations.

Addressing the digital divide amongst citizens requires that public administrations adopt comprehensive digitalisation strategies that inclusively engage individuals with limited exposure to new technologies or constrained access to digital resources. Without such efforts, these populations risk being marginalised, unable to adapt to rapid technological advancements and potentially deprived of equal access to essential services. A promising approach may be to implement a dual-access model: while advancing digital public services, they should also preserve traditional methods of service access, such as in-person interactions and paper-based forms. This approach accommodates diverse needs and digital literacy levels, ensuring inclusivity.

Moreover, disparities in access to digital services may arise due to factors such as gender, socioeconomic background, and varying levels of digital literacy (Rodríguez Ayuso, 2023). These factors underscore the necessity for public policies that actively address and mitigate barriers to access, fostering a more equitable digital landscape.

Regarding digitalisation ratios between administrations, the divide may further increase between different regions at European level. Regions with lower levels of digitalisation risk falling progressively behind those with advanced digital competencies and a higher degree of acceptance of AI-driven technologies. The prospect of an uneven development could lead to unequal access to opportunities for citizens from different European regions. This uneven distribution of digital infrastructure and literacy may inhibit equitable access to emerging opportunities associated with AI, hindering both technological innovation and societal development in less digitally mature regions.

Finally, an ethical aspect that could be relevant in the near future is the so-called 'erosion of human autonomy'. As future AI technologies will be more and more pervasive, the media, the advertising, and even the personal decision-making could be supported by the employment of AI technology. In this context, the overreliance on AI may affect the individual autonomy and lead to a behavioural subtle manipulation that influence choices and compromise human agency (Zuboff, 2019).

Green AI. Environmental sustainability is a key dimension in the evolution and adoption of AI solutions by local public authorities. There are many examples of AI used to reduce energy consumption and CO_2 emissions in European public administrations. Moreover, AI holds considerable potential as a strategic tool for both European and global governments in advancing the achievement of the Sustainable Development Goals (SDGs) by 2030. In particular, it can be a significant booster for 25 targets – equal to 93% of the total – in the goals related to environmental topics, i.e., SDGs number 13, 14 and 15 (Vinuesa *et al.*, 2020). AI-driven solutions can also contribute to the optimisation of alternative energy supply sources, in particular related to renewable energies, from the optimisation of photovoltaic power plants by analysing the sunniest hours and the most advantageous inclination of the panels, to the study of wind flows for wind farms (JRC, 2021). Other functions could be found in the monitoring of infrastructures for planning restructuring and efficiency interventions, the optimisation of logistics for reduction of emissions derived from transports, or the enhancement of efficacy of irrigation systems and reduction of water waste (Rakha, 2023).

European legislators are well aware of the capital importance of data sharing for an effective implementation of AI-driven solutions in general and for the environmental sector. In addition to the INSPIRE Directive – forefather of the European legislation on big data management – the GreenData4All Initiative, following the path set by the European Strategy for Data, aims to a comprehensive upgrading of the communitarian data sharing framework and the creation of a user-centred and trustworthy ecosystem (JRC, 2023). Although it has not been extensively explored, AI-driven solutions can also be a powerful tool for fulfilling

the ambitions and goals of the European Green Deal, through the analysis and exploitation of large volumes of environmental data, enhancing efficiency, finding new methods or improving measuring and monitoring (Corrigan & Lucaj, 2020; Ponti *et al.*, 2024).

On the opposite side of the coin, AI can itself be the direct cause of energy consumption. As highlighted by the study commissioned by the Artificial Intelligent in the Digital Age (AIDA) Committee in 2021, AI needs to rely on digital infrastructures and data centres, which are major energy consumers. The training phase alone of an LLM – of which ChatGPT is the best-known case – can consume up to 1,287 MWh for terabytes of data and more than 175 billion parameters (de Vries, 2023). This energy consumption results in the production of 550 tonnes of CO_2, equivalent to what a single person would generate travelling by plane for 4,538,050 km: 1,100 times the trip between New York and San Francisco (Crivellaro, 2023). In the future, it is esteemed that ICT will be responsible for 20% of global energy consumption by 2030, with a direct contribution to greenhouse gas emissions estimated in the order of magnitude of more than one Gigaton per year (AIDA Committee, 2021).

Although the scientific literature provides numerous examples of case studies where AI systems are utilised to mitigate energy consumption and reduce CO_2 emissions, there is a relative scarcity of research that critically examines the energy consumption directly attributed to AI technologies themselves. Amongst these, Rohde *et al.* (2024) propose a set of guidelines and KPIs to assess the sustainability of AI-driven solutions. An effort to establish a unified framework for assessing not only the environmental but also the social and economic sustainability of AI solutions is exemplified by the Sustainability Criteria and Indicators for Artificial Intelligence Systems (SCAIS) Framework. However, further research on this topic is required, along with the development of comprehensive, institution-level guidelines.

Smart cities. For several years now, the digital transition of cities has been accelerating exponentially. The introduction of AI-driven solutions allows public administrations to offer better and cheaper services to the residents (Şerban & Lytras, 2020). The streamlining of services allows greater availability and possibility to allocate the available budget, directing funds to other projects to meet different needs.

The main fields of AI application within the urban context currently focus on optimising energy consumption, enhancing urban safety, and improving public mobility. Examples such as the **Municipality of Noisy-le-Grand** (**France**) and the **Municipality of Sofia** (**Bulgaria**) (see Cases II.2 and II.8) could be considered good examples of AI solutions implemented to benefit citizens.

As far as the use of predictive and generative capabilities of AI are concerned, even though their potential to contribute to the smart cities approach is undeniable, applications are currently more limited, both in terms of the total number of solutions adopted and their scope in terms of effects and purposes. This is because these kinds of AI applied for public policies and urban dimension may have strong implications in political and legal responsibility.

Predictive AI could allow cities to better address needs and future risks, explore new opportunities for urban governance and face emergencies. On the other hand, generative functions may support urban planning processes and deepen citizen engagement by facilitating the design of adaptive public spaces.

According to what emerges from the survey results, many EU municipalities are today still unable to exploit these tools, either due to a lack of data, digital skills or a lack of political will.

The analysis of the dynamics of smart cities and urban digitisation systems will become increasingly important as the population living within large metropolises grows and technological solutions become more advanced and accessible. One issue that should not be underestimated is that of the population's acceptance of these technologies. It is up to public administrations to ensure that citizens are able to understand the benefits and risks of the proposed solutions, through transparent implementation processes, along with societal engagement.

Edge AI. The development of AI - especially GenAI - has not followed a linear growth model, but rather an exponential one. The possibilities of development are constantly increasing. A future perspective is represented by the deployment of AI algorithms and computational capacity directly on local devices, such as urban sensors, public cameras or people's smartphones, therefore acquiring off-line capabilities. This approach is particularly efficient for solutions that require immediate responses or greater data security in crucial sectors such as healthcare, manufacturing, and urban management.

For instance, as shown by the ARGO project implemented by the **Municipality of Turin** (**Italy**), Edge AI can enable devices such as smart traffic cameras or pollution sensors to detect incidents, traffic, crimes or variations in air quality in real-time, allowing law enforcement to intervene immediately, without the need for data transmission to remote servers (Shi & Dustdar, 2016; Premsankar *et al.*, 2018).

Edge AI can also enhance data privacy by keeping sensitive information, such as healthcare or social data, in compliance with the EU data protection standards.

Furthermore, Edge AI could also offer the possibility for underserved rural areas, possibly having an impact on reducing the digital divide.

However, Edge AI is also likely to bring new challenges. For instance, storing the data locally will increase the vulnerability surface for cyberattacks.

3.1.3 Megatrends

The process of adoption of AI systems by EU public administrations – examined through the answers given by respondents to the survey and the weak signals – can be analysed also under the lens of megatrends. The 14 Megatrends[10] identified by the EC Competence Centre on Foresight are described as *'long-term driving forces that are observable now and will continue to have a global impact in the years to come'*.

In the context of this study, only the megatrends identified as relevant are analysed in terms of their impact on AI adoption.

***Accelerating technological change and hyperconnectivity*.** The impact of technology and digital connectivity on human life has grown exponentially. Technology is taking giant steps forward and through it we are building connections between reality and the digital world, to the point of creating new realities in the digital world. The adoption of IoT and AI driven solutions in increasingly smart cities will aliment itself, with a profound impact on the life of people.

***Continuing urbanisation*.** The process of moving from the countryside to the cities in search of better opportunities - jobs, education, services – has been going on for centuries, constantly increasing in volume and numbers. The technological development of cities and the change of work will further increase the flow of people moving from rural to urban areas across the world. The number of people living in cities has more than doubled over the last 40 years and is projected to reach 5 billion by 2050. While it is true that technology will improve conditions for many, it is also true that digital divide may widen, and the environmental consequences of excessive housing density may exacerbate.

A similar trend is observed for what concerns the increasing demographic imbalances**.** This growth can lead to an imbalance in urban development, creating

[10] i.e., Accelerating Technological Change and Hyperconnectivity, Aggravating Resource Scarcity, Changing Nature of Work, Changing Security Paradigm, Climate Change and Environmental Degradation, Continuing Urbanisation, Diversification of Education and Learning, Widening Inequalities, Expanding Influence of East and South, Growing Consumption, Increasing Demographic Imbalances, Increasing Influence of New Governing Systems, Increasing Significance of Migration, Shifting Health Challenges.

inequalities or divisions between neighbouring areas, increasing the gap with the suburbs, and distancing citizens from experiencing the city as one.

Changing nature of work. Automation and technological advancements are creating unprecedented challenges and opportunities. Machines have already the potential to substitute humans in different fields. At the same time is increasing the need for new digital and technological skills. The shift in occupational structures is leading to polarisation in employment, wages and inequalities. The impact of new generations entering the workforce, and the growing digitalisation is reshaping the world of work.

Changing security paradigm. Security concerns related to digital evolution extend beyond issues of private online security or misinformation on the Internet. The risks associated with the malicious use of technology significantly impact citizens' lives. Internet scams, phishing, deepfakes, and online fraud are global challenges, now commonplace for individuals using digital technologies (Deloitte, 2024). Additionally, cyberattacks and ransomware targeting the digital infrastructures of public administrations have become an escalating issue, with direct consequences for citizens' daily lives (Dudziak-Gajowiak & Szleszyński, 2023).

Beyond these domestic concerns, the digital evolution also carries substantial implications in the international arena. The dynamics of political power are shifting, and warfare is no longer confined to traditional methods or actors. The Westphalian paradigm, which once positioned only nation-states as the primary combatants in war, is increasingly challenged by non-state actors, who now pose military, political, and cyber threats to States. Technology has enabled these actors to expand their scope of attack, amplifying the risk of targeting civilian populations through hybrid warfare tactics. Financial systems, smart home technologies, and urban infrastructures may now become key battlegrounds in this evolving landscape.

AI can be a valuable asset for national and local governments to face such problems, through enhanced data analysis and threat detection. The resilience of digital infrastructures is critical to support the technological development of cities and regions, and safeguarding the proper functioning of the society.

Climate change and environmental degradation. Climate change would persist even if all emissions from human activities were to cease abruptly. However, without significantly stronger mitigation efforts, anthropogenic greenhouse gas emissions will continue to exacerbate global warming and alter climate patterns. Immediate and comprehensive environmental action is essential to mitigate the damage and avert the most severe consequences of climate change and

environmental degradation. AI-driven solutions have the potential to facilitate the adoption of more efficient methods for reducing CO_2 emissions and energy consumption, particularly within the context of smart cities.

Furthermore, environmental changes are likely to amplify the increasing significance of migration, particularly in relation to climate and economic displacement.

Aggravating resource scarcity. This megatrend is particularly important when dealing with critical materials as essential for advanced technologies such as AI, and it poses a significant challenge to the future development and deployment of AI. As demand for AI-driven systems grows, the reliance on rare earth metals, semiconductors, and other critical materials intensifies. These materials are crucial for manufacturing AI hardware such as processors, sensors, and batteries, and their scarcity can disrupt supply chains, increase costs, and limit technological innovation (Binnemans *et al.*, 2013). Moreover, geopolitical tensions surrounding access to these materials could lead to supply uncertainties, hindering the scalability and global reach of AI solutions.

The growing competition for these resources may also drive environmental and ethical concerns, as extraction practices often result in significant ecological damage and human rights issues (Rachovides *et al.*, 2024). In this context, the future of AI development could depend on both finding alternative materials and advancing recycling technologies, as well as fostering international cooperation to ensure equitable and sustainable access to these critical resources.

Other megatrends, such as the **growing consumption of resources**, the **widening of inequalities** and the **shifting health challenges** are going to play a significant role in the future of society and global balances. However, the mutual influence between these dimensions and the impact of AI in European public administration settings appears less significant when compared to the others mentioned above.

3.1.4 Results of the foresight analysis

The exploratory, empirical-analytical foresight analysis has been applied to explore future AI trends and weak signals and analyse their interaction with the megatrends and their implications for public administrations. The analysis is based on three key elements: trends, identified through the LRAs consultation, weak signals and megatrends as provided by the JRC. Trends reflect the respondents' view on topics which are expected to have growing relevance for public administrations adopting AI. Of particular importance amongst these are: AI integration in public services and efficiency, governance, ethics, and digital skills.

In addition to identifying AI applications to enhance internal management of public administrations, which is reflected by the primary data collected, a topic that is becoming central for LRAs is AI governance. Without a well-defined chain of accountability, oversight and risk management, LRAs face significant constraints in fully integrating AI in their processes.

Moreover, respondents shared that it will become more and more important to have clear and shared ethical guidelines, appropriate in-house skills, knowledge sharing mechanisms as well as solid risk monitoring and management approaches. Ethical concerns, including privacy and transparency, are progressively considered more central issues, while risk management and knowledge sharing between administrations are seen as becoming critical for successful AI implementation. Future concerns about the limitations of AI due to the lack of protocols and practices for data interoperability and quality control and for AI projects scalability, its environmental impact, and the financial resources are also noted, with some respondents remaining sceptical about AI's potential benefits.

Moreover, building on the concept of weak signals, the study analyses the ones directly impacting AI implementation at local level. Horizon Scanning is used to identify and explore key weak signals for AI adoption by local public administrations across the EU. The weak signals investigated include ethical AI, environmental sustainability through and of AI (Green AI), the potential of AI in smart cities, and the application of Edge AI to improve the efficiency and reach of AI in areas where digital infrastructures are less developed. Ethical AI focuses on the increasing complexity of concerns related to an ethical AI use, while Green AI aims to go beyond the sole reduction of energy consumption and emissions and aim at making the AI implementation sustainable and environmental conscious. Furthermore, the development of smart cities involves AI-driven solutions to predict actions for energy, safety, and mobility needs, and Edge AI to allow local devices to locally process data securely and efficiently, especially in regions with limited connectivity.

The adoption of AI by EU public administrations is also shaped by megatrends, which are long-term forces with global impact. Amongst them, ‘accelerating technological change and hyperconnectivity’ could enhance the integration of AI and IoT in smart cities, while ‘continuing urbanisation’ could increase digital and environmental challenges in cities. Moreover, ‘the changing nature of work’, leading towards automation, would eventually raise digital skills demand and cause workforce polarisation. Concerning the ‘shifting of security paradigm’, AI could help address cyber threats and hybrid warfare; and for the ‘climate change’, AI can support energy efficiency and sustainability approaches and solutions. Finally, ‘aggravating resource scarcity’, particularly related to critical materials

for AI hardware development, could further exacerbate an equitable and sustainable access to digital devices.

In conclusion, the analysis reveals that AI adoption by EU public administrations is shaped by a combination of forces, including technological advancements, ethical issues, and broader societal challenges. Ethical AI and Green AI will be crucial to ensuring sustainable and responsible implementation, while the development of smart cities and the integration of Edge AI can greatly improve local services. Nonetheless, concerns over AI governance, appropriate digital skills, privacy, transparency, and risks persist. Furthermore, megatrends such as climate change and urbanisation will drive the need for AI solutions that are both inclusive and sustainable. Ultimately, addressing these interconnected challenges will be key to maximising AI's potential in the public sector.

3.2.1 Overview of the policy recommendations on the AI implementation

This section provides an overview of existing recommendations on AI implementation within the public sector, and also more broadly.

In general, over the past seven years, European policies and strategies on AI have been gradually consolidated into a comprehensive framework which considers the ethical, economic, and societal implications of AI. The following paragraphs summarise these policy developments as made by the EU.

By way of example, the 'Tallinn Declaration on e-Government' (2017) called for EU Member States to commit to provide efficient and secure digital public services. The Declaration emphasised the value of collaboration amongst Member States to guarantee coherent development, promoting simplified cross-border digital services and opening the door for the incorporation of AI in public administration.

The importance of values such as human agency, privacy, fairness, transparency, and accountability, was stressed in the 'Ethics Guidelines for Trustworthy AI' (2019a) released by the High-Level Expert Group on Artificial Intelligence (AI HLEG). The Guidelines established the ethical framework for AI deployment, which applies to LRAs.

The AI HLEG also issued the 'Policy and Investment Recommendations for Trustworthy AI' (2019) to supplement the Ethics Guidelines. They are meant to give policymakers direction on how to encourage AI investment that is consistent with the ethics guidelines.

The abovementioned document promotes measures that are deemed to be crucial for providing digital public services that are easy to use, cross-border, and interoperable. In order to support the AI uptake, it also encourages Member States to develop structures dedicated to cooperation actions, capitalise on funding opportunities, and enhance digital infrastructure.

In parallel, the 'Coordinated Plan on Artificial Intelligence' (2018, updated in 2021) aimed to align national AI strategies and create synergies in the EU, ensuring that AI's implementation across Europe is cohesive. The Plan included specific recommendations for the public sector, stressing the need to strengthen cooperation across the different governmental levels. To better operationalise the Plan, the 2021 update added a reference to specific actions to be undertaken by Member States, and also provided a specific timeline. Moreover, the 2021 review integrated the ethics framework introduced by the Ethics Guidelines, and

highlighted the importance of enhancing data sharing, developing national AI strategies, and prioritising the workforce upskilling and reskilling. It also called for concrete actions to implement AI solutions within public administrations.

The 'White Paper on Artificial Intelligence' (2020c) proposed, for the first time, the risk-based AI classification which has become the basis for the risk-based approach in the EU AI Act. Given the strong focus on ethics and citizens' rights, the White Paper specifies that the public sector is particularly required to ensure that AI implementation is aligned with the ethical standards established by previous documents.

Moreover, the strategy 'Shaping Europe's Digital Future' (2020b), frames the EU vision for digital transformation – for which AI is a central technology. The initiative recalls the importance of digital skills, in particular for public sector employees, recommending actions for enhancing AI literacy amongst civil servants, an aspect that is a key part of the 'European Skills Agenda' (2020a).

Furthermore, to complement the strategic and regulatory framework, European funding for the 2021-2027 multi-annual financial framework to support AI research and development is now allocated under the Horizon Europe and Digital Europe programmes. Specific topics related to AI are also included transversally in other funding instruments, such as the European Defence Fund, the LIFE programme, InvestEU, and the digital strand of the Connecting Europe Facility, along with the structural funds available to the Member States.

Finally, the 2024 adoption of the AI Act marked the establishment of the first regulatory framework for European regulation of AI. It is also the world's first regulatory framework that classifies AI systems according to risk and create regulations based on these classifications. In order to promote a cohesive implementation throughout the EU, the Regulation puts forward a set of recommendations for the Member States.

In stressing how national policies are required to be aligned with the objectives and principles of the AI Act to ensure coherent AI adoption and implementation, the AI Act also requires Member States to nominate or establish national regulatory organisations to oversee the regulation of national implementation. Furthermore, to support the successful deployment of AI, Member States are encouraged to fund capacity building initiatives to enhance the AI-related skills necessary to fulfil the increasing demand for expertise in the field.

The AI Act also advocates for robust collaboration between the public and private sectors to improve data quality and standardise sharing protocols, thus facilitating a unified data ecosystem conducive to AI innovation. Furthermore, it underscores

the importance of public engagement, encouraging Member States to promote citizen awareness about both the benefits and risks associated with AI technologies. Finally, the AI Act recommends establishing a monitoring mechanism to evaluate its implementation and track the broader impact of AI across the EU.

The following areas can be identified as summary topics addressed thus far by the recommendations directed to the Member States through European policies, strategies, and legal frameworks:

- **Digital Public Services**: The Tallinn Declaration (2017) encourages efficient, secure, and collaborative digital services across the EU Member States, setting a foundation for AI integration in public administration settings.
- **Ethical Framework**: The Ethics Guidelines for Trustworthy AI (2019) promotes human agency, privacy, fairness, transparency, and accountability in AI deployment.
- **Policy and Investment Guidance**: The Policy and Investment Recommendations (2019) support collaborative AI environments by supporting interoperable, user-friendly digital services with robust legal, security, and ethical standards.
- **Coordinated Implementation**: The Coordinated Plan on AI (2018, updated in 2021) calls for aligned national strategies, data sharing, skills development, and specific action timelines for public sector AI use.
- **Digital Skills and Literacy**: Shaping Europe's Digital Future and the European Skills Agenda (2020a, b) emphasise AI literacy and upskilling for civil servants.
- **Funding for AI:** The 2021-2027 financial framework divides funding between Horizon Europe, Digital Europe, and other EU funds to support AI R&D, with a focus on applications in the public sector.
- **Risk-based Regulation**: The White Paper on AI (2020c) and the AI Act (2024) introduce the concept of risk-based AI classification to ensure AI applications align with the EU fundamental rights and ethical standards, especially in the public sector.

Concerning the regional and local perspectives on AI adoption in the public sector, the CoR, through its rapporteur, Alberto Cirio, presented an opinion entitled 'Challenges and opportunities of artificial intelligence in the public sector: defining the role of regional and local authorities' (European Committee of the Regions, 2024b). The opinion has been adopted by the CoR plenary on 21st November 2024.

The opinion addresses ethical and inclusive requirements for AI adoption by local authorities, focusing on transparency, data management, public engagement, and

support for underserved communities. It also calls for training civil servants, creating AI test beds and regulatory sandboxes, and ethical guidelines. It also prioritises bridging AI disparities, enhancing cybersecurity, and fostering AI ecosystems for local needs. Furthermore, the opinion recalls the importance of promoting human-centred reliable AI, in line with the values promoted at European level, specifying that the most effective approach is to identify AI potential solutions based on public consultations, which allow for a better alignment with the actual needs at societal level. Finally, in terms of addressing disparities at local level, the opinion underscores the urgency of proactively addressing the AI divide, with particular reference to rural areas.

3.2.2 Recommendations

The following recommendations are based on the primary and secondary data gathered through the desk research and literature review, the survey, the experts' interviews, the case studies, and the foresight analysis.

To enhance the AI adoption by the LRAs, there are several topics that emerge from the discussion of the factors for the successful implementation of AI (see Part 2) and from the foresight analysis (see Section 3.1).

Governance, leadership and interaction between the political/managerial level and the technical level are considered to grow in importance in the future and where guidance on establishing models and approaches is strongly called for by the LRAs.

Ethics, risk management and monitoring mechanisms are indispensable activities to comply with the European regulatory framework and that are expected to increase their complexity and nuances in the near future.

Digital skills to address the AI divide and capacity building for civil servants are a clear necessity for the public administrations willing to adopt AI and which requires continuous actions to follow the technological evolution.

Public engagement and co-creation are fundamental to foster public trust and alignments with local societal needs.

Cooperation, knowledge sharing and scalability are crucial to ensure cost-effectiveness of the AI development, cross-border services and coherent solutions across Member States.

Data quality, availability and interoperability are prerequisites for AI implementation and fostering cooperation.

Sustainability and environmental impact are also underlined, including both the application of AI for advancing sustainability goals and the necessity to reduce the environmental impact due to the AI usage.

Emerging technologies, digital sovereignty and partnerships for innovation, lay down the basis for following the innovation in the sector and promoting the European leadership in AI development at global level.

In a lesser extent, funding and investment are also mentioned and will need to be increased as the relevance of AI grows. However, several financial instruments are already available and cover different aspect of AI implementation.

Considering these topics and the recommendations already issued in the literature on the topic, the following recommendations are identified for enhancing the adoption and effectiveness of AI and GenAI at the local and regional levels within the EU:

Recommendation 1. The **EU** should support LRAs to implement AI Monitoring and Evaluation Frameworks by outlining standardised frameworks and KPIs, enabling LRAs to track AI's impact, adjust strategies, and align with technological advances.

This recommendation stresses the growing need for standardised monitoring practices and methods to evaluate AI's effectiveness and alignment with local needs and technological evolution. While ethics and risk management are largely covered by previous recommendations and ongoing work at European level, the debate around the issuing of appropriate monitoring mechanisms is still under-addressed.

According to the survey results, only a small percentage of LRAs are currently evaluating the efficacy and efficiency of their AI applications. As pointed out during the interviews, many respondents are facing difficulties in the definition of precise KPIs, mostly because the concept of AI efficiency itself needs further clarification.

Furthermore, the survey results highlight the fact that, although some LRAs acknowledge the importance of ongoing assessment to modify AI projects in response to evolving requirements and technological evolution, this strategy is not consistently implemented. The need for EU-provided KPIs is further justified by the fact that smaller municipalities, in particular, frequently lack the means to put in place reliable monitoring systems. A unified approach to evaluation would

enable more consistent, effective AI integration across diverse regions, enhancing transparency, accountability, and policy responsiveness at the local level.

In this context, the EU TSI can support with specialised expertise LRAs in designing monitoring and evaluation frameworks which adapt to the specific territorial characteristics, given that a European standardised framework is still needed as common bases for all European regions. In addition, Horizon Europe can also be employed to propose innovative tools for monitoring and evaluation purposes.

Recommendation 2. To foster public trust and citizen acceptance, **LRAs** should involve citizens in the AI development process. This should include guidance on co-creation design and development methods, ongoing collection of feedback, users testing sessions and the promotion of transparent communication. This can include online portals, public workshops, seminars (both virtual and physical), public consultations, and explicit 'resident-in-the-loop' development practices to raise inclusivity, promote the design and development of citizen-centric and explainable solutions, demystification of AI applications and foregrounding of community and societal benefit.

This recommendation places a particular emphasis on direct public engagement at local level. While previous recommendations promote citizen engagement and acceptance through 'Diverse Voices in Policy' and 'Transparent, Ethical AI', this strategy encourages ongoing communication between people and public administrations in order to build public trust and go beyond initial participation.

To comprehend particular local and regional demands, requirements, and concerns, LRAs should endeavour to participate alongside citizens in the design and development of activities that involve them. This may include open digital forums, transparent physical workshops, seminars, or complete integration into R&D lifecycles.

LRAs should commit to radical openness and transparency, whether the technologies are adopted in relation to the public or not. This is especially important in instances where resident data is utilised to improve public services, or to extract insights, or value for the public sector authority (e.g., public health or environmental data).

The survey results highlight that citizens lack a clear understanding of AI's role and potential benefits, which can create apprehension and resistance towards AI,

particularly at the local level. By engaging the public directly through mechanisms such as co-creation, online portals, public consultations, seminars, and workshops, LRAs can address common concerns and work towards building confidence in the technologies, and the deployers of the technologies. Moreover, such a process can also be useful as an educational tool for people, explaining data strategies and specific technological concepts, as well as the implications of specific technology deployments and associated choices that LRAs will choose in their deployment as it is quite gradual and stepwise.

Another interesting aspect emerging from this study is the predisposition for people to be more willing to accept and support AI implementation and appreciate its tangible (and intangible) benefits when they are actively included in the discussions. Additionally, feedback gathered from these interactions can allow to refine AI strategies, making them more tailored to local needs and values. This approach does not only build trust, but also encourages a community-centred perspective on AI, making local projects more suitable to public's specific expectations and concerns.

For this purpose, the Digital Europe programme can be used to create digital platforms that facilitate public engagement, such as online portals and co-creation forum or tools to support public feedback collection.

Recommendation 3. The **EU** and **Member States** should encourage the establishment of regulatory sandboxes across regions, allowing LRAs to experiment with AI solutions within controlled, legally compliant environments. Test beds and living labs would further support local governments in evaluating AI applications' effectiveness before full deployment.

A concept that has not been addressed with sufficient attention in previous guidelines is the possibility to adopt regulatory sandboxes and test beds, contributing to structured oversight and accountability as key components of robust governance frameworks. It is useful to regulate and assure compliance for testing environments for emerging AI technologies. By enabling real-world testing of AI applications, this strategy can help LRAs understand the dangers and limitations of the technology, prior to its widespread implementation. National governments should enhance sandboxing procedures for data governance and processing across departments and regions. This could entail establishing specialised functional sub-departments to enhance compliance procedures, encourage more innovation and research amongst LRAs, and capitalise on the implicit and explicit value of data.

The data demonstrate that while many LRAs are interested in adopting AI, they face significant uncertainty regarding compliance with regulatory standards, risk management, and the practical effectiveness of AI applications. Smaller LRAs, in particular, often lack the resources to fully evaluate AI's impacts or to ensure compliance with complex EU regulations without first testing these technologies in a low-risk setting.

Establishing regulatory sandboxes would allow LRAs to experiment within a framework that maintains legal and ethical standards, fostering innovation without risking non-compliance. The data also reveal that some LRAs hesitate to fully implement AI solutions due to concerns about unforeseen consequences and lack of real-world data on AI's local impact. Test beds and living labs, i.e., structured environments where AI can be piloted, would address this gap by providing LRAs with the opportunity to assess AI's utility, gather data on its outcomes, and refine applications before broader deployment. In support of LRAs, the Horizon Europe programme is the financial instrument that the EU makes available for the creation and implementation of regulatory sandboxes and test beds to conduct experimentations with AI.

Moreover, such experimentation environments could support the testing of GenAI solutions, which are currently not employed at local level, due to its numerous legal implications.

Ultimately, this recommendation aims at mitigating the challenges of AI deployment within complex regulatory frameworks, and seeks to empower LRAs with controlled spaces to innovate responsibly and effectively, aligning with the EU's goals for ethical and well-regulated AI adoption at all administrative levels.

Recommendation 4. To prevent AI adoption from worsening digital inequality and help address digital divides, **LRAs** should implement inclusive practices, such as online guidance, training for vulnerable groups, and affordable access to digital tools. **Member States** could facilitate these initiatives by offering resources and policy support.

Although 'Training and Bridging Digital Divides' was noted in previous recommendations, this recommendation adds specificity by suggesting targeted inclusive practices for digitally disadvantaged groups, such as online guidance, affordable access, and training programmes that specifically mitigate digital inequality in AI adoption.

Research results also show that many LRAs struggle to ensure equal access to digital services for the entire population. Different segments of the population

may not have the digital skills or resources needed to take advantage of AI developments. Disparities may result from this digital divide, with some groups disadvantaged or excluded from emerging AI-based public services.

In order to encourage wider public acceptance and reduce the danger of exclusion, LRAs should proactively address these disparities by providing tailored assistance to ensure that the benefits of AI are available to all residents. Furthermore, as smaller LRAs may not have the funds or infrastructure to carry out these measures on their own, it is crucial that national governments provide resources and political support.

The European Social Fund Plus (ESF+) offers opportunities to finance training programmes to improve the digital skills of vulnerable groups. This can also be coupled with the InvestEU instrument which can support the provision of affordable digital technologies and infrastructure to underserved communities.

In line with the EU's overarching goals of justice and equality in digital transformation, this collaborative effort would reduce the social risks associated with AI deployment and promote digital inclusion.

Recommendation 5. The **EU**, together with **Member States**, should facilitate partnerships between public, private, and academic sectors that can support LRAs access advanced technologies and expertise.

The previous recommendations include cross-border ecosystems and collaborative projects but do not explicitly address partnerships with academic institutions and private entities within regions to strengthen local capabilities. This recommendation fills that gap by advocating for interdisciplinary collaboration with academia and industry, especially to bolster under-resourced LRAs.

According to the survey results, only about 27% of LRAs are currently adopting AI, with larger LRAs generally being more active in implementation. Smaller LRAs face significant hurdles, particularly in terms of limited human resources, technical expertise, and financial capacity, which restrict their ability to leverage AI technologies effectively. Partnerships with external entities (private and academic sectors) could help bridge these gaps by providing essential knowledge and resources for smaller LRAs to adopt and integrate AI. In this sense, LRAs should also consider the opportunities offered by the Horizon Europe programme that foster the creation of such partnerships for innovation.

Beyond addressing internal challenges, these partnerships foster a dynamic ecosystem where public, private, and academic sectors collectively enhance

public service delivery and citizen engagement. Private sector expertise in technological development and academia's role in researching user-centric AI applications can support LRAs to align AI solutions to specific place-based needs, also creating opportunities for pooling resources and sharing infrastructure, which significantly benefits smaller LRAs with budget constraints.

To overcome the significant skills gap identified amongst LRAs, the EU and its Member States should prioritise funding for AI and digital literacy training. Furthermore, offering incentives for AI certifications could help public administration staff build relevant skills, particularly in smaller municipalities where resources are often more limited.

Given the challenges related to data interoperability and security, the EU and its Member States should focus on developing and enforcing standardised frameworks. These frameworks would facilitate secure data sharing between LRAs, thus enhancing the effectiveness of AI-driven public services across jurisdictions.

Finally, this kind of partnerships allows LRAs to follow the evolution of emerging AI technology, such as Edge AI, and support the advancing of a European leadership in the sector and explore new solutions for fostering equitable opportunities to benefit from the AI for all citizens in Europe.

Recommendation 6. **National governments** should prioritise integration at the local and regional level of open standards, software, and hardware, which contribute to ensuring high-quality data and seamless interoperability. This should include investment in IT infrastructure to support permissive research and innovation. This might include the upgrading of systems, porting of existing systems, investing in modern alternatives with improved functionality, that adhere to open standards for data exchange and management. Supporting the deployment of harmonised open-source technologies (regionally/nationally) will not only improve inter-regional scalability and compatibility but also enhance data integrity, consistency, and interoperability across administrative boundaries. This will promote openness, improve public trust, provide clear pathways for inter-regional scalability, and remove private sector dependencies – especially those linked to proprietary software and hardware, and their aforementioned licencing models.

The case studies highlighted the benefits of developing IT infrastructure on open software and permissively licenced technologies. This is especially true in the

case of technologies that support the integration of AI into the wider public sector administration. Removing long-term dependencies on proprietary technology should be a specific focus of governments (both nationally and regionally), to increase national and European technological sovereignty, as well as to aid interoperability, security, and European harmonisation.

Integrating modern IT infrastructure, while carrying a predominant capital cost, will work towards future proofing public administration for the deployment of specific AI technologies. This might include technologies such as Edge AI, smart city integration, the integration of confidential computing, federated learning, or the deployment of specific technologies to aid security such as homomorphic encryption or quantum-proofing.

Focus on integrating open and permissive AI technologies should also include the promotion and deployment of European focused foundational, and/or language AI models, such as those within projects and consortiums such as Euro-LLM (Euro-LLM, 2024), OpenGPT-X (OpenGPT-X, 2024), and SiloGEN (SiloGEN, 2024). This effort would also support the ongoing foregrounding of inclusivity, as Member State language support would be integrated. An improved focus on moving away from proprietary (and mostly US big-tech owned and operated) models will also promote European digital sovereignty. This effort will support research, innovation and societal development whilst maintaining European ethical principles, respecting European fundamental rights, and promoting the notion of European leadership and strategic autonomy in the digital field (Madiega, 2020).

Recommendation 7. **LRAs** should invest in creating stronger ties across various internal departments, especially between management and technical IT teams, also finding more effective way of interaction between the technical and managerial/political levels. This will foster AI adoption and improve cooperation, collaboration, flexibility, and resilience in design, development, and deployment.

The case studies highlighted the need for LRAs to develop appropriate governance procedures for both inter-departmental and inter-regional data sharing – especially when that processing is beyond the normal remit of one or more departments or entities, or, more importantly, traversing across various stakeholder grouping (e.g., public, private, academia, etc.). While expertise is developing at the local level on this data governance, it should be supported by improved efforts directed at creating cohesive relationships across regions and departments, as appropriate. This may include cross-departmental and/or national workshops, seminars, or curated events that support network creation, relationship

building, or expose representatives to success stories (or open challenges) that inspire or direct the creation of new, improved, processes. This effort can be tied into the development of regulatory sandboxes (see Recommendation 3).

Recommendation 8. The **EU** and **Member States** should further explore how AI could support the local level to contribute to the European Green Deal and to the United Nations' environmental-focused SDGs. In parallel, more research is needed to minimise the environmental impact of AI by fostering AI systems that are designed and deployed sustainably.

Concerning the application of AI to pursue international environmental goals, as local authorities can meaningfully contribute to the implementation of sustainability initiatives directly impacting communities, ecosystems, and regional development, the establishment of environmentally-conscious practices is especially important (Rolnick *et al.*, 2019). This will also ensure that LRAs, independently by their size and financial resources, can optimise efforts for enhancing their environmental resilience.

Moreover, according to the results of the foresight analysis, given the rapid development that AI technology will undergo in the next future, it will be equally important to advance the research on how it is possible to reduce the environmental footprint of AI. In fact, AI systems are moving towards large-scale models that will likely pose significant challenges to the energy consumption and environmental protection (Strubell, Ganesh, and McCallum, 2019). This is an aspect that is still underexplored in the ongoing policy debate around AI at European level.

On this matter, it is possible to exploit the clear synergy with the aims of the LIFE programme, which is dedicated to funding environmental and climate-related initiatives.

3.3 Conclusions of the study

This study provides an overview of the opportunities and challenges of the AI adoption by local and regional administrations. Starting from a literature review and a presentation of the state of play of AI adoption by LRAs across the EU, the study investigates critical drivers and best practices for the successful uptake of AI in the public sector at local level.

AI adoption rates are found to be on the rise amongst LRAs, particularly its application for improving the efficiency of internal management. However, the study findings highlight a potential correlation between the size of the administrations and the availability of skills and financial resources which lead to unequal degrees of integration of AI in the organisations' processes across Europe.

Related to this finding, the topic of capacity building for AI in the public administrations is of paramount importance to effectively manage and deploy AI technologies, ensuring that they can adapt to evolving digital landscapes and address emerging challenges.

In this sense, a model that can contribute to addressing the skills gap, whilst fostering innovation and scalability, is the creation of partnerships between local authorities, academia, and the private sector.

A critical point of the research is the need, from a local perspective, to enhance the alignment between AI development and the specific local priorities, stressing the necessity to focus on societal engagement through co-creation practices and citizens' feedback collection.

Similarly, more efforts are required to tackle the AI divide and spread inclusive approaches to AI, which, if not addressed proactively, may lead to significant disparities across the EU LRAs.

Furthermore, ethic, legal and governance concerns are perceived as a major obstacle to the full exploration and exploitation of the AI technology. Therefore, more guidance at European and national level is strongly advocated by LRAs.

Finally, it is crucial to foster the debate on the impact of AI in enhancing the environmental resilience at the local and regional level, both in terms of its application in energy optimisation, waste collection and climate monitoring and also to reduce the energy-intensive processes of training and deploying large AI models.

To further support these findings, it may be interesting to compare these results with a publication of the JRC dated to November 2024 entitled 'What factors influence perceived artificial intelligence adoption by public managers?' (JRC, 2024). This report investigates the state of play of the AI adoption by the public sector, focusing on identifying factors that promote or hinder the AI adoption, found to be relevant both at national and local levels.

The JRC publication shares several findings with the present study. First of all, the research used the TOE framework complemented with individual attitudes, which is used to understand the technology adoption dynamics through these three elements. According to the research results, which are based on a survey conducted in seven EU Member States, it is found that the internal factors are the most crucial for the AI adoption, and in particular leadership support, innovative culture, and in-house expertise. These conclusions reflect this study findings, which highlight similar drivers for the AI adoption such as the centrality of individual managers as initiator of the AI projects (see Section 1.2.2) and the importance of enhancing an effective communication in between the technical and the managerial/political levels (see Section 2.3).

Moreover, the JRC study largely stresses citizens' role in AI adoption. According to its results, public administrations, when developing AI projects, try to anticipate citizens' needs and potential demand, as they are considered as the main stakeholders of the technology. However, consultation and co-creation activities are not particularly spread as practices. This conclusion aligns with this study findings, pointing to the citizens engagement and acceptance as one of the main drivers for the success of the AI adoption in the public sector (see Section 2.4).

To conclude, it is important to note that both studies recommend the implementation of context-sensitive strategies to bridge gaps in expertise, governance, and public acceptance.

Annex I – The online survey

The questionnaire is structured into three sections, aimed at collecting evidence on the following:

- General data on the respondents;
- Data on the implementation of AI/GenAI initiatives by LRAs to identify drivers, barriers, opinions and best practices on the AI adoption by LRAs;
- Views on the future of AI for public administrations to support policymaking.

The design of the questionnaire considered the research questions to which the study aims to respond, as well as the gaps the research group deems relevant to fill to come up with a final evaluation of the implementation of the AI at the local and regional level and its potential improvement. The respondents have been invited via e-mail to participate in the questionnaire. The questionnaire ran for six weeks. The tool used for the technical implementation of the online questionnaire is EUSurvey (https://ec.europa.eu/eusurvey/home/welcome).

Introduction to the survey

The **European Committee of the Regions** (CoR), representing local and regional authorities in the European Union, has tasked **FORMIT** and **Trilateral Research** to conduct a questionnaire and a study to investigate the state of play and the key factors for the successful AI and GenAI adoption at local and regional level.

The survey is structured into four sections. It takes around **15 minutes** to be completed. The survey is available online in **English**, **French**, **German**, **Italian**, **Polish** and **Spanish**. It will remain open until 15 October 2024. For more information, please contact ricercaeinnovazione@formit.org.

Individual contributions provided through the open questions of the survey may be eventually used in the study but in an anonymised form. Fondazione FORMIT standard privacy statement applies.

The follow-up to your contribution requires that your personal data (name, contact details, etc.) be processed in a file. Participation in the consultation is voluntary. Should you require any further information or wish to exercise your rights under Regulation (EU) 2016/679 (e.g., to access, rectify, or delete your data), please contact the data controller (CoR; studies@cor.europa.eu) or the data processor of this survey (Fondazione FORMIT;

ricercaeinnovazione@formit.org or Trilateral Research; dpo@trilateralresearch.com). You have the right of recourse to the European Data Protection Supervisor at any time (www.edps.europa.eu). For any further information on data protection policy and the use of your contributions, please consult the following legal notice: CoR Data Protection Notice (full version) and FORMIT Privacy Statement (full version). Please note that the answers you provide can be used, in an anonymised form for drafting a report. That report could be transmitted to CoR rapporteurs and other EU institutions and used in CoR studies and publications. If you do not wish so, please inform us accordingly.

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☐ *I hereby consent to the transfer to the European Committee of the Regions ('the Committee') of the personal data (first name; last name; organisation; role/position; e-mail) that I submit in the present survey, to be used by the Committee for canvassing purposes. The CoR will retain data collected on the occasion of the study for a maximum of two years after the prospection. However, the personal data of survey respondents having refused to be contacted around survey follow-up activities will be deleted two months after the completion of the study. For any further information on the Committee data protection policy, please consult the following legal notice: Data Protection Notice (full version).*

Section 1 – Details about the respondent

*(Questions marked with * are mandatory)*

Q1.1 – Information about the respondent

First name: [Open answer]_____
Last name: [Open answer]_____
Email*: [Open answer]_____
Role/position*: [Open answer]_____
Organisation*: [Open answer]_____
Country where the organisation is based*: [drop down menu with the EU27 Member States]
Region where the organisation is based*: [drop down menu with the names of NUTS2 of the selected Member State]
City where the organisation is based*: [Open answer] _____

Q1.2 – Your organisation is: [only one answer is allowed]*

- A local public authority.
- A regional public authority.
- A local / regional agency working for a public authority.
- Other. [please specify]

Q1.3 - Does your organisation use any AI and/or GenAI solution? [only one answer is allowed]*

- Yes.
- No. [go to Q1.30]
- I don't know. [go to Q1.30]

Section 2 – Implementation of the AI in the public administrations

Q1.4 - In your organisation, what is AI and GenAI mainly used for? [multiple answers are allowed]*

- To enhance decision-making processes and outcomes in policymaking (e.g., to detect social problems faster than using traditional techniques, to monitor the implementation of policy or to enhance citizen participation, to identify trends and patterns that could be used for policy and predicting trends).
- To improve the delivery of public services and citizen/government interaction, by providing more efficient and effective, tailor-made or altogether new citizens' services, increasing trust and participation by citizens in public sector activities.
- To optimise internal management (e.g., by better allocating human and financial resources or improving the security of public administrations).
- I do not know.
- Other. [please specify]

Q1.5 - For which sector of your organisation is the AI and/or GenAI used? [multiple answers are allowed]*

- Municipal public services (e.g., road maintenance, waste management, green spaces management, streets lighting).
- Energy and sustainability.
- Health.
- Public order and safety (e.g., crime control, emergency management).
- Social protection.
- Environmental protection.
- Education.
- Mobility and transport.
- AI-based services for the public administration.
- AI-based services for citizens.
- Other. [please specify]

Q1.6 - Who was the initiator of the AI/GenAI adoption in your organisation? [only one answer is allowed]*

- An individual expert in the field.
- A manager.

- An in-house agency.
- A partnership.
- I do not know.
- Other, including external subject/actor. [please specify]

Q1.7 - In your organisation, is there any dedicated office/person in charge for the AI development/adoption/integration/monitoring? [only one answer is allowed]*

- Yes. [go to Q1.8]
- No. [go to Q1.9]
- I do not know. [go to Q1.9]

Q1.8 - Please indicate which office and/or role(s) is involved in AI development/adoption/integration/monitoring. [open question]*

Q1.9 - Are the following recommendations being adopted and implemented in practice by your organisation? [multiple answers are allowed]*

- Promote the adoption of ethical principles (e.g., human-centric and trustworthy AI) and identify mitigating measures to minimise the risks of deployment of AI by the public sector.
- Promote co-creation approaches for AI development with citizens and businesses.
- Promote awareness on potential positive impact of emerging technologies in the public sector.
- Promote capacity-building programmes for public sector innovators aiming to develop and/or adopt AI for the public services.
- Promote the use of regulatory sandboxes for public administrations, allowing experimentation of AI-enabled solutions.
- Optimise funding in support of AI in the public sector.
- Support multidisciplinary research with universities and Research and Development institutions around AI for the public sector.
- Reinforce and advance existing initiatives on open data and interoperability.
- Develop and apply impact assessment frameworks based on key influencing factors to measure the use and impact of AI in the public sector.
- Develop sustainable AI in compliance with environmental principles.
- None of the above.
- I do not know.

Q1.10 - Did your organisation organise any of the following actions in the process of developing the AI? [multiple answers are allowed]*

- Regulatory sandboxes.
- Test beds.
- Living labs.

- Best practices exchange.
- I do not know. [go to Q1.12]
- Other. [please specify]
- No. [go to Q1.12]

Q1.11 - Please provide us with the name and weblink of the preliminary initiative for the AI adoption most relevant to you. If there is no weblink, please describe in two lines the initiative. [open question]*

Q1.12 – In your opinion, what are the drivers of the AI and GenAI adoption by public services at subnational level? [scoring on Likert scale]*

- Improved Public Service (e.g., responsive, efficient and cost-effective services; increase quality of information and services; public citizen-centred services; personalised services; new services or channels).
- Improved Administrative Efficiency (e.g., improved management of public resources; increased quality of processes and systems; responsiveness of government operation; cost reduction; better collaboration and better communication; increase transparency, participation; enabling greater fairness, honesty, equality).
- Open Government Capabilities (e.g., increased transparency of public operations; increased participation in government; improved public control on government).
- Other. [please specify]

Q1.13 - In your organisation, which of the following AI-related skills and competences are present? [multiple answers are allowed]*

- Technical qualification (e.g., data science).
- Skills on ethical and transparency requirements.
- Basic knowledge on AI.
- Management of procurement activities.
- I do not know.
- Other. [please specify]

Q1.14 - What can be done to fill potential AI-related gaps in the personnel of your organisation? [scoring on Likert scale]*

- Attracting/Hiring people with the right skill sets.
- Internal training staff provided by external contractor.
- Creation of an in-house agency.
- National initiative for AI skills in public administration.
- Work together with university to develop IT specialist courses for civil servants.
- Public funding for civil servants to pursue private certified AI training courses.

Q1.15 - Are you outsourcing any AI development? [only one answer is allowed]*

- Yes. [go to Q1.16]
- No. [go to Q1.17]
- I do not know. [go to Q1.17]

Q1.16 - How do you keep a balance between internal resources and outsourcing? [only one answer is allowed]*

- By developing the project entirely internally, with a minor contribution from external suppliers.
- By building a system on top of the AI system offered by a private supplier in order to adjust the results to the need of the organisation.
- By developing AI in collaboration with the academia.
- Other. [please specify]

Q1.17 - How did you keep the AI development inhouse? [only one answer is allowed]*

- We already had the right skillset inhouse.
- We have an in-house agency.
- We hired new people with the right skills.
- Other. [please specify]

Q1.18 - Is your organisation working on data interoperability and security for enabling the AI to work properly? [only one answer is allowed]*

- Yes. [go to Q1.19]
- No. [go to Q1.20]
- I do not know. [go to Q1.20]

Q1.19 - Which actions did your organisation put in place for this purpose? [multiple answers are allowed]*

- Agreements with other public organisations for data interoperability.
- Agreements with other private organisations for data interoperability.
- Alignment with regulatory authorities.
- Overcoming ontology fragmentation and consolidating semantic interoperability.
- Addressing the legal consistency amongst different national and international systems.
- Other. [please specify]

Q1.20 - Since the adoption of the AI can increase the digital divide, which measures does your organisation put in place to enable AI to include digitally disadvantaged groups? [multiple answers are allowed]*

- Specific training to vulnerable groups on AI in public services.
- Online guidance and assistance to their interaction with AI.
- Develop Explainable AI (XAI) systems that provide laymen users' explanations for AI-driven decisions.
- Support the affordable access to AI tools and technologies to help tackle the digital divide.
- Awareness raising campaigns to spread the ability to distinguish AI generated content and debunking fake news on AI.
- Other. [please specify]
- None of the abovementioned.

Q1.21 - According to your organisation's experience, can you mention any best practices for managing and scaling AI and GenAI projects within LRAs? Please provide us with the name and weblink of the initiative most relevant to you. If there is no weblink, please describe the initiative in two lines. [open question]

Q1.22 - Does your organisation have partnerships with the private sector, academia, and other stakeholders? [only one answer is allowed]*

- Yes. [go to Q1.23]
- No. [go to Q1.24]
- I do not know. [go to Q1.24]

Q1.23 - Please provide us with the name and weblink of the partnership most relevant to you. If there is no weblink, please describe in two lines the partnership. [open question]*

Q1.24 - How are ethical considerations or guidelines for the AI and GenAI implementation processes integrated in AI development and implementation? [multiple answers are allowed]*

- Ethics by design.
- Ethical data sourcing (i.e., obtaining data in a way that respects individuals' privacy, consent, and applicable data rights).
- Proper data management for AI tools involves secure storage, controlled access, and regulated deletion practices.
- Establish guidance documents in line with European criteria.
- Establish an accountability framework, so there are clear lines of responsibility if the AI system fails or causes harm.
- AI ethics review.
- Training on ethics principles.
- Gather feedback on possible biases from the users.
- Continuous monitoring of ethics.

- Other. [please specify]
- There is no ethics integration.

Q1.25 - According to your opinion/experience, which are the most effective funding mechanisms that support AI and GenAI initiatives at local and regional level? [multiple answers are allowed]*

- EU Recovery and Resilience Facility (RRF).
- European Digital Innovation Hubs (funded under the Digital Europe Programme).
- Other calls under the Digital Europe Programme.
- Horizon Europe Programme.
- Other European structural and investment funds (e.g., ERDF, ESF+).
- Connecting Europe Facility for digital infrastructure.
- Other. [please specify]
- I do not know.

Q1.26 - Does your organisation assess the effectiveness and efficiency of AI and GenAI applications currently in use? [only one answer is allowed]*

- Yes. [go to Q1.27]
- No. [go to Q1.28]
- I do not know. [go to Q1.28]

Q1.27 - Can you explain how? [open question]

Q1.28 - Does your organisation foresee a continuous monitoring and evaluation of AI and GenAI projects to adapt to evolving needs and technologies? [only one answer is allowed]*

- Yes.
- No.
- I do not know.

Q1.29 - Does your organisation foresee the gathering of public feedback for shaping the AI and GenAI strategies of LRAs? [only one answer is allowed]*

- Yes.
- No.
- I do not know.

Section 3 – AI for public administrations perspectives

Q1.30 – According to your opinion, which uses of AI and GenAI should be prioritised or avoided in the future in order to maximise the benefits of AI use? [scoring on Likert scale from prioritised to avoided]*

- To enhance decision-making processes and outcomes in policymaking (e.g., to detect social problems faster than using traditional techniques, to monitor the implementation of policy or to enhance citizen participation, to identify trends and patterns that could be used for policy and predicting trends).
- To improve the delivery of public services and citizen/government interaction, by providing more efficient and effective, tailor-made or altogether new citizens' services, increasing trust and participation by citizens in public sector activities.
- To optimise internal management (e.g., by better allocating human and financial resources or improving the security of public administrations).
- Other. [please specify]

Q1.31 - According to your opinion, what are the main challenges and barriers faced by your organisation in the adoption and implementation of AI and GenAI technologies? [scoring on Likert scale]*

- Lack of skills and expertise.
- Lack of data interoperability.
- Complexity.
- System integration issues.
- Compliance with laws and regulations.
- Budget constraints.
- Quality of data.
- Lack of awareness/knowledge on standardisation processes.
- Lack of engagement with stakeholders (e.g., private actors, regulatory authorities, academia).
- Lack of political interest in the AI adoption.
- I do not know.
- Other. [please specify]

Q1.32 - According to your opinion, how can political leaders at local level support successful AI and GenAI adoption at the local level? [open question]*

Q1.33 - Concerning the future of AI and GenAI, do you see any trend for this technology or lessons learnt that can be used to improve the use and adoption of AI and GenAI at regional and local levels? [open question]*

Annex II – Eight case studies

This Annex reports the eight case studies on the use of AI by LRAs.

1. De Virtuele Assistent ('The Virtual Assistant') (Municipality of Kortrijk, Belgium, 2022-2025, AI-based services for citizens).

2. Green public transport on demand (Municipality of Sofia, Bulgaria, 2020-2023, mobility).

3. Vaasan kadut kuntoon ('Fix the Streets') (Municipality of Vaasa, Finland, 2020-2022, municipal public services).

4. Satellites for Wilderness Inspection and Forest Threat Tracking (SWIFTT) (Municipality of Riga, Latvia, 2022-2025, environmental protection).

5. Vadindekset ('The wet index') (Municipality of Jammerbugt, Denmark, 2021-2023, public order and safety).

6. Policies for Holistic Urban Mobility and Accessibility (Municipality of Nicosia, Cyprus, 2021-2024, mobility).

7. The AI-based LisNav application dedicated to transforming the lives of the visually impaired (Municipality of Lisbon, Portugal, 2022-2023, social protection/mobility).

8. Immediate and Long-Term Energy Reduction (RECITAL) (Municipality of Noisy-le-Grand, France, 2023-2025, energy).

Case II.1. De Virtuele Assistent ('The Virtual Assistant') (Belgium)

Broel Towers and Broel Bridge in the City of Kortijk.
Photo credit: Marc Ryckaert (MJJR).

Initiator: City of Kortijk (BE).

Project partners: City of Kortrijk, Leiedal.

External suppliers: Cronos Public Services.

Sector of intervention: AI-based services for citizens**.**

Funding: EUR 538,488.68, out of which:
80% from 'Municipality without a Town Hall' (EUR 426,660.46), 20% from the City of Kortrijk (EUR 111,828.22).

Timing: 01/06/2022 - 31/05/2025.

Expected impact: Implementation of the Virtual Assistant to official Kortrijk municipality websites; improving access to information, availability of services, search functionality, and integration across public services and administration functions (e.g., public transport information, government services information and booking, public amenities information and services).

Description of the case study

'De Virtuele Assistent' (The Virtual Assistant) is funded as part of wider digitalisation plan for Flanders Region in Belgium, implemented and part-funded by the City of Kortrijk. The strategic plan for AI was created in 2018, for a 6-year period[11]. The Flanders region, through the Digital Ministry of the Interior, allocated EUR 33 million to the 'Project Municipality without a Town

[11] https://www.flandersai.be/en/beleidsplan-artificiele-intelligentie.

Hall' initiative, with the Virtual Assistant receiving EUR 426,660.46 of this funding. The remaining 20% of funding for this particular project was allocated by the City of Kortrijk itself. The Flanders Region received the funding through the Flemish Government's recovery programme, entitled 'Flemish Resilience', which was financed by the EU through NextGenerationEU.

Within the City of Kortrijk, a Digital Transformation team is responsible for the ideation, management, and deployment of digitalisation projects. This team works across administration departments internally and at an inter-municipality level. The Virtual Assistant will be rolled out across municipalities in the Flanders region (and beyond), as part of the Grant Agreement requirements. Internally, the City of Kortrijk also works with a number of complementary initiatives in the broad domain of digitalisation, with responsibilities delegated appropriately. By way of example, the ALL DIGITAL project focuses on building up citizen skills on digital topics, including the provision of 'digihelp' from 'digipoints' (i.e., physical information points/desks in the city). For internal employees, sessions are provided through their internal management system, entitled Copilot. Some of these are focused directly on AI and its deployment within public administration. Kortrijk also works alongside 'The Digital Arts and Entertainment (HoWest)' programme, recognised a number of times for best game education in the world, and the SHIFT-Project, which is focused on increasing digital maturity within staff across all functions at an inter-municipal level.

The Virtual Assistant has integrated aspects of inclusion into its roadmap, with functionality to accept queries in multiple languages. The project team also work directly on aspects of e-inclusion, contributing to an inclusive, equitable and innovative society. Throughout the design and development process, the Digital Transformation team are committed to ensuring the 'e-inclusion reflex' is foregrounded, with focus on user panels, e-inclusion advisory groups and user research.

Discussion of the results

The Virtual Assistant project is due to end in May 2025. The Digital Transformation team will monitor results, in conjunction with the funding body. The expected and achieved results are monitored on an ongoing basis, according to the project workplan, and reported on in a transparent manner - to aid trust and transparency in public spending[12].

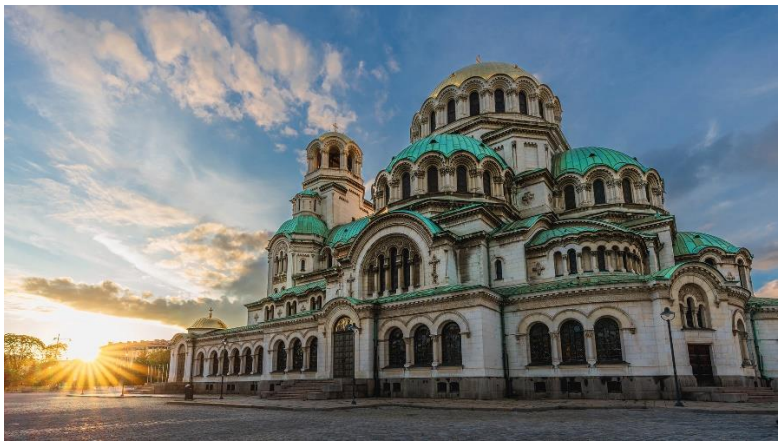
[12] https://www.vlaanderen.be/lokaal-bestuur/digitale-transformatie/gemeente-zonder-gemeentehuis/goedgekeurde-projecten/de-virtuele-assistent.

The project has a distinct focus on scalability and interoperability – predominantly as it is expected to be rolled out to other Municipalities within the Flanders region. The focus is on developing a modular system, that will integrate with any Drupal content management system (used for City of Kortrijk website management), but also with similar Wordpress content management systems. Currently, a custom version of ChatGPT is used for the system, but Microsoft services also allow implementation of open-source alternatives to be deployed, if required. If this was completed, the Virtual Assistant could reduce its dependency on technology providers. While the Virtual Assistant will be rolled out across a number of municipalities, it will be done so on a Software as a Service model (SaaS), with licencing maintained by the external supplier, Cronos Public Services. There are no plans to open source the code developed for the tool.

Currently, the Virtual Assistant is able to receive queries in multiple languages, with translation completed by the integrated language model. However, national legislation obliges the Assistant respond in the national language – which in this instance is Flemish. This hinders the inclusivity of the service, and poses a barrier to wider adoption, effectiveness, and usefulness – especially in the increasingly multi-cultural society. The Digital Transformation team have requested an exemption from the applicable national law, but it was refused. Great harmonisation of relevant laws that affect digitalisation, or greater tolerance on application of laws would provide additional support for this project.

As the project is still in the design and development phase, there has been no wide user-testing. However, this is planned within the timeline of the project. User-testing will validate the Virtual Assistant before it is rolled out to multiple municipalities. Currently, design and development testing is completed internally by the Digital Transformation team in conjunction with the technology provider, Cronos Public Services.

Case II.2. Green public transport on demand (Bulgaria)



Rear View of The Alexander Nevsky Cathedral in Sofia, Bulgaria.
Photo credit: Sergio Formoso (gettyimages).

Initiator: Municipality of Sofia (BG).

Project partners: Municipality of Sofia, Sofia University, Plovdiv University, Sofia Development Association, Sofia Urban Mobility Centre, The National Association of Municipalities in the Republic of Bulgaria, Modeshift Europe Ltd., The National Institute of Meteorology and Hydrology.

External suppliers: n/a.

Sector of intervention: Mobility.

Funding: EUR 3,712,553.00 from the European Regional Development Fund, through the Urban Innovative Actions initiative, now known as the European Urban Initiative.

Timing: 01/07/2020 – 30/06/2023.

Expected impact: The project deploys a novel public transport solution in the Sofia neighbourhoods of '*Manastirski Livadi*' and '*Baxton*'. The solutions provide citizens an alternative to car travel, with the goal of reducing car traffic, improving air quality, and increasing mobilisation. The project targets key segments of the population to promote cultural and behavioural change towards greener and more environmentally friendly modes of transport. The solution is entitled 'On-demand green public transportation', and is formed through a combination of machine learning and advanced analytic capabilities for optimal route calculation for a mini-fleet of electric busses.

Description of the case study

The INNOAIR project was funded through the European Regional Development fund, through a Urban Innovative Actions initiative. The project has multiple objectives, predominantly to improve mobility in the city of Sofia through a series of actions to design, develop, and deploy greener forms of public transport to residents, improving health and reducing air pollution. The project received EUR

3.7million from the funding body. The consortium comprises eight organisations: a mix of public authorities, non-government agencies, universities, and a technology provider.

The project is coordinated by the Municipality of Sofia (INNOAIR, 2023a), with project management duties delegated to a distinct organisation, entitled the Sofia Development Association (SDA) (SDA, 2024). The SDA is 'responsible for testing innovations in the field of culture and digital transformation, research, analysis and educational programmes that create conditions for permanent dialogue between civil society, creative communities, business, academic institutions and the Sofia Municipality' (SDA, 2024). The Association was established in 2010 and is registered as an independent entity with a 'Not-for-Profit' legal status. The SDA has a number of overarching objectives: to popularise and assist in urban development policies; to aid sustainable development; to implement innovative development actions; and to foster coherent relationships between stakeholders within the wider Sofia region for the benefit of citizens and residents in the city.

The INNOAIR project has a work plan, associated milestones and timeline detailed in the funding agreement. The project deployment is monitored within the consortium through a reporting process. The project itself has articulated a number of positive outcomes, including the deployment of five electric buses, six charging stations, and an application that rewards active resident transport. In terms of green objectives, the project has resulted in a number of emissions reductions in the environment (21,645 tons of particle matter, 92 tons of NO_2, and 4,710 tons of CO_2) (INNOAIR, 2023a).

The on-demand electric buses are the flagship of the project and have been successfully deployed in a test region ('*Manastirski livadi*'), with work being conducted to scale up the service into three other suburbs ('*Malinova dolina*', '*Vitosha*' and '*Gorna Banya*'). The buses couple big data and AI to replace traditional bus routes, and timetables, with flexible routes and on-demand services. Routes are decided by a mobile application, developed within the project, as part of the On-demand Public Transportation Platform (ODPTP). The platform provides the ability to request e-buses and create optimised routes depending on real-time data such as citizen demand, traffic, predefined service zones, buses working time and shifts (considering regulatory driver breaks), roadblocks, etc.

The project provides for vulnerable groups, including the elderly and those not less digitally native. The bus routes are integrated with physical stops, and 'request centres' – where someone without the ODPTP application can use a publicly accessible digital terminal to request a bus to come and get them, or hop

on a bus as it passes. These request centres are placed in strategic places within the area (near public services, shopping areas, recreation areas, etc.). The hybrid nature of the system improves accessibility and inclusion, while altering residents' perceptions of what a public transport system might look like. The service is continuing to develop, with a number of features planned to be integrated including payment modules, and improved ticketing schemes.

Discussion of the results

The INNOAIR project has consistently worked with citizens and citizen groups/representatives to understand needs and foster dialogue. This is an explicit way of working for the SDA and has been integrated into the way in which the ODPTP has been developed. The user testing and user feedback will continue throughout the development cycle and into the scaling up phase, to ensure that the service continues to meet resident needs.

Key concerns for the project has been data governance, data protection compliance, and information security. This is found to be a common issue in many data-driven research and innovation actions for the SDA. Many government departments of Sofia, it was communicated, do not have the experience or expertise in-house to obtain value from the data they have access to, coupled with the fact data is not commonly shared or processed for analytics purposes by inter-dependent (or related) governmental departments.

In the INNOAIR project, datasets were utilised from transport, planning, and housing departments, taking time, patience, and effort to ensure compliance and security obligations. Most of this was overseen by the relevant departments, with support from the technology provider and the research centres (i.e., universities), who had more experience with data analytics functions. Cybersecurity and data protection concerns were consistently foregrounded, and often led to complex discussions around ownership, control, liability, risk, and potential (and deployed) mitigation measures. The EU AI Act was also a concern for the INNOAIR project, but compliance was led by the technology provider - who had better insight into specific obligations that were (and would be) required as the AI Act came into force. This compliance effort was also supported by the relevant sub-departments in the governmental organisations.

The ODPTP was always focused on rolling out to a number of suburbs in the greater Sofia area – so the project's goal from ideation stage was scalability. The suitability of areas depended on access to the required data (to inform the algorithms for route optimisation), but also on the demographics of the area, and the available infrastructure. The project itself is interested also in sharing learnings outside of Sofia, potentially across Bulgaria, but also wider throughout

other European Member States. They see the success of the trials in Sofia and understand the potential for wider rollout across Europe, considering the learnings made from the project.

There were communicated externalities that caused concerns for the project, such as the COVID-19 pandemic and the outbreak of war in Ukraine. These were disruptive, but did not hinder the successful uptake of the system. The ODPTP was supported by a number of complementary objectives, deployed into the Sofia region, including Bulgaria's first low-emission zone. The zone had some issues with enforcement but has opened the conversation to changing resident behaviour in the city and its suburbs.

The ODPTP has not been without some challenges, including aspects related to the ticketing system. Local regulations govern the way in which ticketing can be offered to the public (specific ticketing systems, protocols, prices, etc.), and this has hindered how ticketing could work in the on-demand service. However, this is viewed as a surmountable challenge, with work being completed at the municipality level to ensure the ODPTP can be implemented successfully.

Case II.3. Vaasan kadut kuntoon ('Fix the Streets') (Finland)

Vaasa Church, Finland.
Photo credit: Harry P.

Initiator: Municipal Engineering (Vaasa City) (FI).

Project partners: n/a.

External suppliers: Crowdchupa (now known as Crowdsorsa).

Sector of intervention: Municipal public services.

Funding: EUR 39,150.00.

Timing: 01/11/2020 - 31/08/2022.

Expected impact: Through the deployed app, developed by Crowdchupa (now known as Crowdsorsa), the Vaasa City will reward citizens with money for sourcing of information on the health of the streets and roads across the city. The information will be used to inform the Municipal Engineering department's (responsible for road maintenance) infrastructure database, which is then used to direct resources into the road maintenance programme. Through the application, streets are sprinkled with coins and other objects of monetary value which users collect by recording a video image. Data collectors are paid a fee of around two euros per kilometre, usually within the same day. The collected video data, which is checked by AI, is used in the planning of street network repairs. The method enables mass data collection for any road user with a smartphone (Vaasa, 2024a).

Description of the case study

'*Vaasan kadut kuntoon*' ('Fix the Streets') is funded through the Vaasa City, as part of the 'Innovation activity Ecosystem Agreement 2021-2027' between Vaasa city region and the Government of Finland. This is managed through the Ministry

of Economic Affairs and Employment (Vaasa, 2024b). The ecosystem agreements harness the region's ability to develop and deploy digital technologies and carbon neutral activities, helping them to meet Twin Transition goals. The ecosystem agreement promotes the development of an innovation ecosystem in the region and closer cooperation with international research, development, and innovation (RDI) networks. The ecosystem is built on a cooperation model, including companies, universities, research institutes, financiers, and other RDI stakeholders, to increase research and development activities in the market. The core goal is to improve resident well-being (Vaasa, 2024c).

In Finland, it is the responsibility of the State and the municipalities to ensure proper regional development. Vaasa City participates in national urban policy networks, the most important one of which is the Urban Policy Committee. The committee's main task is to implement urban policy decisions. Vaasa City also participates in the Association of Finnish Municipalities' Urban Policy Working Group. The Working Group's tasks include highlighting specific issues concerning the largest cities and acts as an arena for exchanging ideas[13]. The 'Fix the Streets' initiative is a pilot action, concerned with improving the way in which the city manages and maintains its road network.

Vaasa City has a development budget every year, which allows it to experiment with projects, research, and pilot actions. This budget is allocated every year and is provided as part of the regional and urban development policy and wider Finnish commitment to digitalisation and research and innovation. The 'Fix the Streets' initiative was allocated EUR 37,150.00 from this budget.

The initiative is managed by the Municipal Engineering department of Vaasa City's public administration. It was deployed with support from a private sector technology provider, Crowdsorsa (formally Crowdchupa). Crowdsorsa is a company based in Tampere, Finland. They have developed technologies for public administrations to delegate various tasks to citizens, paying them for their time and effort. The technology itself has a number of functional use cases, from road health mapping and analysis (e.g., Fix the Streets) to mapping of invasive species and accessibility aspects and concerns within cities. At a very high level, the tool is a mobile phone-based application that allows residents to provide (typically) geo-located information to the public authority, including text, photos, and video (as required). This then allows the public authority to better understand their city infrastructure and to make decisions based on the improved monitoring data set.

[13] https://www.vaasa.fi/en/regional-development-and-urban-policy/

The ‘Fix the Streets’ pilot initiative was implemented over a two-year time frame (including planning, design, and deployment) to help the Vaasa City’s road infrastructure department build a multi-format knowledge database (text, image, video) of the city’s streets and roads – especially in the context of their current health (potholes, road cracks, incorrect/damaged signage, incorrect/damaged curbing, road markings, etc.). The application ingests user collected data, and then conducts AI-leveraged analysis to determine specific features of the road, or street, as well as identify damage, cracks, potholes, opaque road markings, etc.

The application complements a digital signage system in the city, where every street or road sign had been assigned a unique and persistent identifier. This identifier system was integrated to provide geo-location data for the media uploaded by residents. This was chosen over GPS systems (or similar) predominantly for data minimisation purposes, but also because the digital sign system was a notable feature of the city’s infrastructure, so it was of benefit to utilise it.

The crowdsourcing initiative allows Vaasa’s Municipal Engineering department to implement a more reliable road maintenance schedule, plan, and approximate costings. It also allows them to better understand areas of the city that require more attention, or further analysis by a ‘field crew’ team. The data they gather also supplements a separate, internal, road management and maintenance application. This application allows the public authority to understand whether any road or street requires full re-paving (as opposed to fixing the potholes only), and what steps are required to repave the road considering other factors such as water pipe depth, condition, age, etc. The algorithmic component of this internal system analyses aspects of the media uploaded by the residents and maps the information to the City’s database. It includes analysis such as depth, width, and length of potholes, lengths of cracks across roads, and aspects related to poorly marked road markings, damaged signs, overall asphalt quality, current drainage capabilities, etc.

The ‘Fix the Streets’ application, as developed by Crowdsorsa, has been implemented in a number of regions throughout Finland and Vaasa City has shared their own implementation experience with other public authorities across the country. Vaasa City believe the project was a success, with informal feedback received from residents coupled with positive media coverage of the initiative. They intend to repeat this crowdsourcing drive every three or four years, as it allows them to gather a complete update of their database over a short time period. This update will then inform the next years of road infrastructure maintenance and repair. They have indicated that the reliability of the data they now have has been greatly improved, and has provided a much better evidential base for road maintenance planning, improvements, costing, and scheduling.

Discussion of the results

The ‘Fix the Streets’ initiative is deemed a success by Vaasa City and was described by the representative from Vaasa’s Municipal Engineering department as a considerable boost to the manner in which the department gathered information about the city’s roads and streets. It also allows the department to merge two road maintenance systems, as they were able to take the data gathered through the Crowdsorsa application and use it to inform their primary IT road engineering tool.

In terms of accessibility and inclusivity, Vaasa’s Municipal Engineering deployed the application alongside normal information gathering methods. This meant that users were able (if they desired) to continue to use email or telephone as methods of communication to log incidents concerning road health in the city. These logs would then be investigated. This method was not as automated and did not provide the rich multi-modal (text, image, video, and associated analysis) data sets that the application did, but it allowed residents to be involved in the process. These alternative methods of communication still exist.

The Crowdsorsa application has been developed for many other use cases. There have been extensive testing periods where end-user feedback has been sought, received, and integrated into iterative versions of the software. This feedback was not sought directly for the ‘Fix the Streets’ campaign.

The Crowdsorsa application is owned by the Crowdsorsa company, and it is licenced on a SaaS basis. This allows the system to be implemented in a wide array of use cases across Finland (and more broadly, if required). This scalability is welcomed, as it provides the basis for a cohesive business relationship between public authorities and technology providers. However, the licence model also creates strong dependency on the service provider, and limits how other public authorities might integrate the application with their own systems. It is possible that integration costs would be prohibitive for some public authorities, given the scale and complexity of changes required from the application. As it stands, there are no elements of the application that are open-sourced or provided on permissive licences.

Case II.4. Satellites for Wilderness Inspection and Forest Threat Tracking (SWIFTT) (Latvia)

Sigulda, Latvia.
Photo credit: mharris97.

Initiator: AXA Climate (Project Coordinator) (LV).

Project partners: SIA "Rīgas meži, Wildsense, Space Research Institute of the National Academy of Sciences of Ukraine, University of Bari Aldo Moro (Department of Computer Science), Leibniz Universität Hannover (TNT), Timbtrack, Fürstliches Forstamt (Donatus Prinz zu Schaumburg-Lippe), Groupe Coopération Forestière, Da Vinci Labs.

External suppliers: n/a.

Sector of intervention: Environmental protection.

Funding: EUR 3,680,231.25 from the EC Horizon Europe programme. The budget allocated to SIA Rigas Mezi is of EUR 201,225.00, of which EUR 140,857.50 is funded through the SWIFFT project (SWIFFT, 2024), and EUR 60,367.50 is funded internally.

Timing: 01/11/2022 – 31/10/2025.

Expected impact: Forests are essential to life on Earth. They provide habitats for thousands of creatures and combat climate change through carbon sequestration. However, our forests are threatened by insect outbreaks, fires, windthrow and droughts. Notably, insect outbreaks are one of the leading causes of forest loss globally, destroying 85 million hectares (ha) of forest worth EUR 15 billion annually. SWIFTT will provide a scientifically sound and technically feasible way to help monitor and manage forest risks: windthrow, insect outbreaks, and forest fires by enabling forest managers with affordable, simple and effective remote sensing tools backed up by powerful machine learning models. The solution will offer a monthly health monitoring service using Copernicus satellite imagery to detect and map the various risks to which forests are exposed. Early threat detection aids timely intervention. The solution anticipates monitoring and protecting up to 40 million

hectares of global forests by 2030, saving foresters over EUR 468 million in monitoring costs, and creating over 50 direct jobs (SWIFFT, 2024).

Description of the case study

The SWIFTT project is funded through the Horizon Europe programme (HORIZON.2.4.10 - Space, including Earth Observation) (EC, 2024a) under the topic entitled: HORIZON-EUSPA-2021-SPACE-02-51 - EGNSS and Copernicus applications fostering the European Green Deal. The topic has a number of overarching objectives and themes, with the SWIFTT project focusing on the sub-topic of 'Preserving and restoring ecosystems and biodiversity' (EC, 2024b). The project is comprised of a consortium of nine organisations, which are a mix of technology providers, research institutes, and regional authorities, including SIA Rīgas meži (Rīgas meži, 2024a), from Latvia. SIA Rīgas meži is the government agency responsible for management of forestry and parks (green infrastructure) within the regions of Riga and Pieriga in Latvia.

SIA Rīgas meži is a municipal company founded in 2008. It is responsible for approximately 63 thousand hectares (ha) of forest, 453 ha of Riga's gardens, parks and greenery, and for 367 ha of cultural and recreational parks, also known as '*Mežaparks*'. It also has responsibility for sustainable development, biological diversity and accessibility of these territories to the public (Rīgas meži, 2024b). They are a private, for-profit entity, with direct links to the municipality, the public, and stakeholders in the region. They are committed to governance, transparency, and excellence in efforts towards sustainability (Rīgas meži, 2024c).

SIA Rīgas meži is involved in a number of research and innovation projects, both nationally and at European level. The main objectives of their projects are: to use satellite data and AI in the monitoring of forest areas; biodiversity conservation and climate change mitigation; to use IT in improving forest care; and to improve the quality and protection of tree seedlings (Rīgas meži, 2024d). Project monitoring is handled according to internal processes, as well as at the project level through monitoring to funding bodies. There is also annual reporting to the Riga Municipality regarding involvement in research projects, implementation phases, challenges, as well as budgets, results, and impacts.

SIA Rīgas meži have a number of ongoing R&I projects, and work with integrating technology on a daily basis. The organisation place digital literacy high on their agenda and have been skilling their 'field crew' on related technology such as field tablets, monitoring programmes, and drone monitoring technologies for a number of years. The company also value working with technology providers at a local, national, and European level to improve the

efficiency and effectives of their forestry and green area management. This includes integration with Latvian smart city solutions and overarching digitalisation services, based on use of the Copernicus satellite infrastructure. Currently there are no specific AI skilling initiatives.

As an end-user in the SWIFTT project, SIA Rīgas meži were involved at an early stage in the development of the research plan – shaping the overview of the proposed technology to their distinct needs and requirements for forestry management. Now the project is underway, it is managed internally by a project deployment team with a distinct research lead, supported by a number of staff in administration roles, as well as 'field crew', who are involved in the management and monitoring process of the green areas. The project is about halfway through its projected timeline, with the first iterations of the technology being provided to end-users within the project. They are not yet at an operational level, but continued refinements are being integrated into new versions.

Discussion of the results

SIA Rīgas meži have been able to support the development of user requirements for the tool – to ensure that the end-product meets their distinct needs. This process was shared with other end-users in the project, drawn from across Europe. SIA Rīgas meži found this process challenging, as distinct needs from various regions across Europe were being accommodated by the technical developers. The accommodation of varied requirements, however, should lead to greater scalability and interoperability of the tool.

The tool being developed is for forestry management; it will support the gathering of data, field analysis, and monitoring of tree health. There are, however, aspects of European regulatory requirements (including the European deforestation regulation[14]) which are not being built into the tool. These legally binding requirements stem from the European Communication on 'Stepping up EU action to protect and restore the world's forests' (EC, 2019). Whether or not the tool can incorporate some of this functionality is still unknown.

As mentioned, the tool is still in early design iterations, so as it stands there has been little work on integrating specific inclusivity and accessibility features. Efforts have been taken by the consortium to ensure that 'field crew' are provided with the knowledge and skills to use the software. From a compliance perspective, the project has not yet focused on EU AI Act compliance but given the perceived low-risk of the tool, it is not seen as a major obstacle.

[14] For more information, please see: https://environment.ec.europa.eu/topics/forests/deforestation_en.

One of the stated primary objectives of the funding topic was that technologies should have clearly defined commercial potential and paths to market – including a clear valorisation strategy and identified market need (EC, 2024b). The SWIFTT software is intended to be offered on a licence basis to end-users, post project, as a SaaS offering. SIA Rīgas meži have acknowledged this as being a potential hurdle to adoption, as the licence model must consider relevant economic factors across Member States, and relevant budgets that forestry agencies may have. The SaaS model may hinder pan-European uptake, and in turn hinder a number of interoperability goals with regards to open data markets for forestry and green space management. As it stands, there have been no communicated plans to make components of the software open-source, or open-access.

In separate projects and initiatives, SIA Rīgas meži are also working with a number of related tools that incorporate algorithmic or AI components. This includes tools for monitoring sapling health within their tree nurseries, and tools for monitoring social media for the gathering of input into urban tree health and park maintenance and management. These technologies have been welcomed by the organisation as they can improve delivery of its responsibilities to the public, and other stakeholders. The organisation also mentioned how the public procurement process is changing – with AI components being requested and offered more frequently. This has demanded a corresponding increase in AI fluency amongst both procurement teams, and tenderers.

Case II.5. Vadindekset ('The wet index') project (Denmark)

Municipality of Jammerbugt coastline.
Photo credit: C. TORP.

Initiator: Jammerbugt Municipality (DK).

Project partners: Jammerbugt Municipality, DTU Sustain, the Alexandra Institute, KMD.

External suppliers: n/a.

Sector of intervention: Public order and safety.

Funding: DKK 5.0 million from the investment fund for new technologies (*Danish Agency for Digitalisation*).

Timing: 2021-2023.

Expected impact: The '*Vadindekset*' project, developed by the Jammerbugt Municipality in Denmark, represents an innovative application of AI to tackle the growing challenges posed by climate change, particularly in terms of managing and forecasting floods, through the implementation of a 'wet index'. The primary impact of this tool is its potential to significantly improve flood forecasting. The ability to foresee and proactively respond to flooding events is expected to (1) reduce flood damage by enabling local authorities to take early action; (2) enhance public safety by providing timely warnings to residents, allowing them to take necessary precautions; (3) increase emergency preparedness by informing local government response teams about flood risks well in advance, reducing the impact on public services. Although the tool is still in its development phase, the expected impact of the project is significant. It could serve as a model for other municipalities facing similar challenges, contributing to more resilient communities and better management of public resources against natural hazards due to climate change.

Description of the case study

In 2023, Denmark has been hit by precipitation far above the national average of the last ten years, and future climate in the country is expected to be significantly wetter. The dangers of flooding are greater in coastal areas. Indeed, intense rainfall caused damage to the community of Jammerbugt and increased the municipality's emergency preparedness and management costs. Within the '*Vadindekset*' project, the Jammerbugt Municipality designed an early warning tool based on AI in response to the consequences for citizens and landowners of the massive rainfall that affect the area. Hence the usefulness of a tool that through AI, supports flood forecasting and contributes to decision-making in monitoring and local planning for urban and rural areas. The development of the tool, the so-called 'wet index', was facilitated by the large availability of geo and climate data and the solution is particularly helpful in a coastal city, prone to intense rainfall and with high level of groundwater. The project development was thus facilitated by the abundance of free data which increases the scalability of the project.

The initiative is part of the national effort from the Danish Agency for Digitalisation which works on the testing and development of new applications based on AI. In more detail, the '*Vadindekset*' project is one of the '*Signaturprojekter*' ('Signature projects') that benefitted from the investment fund set up by the Danish government, the Local Government Denmark (KL) and Danish regions. The investment fund was arranged in occasion of the agreement on the municipalities' and regions' finances for 2020 and has supported a total of 40 'signature projects' between 2020 and 2022 that explored the use of AI in the public sector.

The government, KL and Danish Regions selected the projects to be financed based on their concrete use of AI in the areas of welfare, climate and administration in support of the public sector. In this process, priority was given to initiatives that delve into yet unexplored uses of AI that can improve the quality of public service by scaling the technology.

The Jammerbugt Municipality is located in the North Jutland region of Denmark, an area that is not fully digitally mature and makes this case stand out even more. Despite the absence of specific AI skills, the local government relies on the IT unit as dedicated office for digitalisation, and one of the key success factors of this initiative is the creation of a balanced partnership. Indeed, in the project design and development processes, the municipality collaborated with private suppliers (KMD) and research institutes (DTU Sustain and the Alexandra Institute) and relied on the expertise of the Technical University of

Denmark. Regarding the technical specification, the model makes use of AI and historical data (e.g., satellite images, rainfall data and data on terrestrial groundwater) to train an algorithm to predict potential floods in the municipality 48 hours in advance. To increase the precision of the forecast, the researchers integrated an understanding of the movement, distribution and interaction of water with its surroundings. The project workplan included a development and a testing period.

Discussion of the results

In line with the priorities followed in the investment fund allocation, the '*Vadindekset*' project devoted particular attention to its scalability, especially through the selection of data that are available also at national scale, such as those from the hydrological information and forecasting system (HIP). Indeed, in case of successful implementation of the project, it is expected to be extended nationwide.

Despite to date the initiative is suspended due to lack of funds, at the current stage of development, the model demonstrates good forecasting ability, but it still needs to be improved and matured to achieve greater accuracy.

The 'wet index' was tested by the Jammerbugt Municipality in 2023. The results demonstrated that forecasts are better than expected for the wet months of spring. However, the accuracy of the forecasts is also assessed in the ability to prevent 'false alarms'. In this regard, the instrument proved to perform incorrectly during the summer period, and the reason was found to be that the instrument had been trained with insufficient data for the summer months, thus demonstrating a limit and at the same time an area for improvement.

The aspect of reliability of forecasts is particularly important with a view to acceptance by the citizens, which will then be amongst the users and final beneficiaries of the tool. As proof of this, a small group of citizens was selected in the test phase who could check the functioning of the system on a regular basis. The ambition of the project designers is to make the 'wet index' available on the website of the Jammerbugt Municipality as an overview map that allows inhabitants to monitor and be notified of flood risk.

Case II.6. Policies for Holistic Urban Mobility and Accessibility (Cyprus)

Eleftheria Square, Nicosia (Cyprus).
Photo credit: Athina Vrikki.

Initiator: Nicosia Municipality (CY).

Project partners: Nicosia Municipality, GFT Italia, EGI Foundation, Netcompany-Intasoft, Novoville, Unparallel Innovation LDA, ViLabs LTD, Arthur's Legal BV, Universidad Politecnica de Madrid, City of Athens IT Company, City of Genoa, Lisboa E-Nova, Reportbrain, Burgas Municipality, EKSO SRL, Tecnè Italia.

External suppliers: CYENS Centre of Excellence.

Sector of intervention: Mobility.

Funding: EC funding through Horizon 2020: EUR 3,999,988.25.

Timing: 1/03/2021- 30/04/2024.

Expected impact: Within the AI4PublicPolicy EU funded project, the expected impact of the Pilot 'Policies for Holistic Urban Mobility and Accessibility' led by the Nicosia Municipality covers three main areas: (1) Urban transformation: the initiative aims to support the creation of a more equitable, accessible and liveable city for all population segments; (2) Foster inclusivity and community empowerment: the Pilot intends to promote social inclusion and equity, also fostering community cohesion; (3) Community empowerment: the involvement of stakeholders is instrumental to align policies to the needs of the community, thus empowering citizens to participate in the policy-making process.

Description of the case study

The initiative 'Policies for Holistic Urban Mobility and Accessibility' led by Nicosia Municipality is part of the broader project 'AI4PublicPolicy', which

exploits technological advancement to support a field in which it is less common to see the contribution of AI, that is policy development. The 'AI4PublicPolicy'project is funded by the EU Horizon 2020 programme and represents a collaborative initiative between policymakers and Cloud/AI specialists aimed at unlocking the potential of AI for the development of public policies. Objective of the initiative is to develop and promote an open cloud platform (the AI4PublicPolicy Platform) that uses AI technologies for policy management.

The 'AI4PublicPolicy' project includes the launch of five pilots led by public authorities, the third of which is the Municipality of Nicosia. As per the objective of the entire initiative, the case of Nicosia Municipality is oriented towards the development of a citizen-centric solution and its specific aim is to develop evidence-driven policies that enhance citizens' mobility and reduce travel time. In more detail, the project aims to support inclusive mobility and using comprehensive traffic and public transport data is targeted to the elderly and individuals with disabilities.

Within the broader goal to improve urban mobility, the Pilot specifically focuses on two policies aiming at (1) improving the accessibility for people with disabilities and at (2) optimising parking accessibility for individuals with disabilities. The development of the first policy implies the combined use of AI algorithms to analyse traffic data, the whitelist of the Smart City platform and License Plate Recognition (LPR) cameras to improve access for individuals with disabilities to streets with limited vehicle entry during periods of traffic congestion. The aim is to address the unique challenges in navigating high-traffic areas by providing an accessible and effective solution to these barriers. The second pilot policy, 'Smart parking management for people with disabilities', harnesses the predictive power of AI and in particular to forecast congested areas and enhance parking accessibility in specific support of individuals with disabilities.

In the development of the Pilot, the composition of the partnership was crucial, which saw the collaboration of local universities and international institutes. Particularly decisive was the involvement of the CYENS Centre of Excellence, which is active in cutting-edge research and the cooperative development of innovation and high-impact projects.

Discussion of the results

The aim of the pilot 'Policies for Holistic Urban Mobility and Accessibility' of Nicosia Municipality is to contribute to the development of evidence-based and data-driven policies on inclusive mobility. The implementation of the policies

is planned at the conclusion of the Pilot and is not yet finalised; however, the results of the initiative are considered to be positive to date.

Analysing the success factors and criticalities of the Nicosia Municipality case, what emerges clearly is the crucial importance of an ecosystem external to the local public administration that is collaborative and innovation oriented. In the development of the technological solution, external cooperation was in fact fundamental for the procurement of the specific technical competencies absent within the municipality. Likewise, for the purposes of successful implementation, it was useful to investigate and monitor the level of acceptance amongst target groups through the involvement of organisations working with people with disabilities.

A decisive factor that enabled the feasibility of the Pilot was the prior presence of a smart city strategy. On the one hand, this strategy and its alignment with the work of the CYENS Centre of Excellence encouraged the actual initiation of the case, and, on the other hand, it resulted in the availability of tools used for traffic monitoring and management such as the city sensors to monitor traffic congestion and the Smart City platform providing the list of individuals with disabilities.

On the opposite side, a challenge that the pilot case faced was the delay in the availability of useful data, due to the actions being launched at a premature stage compared to the implementation of the smart city strategy. Furthermore, while the collaboration with stakeholders and the partnership with the CYENS Centre of Excellence were particularly positive, it was challenging to obtain the approval of the project idea and implementation modality within the organisation and from citizenship. This underlines the importance of gaining trust and consensus on the introduction of AI based innovation not only from the direct beneficiaries but from the general public that can influence the perception and actual success of the initiative.

Although the pilot has not yet reached the policy implementation phase and at the present stage the results are not applicable to the entire city, the case of the Municipality of Nicosia is an excellent precedent for the use of AI to support policy makers in the development of evidence-based policies. The scalability of the initiative in the municipality is facilitated by the existence of a pre-existing infrastructural base related to the smart city strategy and other cities in the country and abroad can benefit from the lessons learnt from the partial results achieved so far in terms of infrastructural challenges, compliance with ethical procedures and stakeholder engagement priorities.

Case II.7 The AI-based LisNav application dedicated to transforming the lives of the visually impaired (Portugal)

Praça do Comércio, Lisbon, (Portugal)
Photo credit: Claudio Schwarz

Initiator: 3FINERY LTD startup, Municipality of Lisbon (PT).

Project partners: Municipality of Lisbon, Camara Municipal de Aveiro, 3FINERY LTD startup.

External suppliers: n/a.

Sector of intervention: Social protection; Mobility**.**

Funding: Camara Municipal de Lisboa, Camara Municipal de Aveiro and the European Regional Development Fund.

Timing: 2022-2023.

Expected impact: The LisNav project is aimed at having a transformative impact on the lives of people with visual impairments, improving their accessibility to both urban and transportation environments through innovative technologies. By leveraging AR and AI, this project is designed to enhance mobility, independence, and safety for individuals with visual disabilities in both indoor and outdoor spaces.

Description of the case study

An exemplary case of successful public-private collaboration, the LisNav project, aimed to use AR and AI to enhance the quality of life of people with visual impairment. Within the framework of the Urban Innovative Action (UIA) promoted by the EC, the project was co-financed by Camara Municipal de Lisboa, Camara Municipal de Aveiro and the European Regional Development Fund. In addition, in the context of the Better Mobility Accelerator (BMA)

programme, the project was supported by the European Institution of Innovation & Technology (EIT). The initiative was in fact aligned closely with the main area of interest of the BMA programme that is ‘Mobility for all’, intended to improve the physical and geographical accessibility of underserved and vulnerable travellers.

The technological solution of the LisNav project was conceived and devised by the startup 3FINERY LTD, specialised in the use of AR to create new forms of experiencing reality in an interactive, game-focused and inclusive way.

LisNav was an app specifically dedicated to people with visual impairment that improved the perception and interaction of users with reality through real-time audio descriptions that augment accessibility in urban outdoor and indoor environments. The application made use of a combination of data from publicly available datasets and allowed users to incorporate information such as those on local points of interest. The LisNav app had the distinction of supporting people in using public transport by providing information on bus stops and the bus stop network. The use of intelligent algorithms combined with real-time audio descriptions was thus exploited to facilitate the accessibility of public transportation and to increase the independence of users even in unknown surroundings. Furthermore, users had the possibility to both access and input real-time updates. This feature was specifically designed to make travel safer through real-time detection of warnings, hazards and emergencies.

The LisNav project not only benefitted from support at the European level but is also currently part of the VoxPop initiative led by the Lisbon City Council (CML). This project aims to promote the digital transition of Lisbon’s mobility sector and is characterised by its cooperative approach as evidenced by the involvement of public and private representatives of the mobility sector, aiming to ensure the active participation of citizens.

Discussion of the results

The LisNav project started in 2022 and lasted 12 months. Nevertheless, the app designed by the startup 3FINERY LTD is still downloadable by users. The download is free while some additional features are available for a fee. The initiative of the Municipality of Lisbon has attracted more interest than its creators anticipated, especially from the point of view of its commercial implication. To date, more than a thousand downloads of the app have been recorded, a number considered substantial considering the specific target audience to which it is dedicated.

The success of the project is based on several factors. These include the large availability of various categories of publicly accessible data (e.g., historical data, real-time connections, databases) and the contribution of programmes at local and international level supporting the technological advancement at the service of the inclusive mobility sector. These programmes provided not only financial support but also consultancy and technical support to test and initiate the innovative proposal.

From the point of view of public acceptance, the solution proposed by the LisNav project reported a consensus from both the political level and the public, presumably related to the evident benefit to users and in particular to people with disabilities. To ensure user acceptance, the app also includes a monitoring mechanism for collecting feedback. Furthermore, the use of data and the deployment of applications such as machine learning models and Optical Character Recognition (OCR), which converts text into machine-readable formats, was carried out in compliance with security procedures and taking into account the potential risks of using AI, and in particular in its use for guiding user mobility, as it would soon be regulated by the EU AI Act.

The LisNav initiative can be considered a good practice of public-private collaboration, bringing together stakeholders from municipal governments, European programmes and a private start-up. The app’s data-driven approach can also inform future urban planning and transportation policies, enabling cities to become more inclusive, accessible, and adaptable to the needs of all citizens.

Case II.8. Immediate and Long-Term Energy Reduction (RECITAL) (France)

Next to the Arènes de Picasso: Victor Jara Avenue, Noisy-le-Grand.
Photo credit: Zairon (Source).

Initiator: Municipality of Noisy-le-Grand (FR).

Project partners: n/a.

External suppliers: Citégestion, Datanumia, Efficacity, Eridanis.

Sector of intervention: Energy.

Funding: EUR 2.2 million, out of which 50% from the 'National Strategy for Artificial Intelligence' (EUR 1.1 million), 50% from the Municipality of Noisy-le-Grand (EUR 1.1 million).

Timing: 01/09/2023 - 2025.

Expected impact: To reduce energy consumption and carbon impact of the city's public buildings. 20% reduction within the first two years, 50% cut by 2030, while optimising renovation expenditure. The project will also be useful for analysing possible scenarios for refurbishment and renovation of buildings, optimising costs and limiting CO_2 emissions.

Description of the case study

Noisy-le-Grand has been implementing a smart strategy based on technology and data driven by an innovative approach, in which 'Immediate and Long-Term Energy Reduction' (RECITAL) fits. Launched in summer 2023, the project entered its operational phase. In the words of Philippe Sajhau, Director of the Intelligent City, Innovation and Data:

'*For several months now, this 'energy hypervisor' has been collecting consumption data from our buildings, with a ten-year history. This will make it possible to track consumption on a daily basis and identify episodes of over-consumption by means of alerts*'[15].

The project will also be useful for analysing possible scenarios for refurbishment and renovation of buildings, optimising costs and limiting CO_2 emissions. The city administered questionnaires to sports clubs and associations sites within public buildings to evaluate their energy needs and optimise building usage times (particularly for schools and gymnasiums) in order to limit heating times, which will further reduce consumption by around 5%. A considerable percentage of the available funds will be earmarked for renovation work (double insulation of walls and floors, renovation of ventilation and aeration systems, replacement of boilers, window frames, etc.), which is essential to ensure energy efficiency and optimise consumption.

To finance RECITAL, the municipality has obtained financial assistance as part of the 'DIAT' call for projects (Demonstrators of frugal artificial intelligence at the service of the ecological transition of territories), launched by the Ministry of Ecological Transition and Territorial Cohesion, endowed with EUR 40 million over five years, as part of the second phase of the 'National Strategy for Artificial Intelligence' (Snia). The programme, combining two key acceleration strategies such as 'Sustainable Cities and Innovative Buildings' and 'Artificial Intelligence', covered 50% of the RECITAL project (equal to EUR 1.1 million). Noisy-le-Grand is one of the first four French regions to be recognised by the Government for proposing a solution based on frugal AI to accelerate the ecological transition. Noisy-le-Grand participated alongside Eridanis, Efficacity, Datanumia et Citegestion as partners of the project. State funding was also granted in view of a possible - as well as desired - replicability of the project in other municipal contexts throughout France.

The RECITAL project follows the guidelines laid down by the '*France Nation Verte*' ecological planning programme, which aims to highlight the potential of data, and more specifically AI, to respond to the five main challenges of the ecological transition (i.e., consumption of resources, preservation of biodiversity, reduction of pollution affecting health, mitigation of and adaptation to global warming). Published in September 2021, the first version of the AI and Ecological Transition Roadmap of the Ministerial Centre for Ecological

[15] "*Depuis quelques mois, cet "hyperviseur d'énergie" récupère les données de consommation de nos bâtiments, avec un historique sur dix ans. Cela permettra de connaître les consommations à la journée et de repérer des épisodes de surconsommation grâce à des alertes." (French original version).* https://www.noisylegrand.fr/information-transversale/actualites/recital-reduire-de-50-les-consommations-energetiques.

Transition, Land and Sea covers the period 2021-2023. The project answers also to the objectives imposed to French municipalities by '*Décret tertiaire*'. Also known as the Tertiary Eco-Energy Scheme (DEET), this measure – designed to promote the energy transition – has been introduced in 2019 as part of the 'Law on changes in housing, land management and digital technology' (ELAN) and requires a progressive reduction of energy consumption in buildings and parts of buildings of 1,000 m² and above in tertiary sector to tackle climate change.

Discussion of the results

The aim of this project is to use AI to reduce the energy consumption and carbon impact of the city's 200 public buildings. The goal is to achieve a 20% reduction within the first two years and reach a 50% cut by 2030, while optimising renovation expenditure.

The project started in September 2023 with 40 buildings and, after analysing the initial performance in the first 18 months, it will be extended to a further 160 buildings.

RECITAL also focuses on the installation of smart metres and sensors in each building to measure energy consumption, exploiting IoT as a tool to make the process of decarbonisation more efficient. The aim is to be able to exploit AI to bring more and better services to the population with less money, improving the job of people working for the city and the citizens. By the end of 2024, an algorithm will be deployed to study and propose the most appropriate programmes of works over six years, starting with the forty buildings that consume the most energy. The first works suggested by RECITAL algorithm should take place in 2025.

Noisy-le-Grand thus becomes a place dedicated to technological innovation, where environmental protection and care for citizens and the territory meet, providing a virtuous example of green and digital transition.

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